FUNCTIONAL SERVICING & STORMWATER MANAGEMENT REPORT

271 MAIN STREET EAST STACKED TOWNS

VILLAGE OF DUNDALK
COUNTY OF GREY

PREPARED FOR:

271 MAIN STREET EAST INC.

PREPARED BY:

C.F. CROZIER & ASSOCIATES INC.
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CFCA FILE NO. 2514-6796

CROZIER
CONSULTING ENGINEERS

Revision Number	Date	Comments
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1.0 Introduction

CF Crozier & Associates Inc. (Crozier) has been retained by 271 Main Street East Inc. (Developer) to prepare a Functional Servicing, Preliminary Stormwater Management Report to support the Site Plan Application and Zoning By-law Amendment for a stacked townhouse development located at 271 Main Street East in the Village of Dundalk, within the Township of Southgate (Township) and Grey County (County). The development block will herein be referred to as the Subject Property. Refer to **Figure 1** for the Site Location Plan.

The Subject Property is approximately 0.26 ha (0.65 ac) in size and is legally described as Plan 480 Block of Part of Lot 50, Registered Plan 16R11367 Part 3. The proposed development is comprised of twenty-four stacked townhouses with a 6m drive aisle. Refer to **Figure 2** for the proposed Site Plan prepared by Orchard Design Studio Inc. (April 29, 2024).

The Owners of the Subject Property have assembled a multi-disciplinary team, whose consultants have prepared studies/plans to support the planning application. This report should be read in conjunction with the work of the other team members, who include:

- MHBC Planning Ltd. (Planning)
- C.F. Crozier & Associates (Engineering, Transportation, Hydrogeological, Landscape Architecture)
- Green Geotechnical (Geotechnical)
- Orchard Design Studio Inc. (Architect)
- Great Lake Archaeology (Archeological)

In addition to this report, Crozier has also prepared a Traffic Opinion Letter to support the various planning applications, which should be read in conjunction with this report.

2.0 Site Description

The Subject Property covers an area of approximately 0.26 ha and currently consists of vacant land, sparse coniferous trees, and overgrown vegetation. The property is designated as a Residential Area Type 3 per the Township of Southgate Official Plan, located in a fully serviced urban settlement area. It is bounded by Main Street (County Road 9) to the north, a funeral home to the east, and single-family homes to the west and south.

The Subject Property is located within the jurisdiction of the Grand River Conservation Authority (GRCA). Through a review of the GRCA regulation mapping, the Subject Property is outside of the regulation limit of the two constructed municipal drains which are tributaries of the James Foley Drain. According to Ontario Geological Survey (OGS) mapping, the surficial geology in the region of the Subject Property is mapped as Till consisting of stone-poor, sandy silt to silty sand-textured till on Paleozoic terrain. As per the Grey County Official GIS, the general soil type found on the Subject Property is classified as Parkhill Loam and a part of Soil Group C.

A geotechnical investigation was completed by Green Geotechnical in November 2023 in which 4 total boreholes were advanced across the site. The investigations determined on site soils can be classified as sandy silt across most of the site, which falls into the parent Hydrological Soil Group C. Please refer to **Appendix A** for the geotechnical report.

3.0 Background

The report is based on pre-consultation meetings and discussions as well as review of material acquired from the Township of Southgate. In addition, several documents/plans were reviewed during this engineering assessment which include:

- Township of Southgate Dundalk Water Supply and Sewage Treatment Systems 2024 Reserve Capacity Calculations (Triton Engineering, March 22, 2024)
- Township of Southgate Official Plan (October 27, 2022)
- 2022 Development Charges Background Study (Watson & Associates Economists, August 2, 2022)

4.0 Proposed Servicing Strategy

The following subsections provide an analysis of the servicing strategy for the proposed sanitary sewage system, potable water supply and utilities for the Subject Property.

4.1 Sanitary Sewage System

4.1.1 Existing External Sanitary Infrastructure

The Village of Dundalk is serviced by the Dundalk Wastewater Treatment Facility (WWTF). The WWTF is located in the south-west end of Dundalk. The WWTF discharges to Grand River via the Foley Drain. According to Triton Engineering Services Ltd. (Triton) (March 2024), the three-year average daily flow for the WWTP was 1,149 m^3/day and has a design capacity of 1,832 m^3/day. Based on the 2023 data collected by Triton the 2024 uncommitted reserve capacity was determined to be 464 Equivalent Residential Units (ERUs). To meet future development demands, the Township has commissioned the necessary process to proceed with a Wastewater Treatment Facility expansion with the expectation that the project will be tendered in 2024. This upgrade is intended to increase the plants processing capacity to an Average Daily Flow (ADF) of 3,025 m^3/day. Based on this information we believe there will be sufficient capacity available in the municipal sanitary infrastructure system for the Subject Property.

To evaluate the existing municipal wastewater infrastructure adjacent the Subject Property, the as-constructed drawings from Triton were utilized. From the evaluation of the as-constructed drawings there exists a 250 mm diameter sanitary sewer along Main Street in which the Subject Property is proposed to connect to. To evaluate the available capacity in the 250 mm diameter sanitary sewer the Dundalk Sanitary Infrastructure Map provided in **Appendix B** was consulted.

4.1.2 Proposed Sanitary Servicing Strategy

Sanitary servicing to the Subject Property will be provided by two connection points to the 250mm diameter sanitary sewer on Main Street.

Units within Block A will drain internal to the building to a main combined outlet to one of the connections to the 250 mm diameter sewer along Main Street. Units within Block B will also drain internal to the building to a combined outlet but will discharge sanitary flows to the second connection to the 250 mm diameter sanitary sewer. The existing sewer at Main Street is approximately 4 m deep and can be extended to the site with the required cover.

Preliminary sanitary flows for the site were estimated using the Ministry of Environment, Conservation and Parks (MECP) criteria and Township of Southgate Engineering Standards:

- Average Residential Flow Rate – 350 L/cap/day
- Infiltration – 0.15 L/s/ha
- Residential Peaking Factor – 4.29 (Harmon)
- Population Density – 2.61 persons/unit

Based on these values it is estimated that peak sanitary flow from the site will be 1.11 L/s. There is sufficient capacity in the downstream sanitary sewer network to service the Subject Property when evaluating the existing sewer network in the Dundalk Sanitary Infrastructure Map. Refer to **Appendix C** for the sanitary demand calculations.

4.2 Potable Water Supply

4.2.1 Existing External Water Infrastructure

As-constructed drawings from Triton were utilized to determine the existing municipal water infrastructure adjacent to the Subject Property. The existing municipal water infrastructure near the Subject Property include:

- 250 mm PVC watermain at the northern limits of Main Street.

- Available water service stub terminating at Subject Property.

Potable water for the Subject Property will be supplied by the Township's municipal water distribution system. The existing water treatment system in Dundalk includes three existing production wells, one on-grade reservoir and one elevated water tower. Per the 2024 Reserve Capacity Calculations, the water supply system has an available uncommitted reserve capacity of 1,714 ERU's. Based on this information we believe there will be sufficient capacity available in the municipal water system for the Subject Property.

4.2.2 Proposed Water Servicing Strategy

The proposed servicing solution for the Subject Property will be to connect to the existing 250 mm water main on Main Street. The existing watermain stub at the property is anticipated not to have sufficient capacity or pressures to service the Subject Property. As such, a 150 mm watermain is proposed to be extended to the site, such that service connections can be provided to all 24 townhouse units.

To confirm that external municipal infrastructure can sufficiently accommodate the proposed development, the Township of Southgate's water distribution model will need to be revised to include the proposed development.

Preliminary domestic water demands for the Subject Property have been estimated in conjunction with Township of Southgate Engineering Standards as follows:

- Average Residential Flow Rate - 350 L/cap/day
- Peak Factors: Peak Day/ Peak Hour – 6.97/10.50
- Population Density – 2.61 persons/unit

Based on these values it is estimated that water demands for the site are as follows:

- Average Day – 0.25 L/s
- Maximum Day – 1.77 L/s
- Peak Hour – 2.66 L/s

Fire flows required to service the Subject Property were calculated using the Fire Underwriters Survey and is 183.3 L/s. The required domestic water flow was calculated to be 185.07 L/s. Refer to **Appendix D** for potable water servicing demand calculations and fire flow demand calculations. It is recommended that fire hydrant testing be completed to confirm that fire flows can be sufficiently accommodated.

4.3 Utilities

There are both aerial and buried utility servicing within the Subject Property that includes Hydro One, Bell, Enbridge Gas and EH!tel. Street lighting is on hydro poles where provided. From our previous experiences in the area, we are aware that Enbridge Gas has limited supply of natural gas and are in the process of upgrading pipeline in the area. Based on correspondence with Enbridge, it is projected there will be additional supply for late 2024. The remaining utility capacity will be confirmed later with input from the utility providers.

5.0 Stormwater Management and Site Drainage

The management of stormwater from the Subject Property must comply with the policies and standards of:

- Township of Southgate;
- The Grand River Conservation Authority (GRCA); and,
- The Ministry of the Environment, Conservation and Parks (MECP);

The stormwater management strategy recommended for the proposed development has been included below:

- Water Quantity Control
    - Control of the post development peak flows to pre-development levels for all storms up to and including the 100-yr generated by the Subject Property (on-site 'post-to-pre' control).

- Water Quality Control
    - "Enhanced Protection" given the Grand River as ultimate receiver.

- Development Standard
    - Lot Grading at 2% optimum
    - Minor and major drainage systems to convey runoff from frequent and infrequent rainfall events to a suitable outlet.

5.1 Existing Storm Servicing

To determine the existing municipal stormwater infrastructure adjacent the Subject Property, the as-constructed drawings for the "Reconstruction of Main Street East/Grey Road 9" (Triton, August 2018) were utilized. The nearby municipal stormwater infrastructure includes:

- 200 mm diameter storm sewer on the south side of Main Street running west at 1.3%.

- 200 mm diameter storm sewer on the south side of Main Street running east at 1.12%.

- 100 mm diameter stormwater service stub terminating towards Subject Property.

The capacity of the sewers was determined to be 37.4 L/s and 34.7 L/s for the west and east sewers, respectively. The capacity calculation considers the storm service flows shown on the as-constructed drawings and provided in **Appendix E**.

5.2 Existing Drainage Conditions

To accurately determine onsite drainage flow routes and pre-development drainage conditions, a topographical survey was completed December 11, 2023, by Schaeffer Dzaldov Purcell Ltd. To facilitate the pre-development stormwater analysis, the following four (4) internal catchments have been delineate based on the existing drainage conditions. The pre-development drainage catchments are illustrated in **Drawing C103** and summarized below:

- **Catchment PRE-1 (0.12 ha):** This catchment area is located on the northwest side of the site. It consists of primarily lawn and some impervious driveway area. Flows sheet northwest and are collected by a catch basin that drains to a municipal drain which is a tributary of the Grand River.

- **Catchment PRE-2 (0.08 ha):** This catchment area is located on the northeast side of the site. It consists of primarily lawn and some impervious driveway area. Flows sheet northeast and are collected by a catch basin that drains to a municipal drain which is a tributary of the Grand River.

- **Catchment PRE-3 (0.03 ha):** This catchment area is located on the southwest side of the site. It consists of primarily lawn and some impervious driveway area. Flows sheet southwest and are collected on adjacent properties that eventually drain to a municipal drain which is a tributary of the Grand River.

- **Catchment PRE-4 (0.03 ha):** This catchment area is located on the southeast side of the site. It consists of primarily lawn and some impervious area. Flows sheet southeast and are collected on adjacent properties that eventually drain to a municipal drain which is a tributary of the Grand River.

5.3 Proposed Drainage Conditions

The Subject Property will consist of one 6.0 m wide entranceway, stacked townhouses, and landscaped amenity space. The site has been separated into two (2) different drainage areas shown on **Drawing C104** and summarized below:

- **Catchment POST-1**: This catchment is approximately 0.20 ha. It consists primarily consists of impervious areas such as rooftops, sidewalks, parking areas, and the site entrance laneway. Runoff will be collected via catch basins and controlled beyond pre-development levels via multi-stage outlet control structure. Controlled stormwater runoff from this area will be treated by an Oil Grit Separator providing 94% total suspended solids removal prior to discharging to the catch basin north of the Subject Property.

- **Catchment POST-2**: This catchment is approximately 0.06 ha. It consists of primarily landscaped areas and sidewalks. Runoff from this drainage area will be considered clean. Uncontrolled stormwater runoff will be conveyed overland and flow offsite along the property boundary.

The Subject Property has been designed and graded to capture and retain minor storm events (up to the 25-year storm) in underground pipe storage, and larger storm events up to the 100-year storm within underground pipe storage and aboveground parking lot ponding areas. The underground pipe storage is achieved using 375mm and 525mm concrete superpipes, where the associated stage

storage discharge tables for the superpipe system have been provided in **Appendix F.** Insulation for storm pipes located at a depth of less than 1.5m may be required and can be installed where cover requirements are not met. Ponding areas graded throughout the parking lot will be utilized to provide above-ground storage to a maximum ponding depth of 0.15m. Flows discharging from the underground and above-ground stormwater storage system will be controlled by a multi-stage orifice control structure, consisting of a 95mm diameter lower orifice and 80 mm diameter upper orifice within the outlet control structure, located at the northern boundary of the site. Downstream of the orifices, flows will pass through an Oil/Grit Separator (OGS) for quality treatment prior to discharging to the proposed catch basin manhole which will replace the existing catch basin 7B, found in Drawing 03 in the as-constructed drawings from Triton. From the catch basin, flows will discharge through the east and west 200mm storm sewers to their respective tributaries of the Grand River. Flows will be controlled to not surpass the capacity of the two existing storm sewers.

5.4 Stormwater Quantity Control Analysis

Given the relatively small area of the proposed development property, the analysis of onsite quantity control requirements was performed using the Modified Rational Method. Runoff coefficients for the existing and proposed site condition were calculated per the Township of Southgate Municipal Servicing Standards and the MECP. **Appendix G** illustrates the determination of pre- and post-development runoff coefficients & calculations for required storage using the Modified Rational Method.

The proposed 375mm & 525mm diameter superpipes, manholes, and catch basin structures provide stormwater storage to contain the 2-year to 25-year storm events to provide quantity control. During the 50-year storm-event, water begins to pool above-ground and utilizes the sawtooth grading style of the parking lot to provide additional above-ground storage for events up to the 100-year storm. Internal paved areas will be graded with varying slopes typically ranging from 0.5% - 2.8% to promote stormwater drainage towards proposed catch basins throughout the parking area as reflected on **Drawing C101**. Once max ponding depth is surpassed, overland drainage above the 100-year event will be safely conveyed towards Main Street. Safe conveyance was determined using FlowMaster to confirm adequate floodproofing assuming a worst-case scenario where the entirety of the 100-year flow is discharged through the laneway. The depth of flow was determined to be 0.05m and completely contained within the laneway. For the FlowMaster output, please refer to **Appendix H**.

All post-development release rates account for the uncontrolled catchment (POST-2) peak flows. The calculations to determine the uncontrolled peak flow are found in **Appendix G.** The target flows and actual release rates are summarized below in **Table 1**.

Table 1: Modified Rational Method Flow Rate Results & Storage Summary

	Pre-Development	Post-Development				
Storm	**Allowable Peak Flow (m^3/s)**	**Post 1 Uncontrolled Peak Flow (m^3/s)**	**Target Peak Flow (m^3/s)**	**Actual Post-Development Total Release Rate (m^3/s)**	**Storage Volume Requirements (m^3)**	**Storage Volume Provided (m^3)**
2 Year	0.022	0.005	0.017	0.016	12.4	12.8
5 Year	0.029	0.007	0.022	0.022	16.3	17.3
10 Year	0.034	0.008	0.026	0.025	18.9	20.1
25 Year	0.043	0.010	0.033	0.032	24.6	24.6
50 Year	0.052	0.013	0.040	0.039	29.9	31.6
100 Year	0.060	0.014	0.046	0.042	36.6	38.6

The proposed storm sewers, superpipes and structures upstream of the control manhole provide a total storage volume of 38.6m^3. **Table 1** demonstrate the 2-year and up to the 100-year storage requirements can be accommodated onsite through underground and parking lot storage and post-development peak flow rates will not exceed the maximum pre-development and the maximum discharge to the outlet or the combined pipe capacity of the west and east storm sewer pipes of 72.1 L/s. Refer to **Appendix F** for the orifice sizing calculations and storage volumes provided by each structure and pipe.

5.5 Stormwater Quality Controls

Quality Control will be provided through end-of-pipe quality control measures (i.e., OGS unit). Runoff from Catchment POST-1 will be treated in an oil/grit separator discharging to the existing storm sewer. Based on the 0.26 ha contributing area and a runoff coefficient of 0.90, a Stormceptor oil/grit separator unit was sized to provide 80% total suspended solids removal in accordance with GRCA and MECP standards.

Refer to **Table 2** for a breakdown of the oil/grit separator sizing. Refer to **Appendix I** for the detailed sizing calculations of the proposed water quality treatment unit.

Table 2: Water Quality Treatment Unit Sizing Criteria

Contributing Drainage Area (ha)	Treatment Unit	Total Suspended Solids Removal (%)	Total Annual Runoff Volume Treated (%)
0.26	FD-4HC	94	>90

6.0 Erosion & Sediment Controls

Erosion & Sediment Controls will be implemented prior to any on-site construction works. An Erosion & Sediment Control Plan will be prepared as part of the forthcoming Site Plan Application. Below is a description of the various measures that may be implemented.

- Silt fencing

Silt fencing will be installed along the perimeter of the development to define the limits of the disturbed area including site clearing, topsoil stripping, fill operations, temporary drainage swales, as well as in areas to intercept any flows leaving the site. Silt fencing will play a crucial role in preventing sediment from migrating off site. Locations for the fences are shown on **Drawings C105**, but additional fencing may be added as necessary based on decisions by Crozier and the Developer prior to and during the placement of fill.

- Silt Sacks

Silt sacks will be placed in catch basins adjacent to the development to prevent silt and sediment from entering the catch basins. The silt sacks will trap silt/sediment while allowing water to pass through into the storm sewer. Locations for the silt sacks are shown on **Drawings C105**, but additional silt sacks may be added as necessary based on decisions by Crozier and the Developer prior to and during the placement of fill.

- Mud Mat

A mud mat has been proposed at the entrance to the development from Main Street. This mud mat will be maintained at the site until base asphalt is placed to limit mud tracking from the site onto Main Street and the surrounding Municipal roadway network. The Contractor shall ensure mud mat maintenance (cleaning / additional stone) is completed on an as needed basis to ensure proper operation.

- Flow Check Dams

A temporary straw bale dam will be utilized on-site in order to prevent any silt mitigation off site during and after construction activities. This dam will promote settling of suspended solids and will reduce flow velocities. Sediment accumulation will be monitored and removed as necessary.

- Dust Control

During earthwork activities, the Developer and Contractor will be responsible for ensuring that measures are taken to suppress dust generated from the construction activities. The extent of the dust control measures that are required will vary depending on factors such as construction staging, weather, and construction activities. Given the variability of the control measures necessary, the scheduling and application rates required will be determined by the contractor to meet their preferred dust mitigation strategy. Furthermore, it will be the responsibility of the contractor to implement dust control measures on as needed basis to the satisfaction of the Township.

7.0 Conclusions & Recommendations

The analysis presented in this report provides a comprehensive stormwater management and servicing assessment as well as design for the proposed residential development. Our conclusions and recommendations include the following:

- Access to the Subject Property will be provided by one entrance along Main Street East. The internal laneway will access for residents and other service vehicles/trucks.

- Gravity sanitary services for the Subject Property will be provided via combined services with two connections to the Main Street sanitary sewer.

- An internal watermain system with individual services to each unit will be provided through the Subject Property with one connection to the watermain along Main Street.

- The development will be fully serviced by hydro, natural gas, cable, and telecommunications.

- The proposed superpipe network and OGS unit will provide quantity and quality control which are adequately sized to provide “enhanced protection” level treatment while controlling post-development flows to pre-development levels for all storms up to the 100-year storm event.

Given the above noted conclusions, we support the development of the Subject Property from the perspective of engineering servicing and stormwater management requirements.

Respectfully submitted,

C.F. CROZIER & ASSOCIATES INC.

Justin L'Abbe, P.Eng.
Project Manager

C.F. CROZIER & ASSOCIATES INC.

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Project Engineer

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APPENDIX A

Geotechnical Investigation

"BUILT ON THE ROCK"

GEOTECHINCAL INVESTIATION REPORT

PROPOSED RESIDENTIAL SUBDIVISON,

271 MAIN STREET,

DUNDALK, ON;

PROJECT NUMBER: 23-115-01

CLIENT: 271 Main Street East Inc.

ATTENTION: Cale Barnes

DATE: April 30, 2024

PREPARED BY: Green Geotechnical Ltd.
576 Bryne Drive, Unit 'O'
Barrie, ON
L4N 9P6

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1.0 SITE AND PROJECT BACKGROUND

Green Geotechnical Ltd. (Green Geotechnical) was retained by 271 Main Street East Inc. to conduct a subsurface investigation and prepare a geotechnical design report for the proposed residential development at 271 Main Street East, in the community of Dundalk, in the Township of Southgate, Ontario. The site is located in a predominately commercial and residential area on the southeast side of Main Street East. A site location plan is provided as Figure 1. Currently the site is an approximately 0.65-acre vacant property with remnants of a demolished building and driveway.

Based on email communication dated August 2023 and the conceptual site plan, it is understood that the site will be developed to include the construction of 32 stacked townhome units with below-grade basements and a 6m wide drive aisle. It is assumed that the development is to be fully serviced municipally serviced to an urban standard.

At the time of this investigation, no conceptual grading or servicing plans were available. It is presumed that site grades will generally be near or slightly above their current elevations. Any regrading within the influence zones of building or settlement sensitive areas is anticipated to be done with the use of Engineered Fill.

This report encompasses the geotechnical investigation conducted for the Property to assess its geotechnical suitability for the proposed development. The field investigation consisted of advancing a total of four (4) exploratory boreholes (Boreholes 1 to 4) at the Property. The objective of the geotechnical investigation was to determine the prevailing subsurface soil and groundwater conditions, in order to provide geotechnical engineering recommendations for the design of the proposed building foundations, basement-slabs, lateral earth pressure and seismic design parameters, pavement design, and pipe bedding. In addition, comments are also included on the pertinent project construction aspects including excavation, backfill and groundwater control.

2.0 INVESTIGATION PROCEDURES AND METHODOLOGY

The field investigation was conducted on November 27th, 2023, and consisted of drilling and sampling a total of four (4) exploratory boreholes (Boreholes 1 to 4) extending to termination depths ranging from approximately 6.3m to 6.6m below existing ground surface.

The boreholes were staked out in the field by Green Geotechnical based on the proposed development and existing site features. The approximate borehole locations are shown on the enclosed Borehole Location Plans as Figure 2A – Existing Conditions and Figure 2B – Proposed Conditions.

Various utility locates agencies (including a private locate company) were contacted by Green Geotechnical to clear the borehole locations prior to the commencement of the field investigation.

The ground surface elevations at the borehole locations were surveyed by Green Geotechnical. Borehole elevations are provided relative to Geodetic Datum (NAD). The horizontal coordinates are reported relative to the Universal Transverse Mercator geographic coordinate system (UTM Zone 17T). It should be noted that the elevations provided on the Borehole Logs are approximate and provided only for the purpose of relating borehole soil stratigraphy and should not be used or relied on for other purposes.

The borings were drilled by a specialist drilling contractor using a track mounted drill rig power auger and sampled at regular intervals with a conventional 50mm diameter split barrel sampler when the Standard Penetration Test (SPT) was carried out (ASTM D 1586). The field work (drilling, sampling, and testing) was observed full time and recorded by Green Geotechnical field staff, who logged the boring and examined the samples as they were obtained.

All samples obtained during the investigation were sealed into plastic jars and transported to our geotechnical laboratory for detailed inspection and testing. The borehole samples were examined (tactile) in detail by a geotechnical engineer and classified according to visual and index properties. Geotechnical laboratory testing consisted of water content determination on all samples, and grain size analysis on two (2) selected soil samples. The measured natural water contents of individual samples and the results of the grain size analysis test are plotted on the enclosed borehole logs at respective sampling depths. The results of the grain size analyses are also summarized in Section 3.5 of this report and are appended in Appendix B.

Groundwater levels were observed in the open boreholes upon the completion of drilling. Monitoring wells were installed in two (2) boreholes to facilitate one (1) stabilized groundwater level reading by Green Geotechnical, which was taken on January 6th, 2024, and two (2) readings by Crozier on December 13th, 2024 and March 13th, 2024. The results of the groundwater level readings are enclosed on the borehole logs and summarized in Section 3.4 of this report.

3.0 SUBSURFACE CONDITIONS

The specific soil conditions encountered at each borehole location are described in greater detail on the Borehole Logs, with a summary of the general subsurface soil conditions outlined below. This summary is intended to correlate this data to assist in the interpretation of the subsurface conditions at the site. The borehole logs are enclosed in Appendix A.

It should be noted that the subsurface conditions are confirmed at the borehole locations only and may vary between and beyond the borehole locations. The boundaries between the various strata as shown on the logs are based on non-continuous sampling. These boundaries represent an inferred transition between the various strata, rather than a precise plane of geologic change.

3.1 Topsoil

Surficial topsoil with a thickness of approximately 0.2m to 0.6m was encountered at the ground surface of all Boreholes. The topsoil was dark brown in colour.

Topsoil thicknesses provided in this report were obtained at the individual borehole locations, as measured through the collar of the open borehole. Thicknesses may vary between and beyond borehole locations and should not be used/relied upon for costing purposes.

3.2 Earth Fill

Earth fill comprised of a sandy silt, with trace to some gravel to cobbles, trace clay, and organic inclusions was encountered in Boreholes 1, 2, 3, and 4 underlying the surficial topsoil, with thicknesses ranging from approximately 0.4m to 1.3m. The earth fill zone was underlain by the native glacial till.

The Standard Penetration Test result (N-Values) obtained from the earth fill zone ranged from 4 to over 50 blows per 300mm of penetration, indicating a very loose to very dense relative density.

The in-situ moisture contents of the earth fill samples ranged from 4.6 to 37.2 percent by weight, indicating a generally moist to wet condition.

3.3 Silt Glacial Till

Native deposits of a sandy silt glacial till with some gravel to cobbles and occasional boulders, sand content ranging from sandy to and sand, and trace to some clay was encountered in Boreholes 1, 2, 3, and 4 underlying the Earth Fill layer and extended to the borehole termination depths of approximately 6.3m to 6.6m.

The Standard Penetration Test result (N-Values) obtained from this layer ranged from 11 to over 50 blows per 300 mm of penetration, indicating a generally compact to very dense relative density.

The in-situ moisture contents of the silt soil samples ranged from 5 to 35 percent by weight, indicating a generally moist to wet condition.

3.4 Groundwater

The depth of ground water and caving was measured in each of the boreholes immediately following the drilling. Water level measurements were made in the monitoring wells installed in Boreholes 2 and 3 on January 6th, 2024 by Green Geotechnical. Two more measurements were made by Crozier on December 13th, 2023, and March 13th, 2024. The ground water observations of all the boreholes are summarized as follows:

Borehole No.	Depth of Augering (m)	Depth to Cave (m)	Unstabilized Water Level (Depth/Elevation) (m)	Stabilized Water Level in well on December 13th, 2023 (Depth/Elevation) (m)	Stabilized Water Level in well on January 6th, 2024 (Depth/Elevation) (m)	Stabilized Water Level in well on March 13th, 2024 (Depth/Elevation) (m)
1	6.1	5.5	Dry	N/A	N/A	N/A
2	6.1	Open	Dry	2.9 / 516.9	2.6 / 516.2	2.5 / 516.3
3	6.1	Open	Dry	3.4 / 515.0	1.6 / 516.8	1.4 / 517.0
4	6.1	Open	Dry	N/A	N/A	N/A

Groundwater levels will fluctuate seasonally and depending on the amount of surface runoff and precipitation.

3.5 Geotechnical Laboratory Test Results

The geotechnical laboratory testing consisted of natural moisture content determination for all samples, while grain size analysis was conducted on two selected soil samples (Borehole 2, Sample 4 and Borehole 4, Sample 4). The test results are listed on the enclosed Borehole Logs at the respective sampling depth.

The results (graphs) of the grain size analyses are appended and a summary of the results are as follows:

Borehole No. Sample No.	Sampling Depth below Grade (m)	Percentage (by mass)				Descriptions (MIT System)
		Gravel	Sand	Silt	Clay	
Borehole 1, Sample 4	2.3 – 2.8	29	24	34	13	GRAVELLY, SANDY SILT, some clay
Borehole 4, Sample 5	3.0 – 3.5	39	23	28	10	SILTY, SANDY GRAVEL, trace clay

4.0 GEOTECHNICAL ENGINEERING DESIGN

The following discussion and recommendations are based on the factual data obtained from this investigation and are intended for use by the owner and the design engineer. Contractor's bidding or providing services on this project should review the factual data and determine their own conclusions regarding construction methods and scheduling.

This report is provided on the assumption that the design features relevant to the geotechnical analyses will be in accordance with applicable codes, standards, and guidelines of practice. If there are any changes to the site development features or any additional information relevant to the interpretations made of the subsurface information with respect to the geotechnical analyses or other recommendations, then Green Geotechnical should be retained to review the implications of these changes with respect to the contents of this report.

Based on email communication dated August 2023 and the conceptual site plan, it is understood that the site will be developed to include the construction of 32 stacked townhome units with below-grade basements and a 6m wide drive aisle. It is assumed that the development is to be fully serviced municipally serviced to an urban standard.

At the time of this investigation, no conceptual grading or servicing plans were available. It is presumed that site grades will generally be near or slightly above their current elevations. Any regrading within the influence zones of building or settlement sensitive areas is anticipated to be done with the use of Engineered Fill.

4.1 Foundation Design Parameters

Based on the field investigation at this site, below the surficial topsoil and earth fill layers, the subsurface conditions at the location of the proposed structures predominantly consist of compact to very dense sandy silt to sand and silt glacial till soils. The undisturbed native site soils are suitable for the support of conventional spread footings, provided that all loose, caved, soft, or deleterious materials are removed, and excess water is pumped out prior to concrete placement. The surficial topsoil, earth fill zones, weathered/disturbed native soils or high organic soil areas and/or any other deleterious materials are not suitable to support building foundations.

The compact to very dense native soil conditions encountered will allow structure foundations placed directly on them to be designed with a maximum net geotechnical reaction of 150 kPa (SLS) and a factored geotechnical resistance of 225 kPa (ULS), subject to foundation inspection confirmation by Green Geotechnical. Greater capacity can be available at greater depths if required for specific components and can be assessed by Green Geotechnical on a case-by-case basis.

A minimum soil cover of 1.6m or equivalent insulation is recommended for frost protection to footings in exterior or unheated areas. Construction during cold weather should also ensure temporary frost protection of footing bases.

Native soils tend to weather rapidly and deteriorate on exposure to the atmosphere and surface water. The time between foundation excavation and concrete placement should be minimized as much as possible.

The minimum footing widths to be used in conjunction with the above recommended soil bearing pressures should be 0.5m for continuous footings and 0.9m for individual footings placed on native soils. The above recommended bearing capacities are based on estimated maximum total settlement of 25mm and differential settlement of 19mm.

It should also be noted that due to the variable conditions in the upper approximately 1 to 2m of the site, some downward stepping of footings should be anticipated in order to extend to competent soils. Footings stepped from one level to another must be at a slope not exceeding 7 vertical to 10 horizontal, and with a grade change not exceeding 600mm.

Prior to placing foundation concrete, all excavated foundation subgrade soils should be cleaned of all deleterious materials such as topsoil, fill, softened or disturbed materials as well as any standing water. It is recommended that the foundations be inspected by Green Geotechnical in order to confirm the exposed soil conditions and recommended bearing capacities.

4.1.1 Foundations on Engineered Fill

At the time of this investigation, no conceptual grading or servicing plans were available. It is presumed that site grades will generally be near or slightly above their current elevations. Any regrading within the influence zones of building or settlement sensitive areas is anticipated to be done with the use of Engineered Fill.

The undisturbed native soils beneath the topsoil, weathered/disturbed zones, and earth fill are considered suitable for the support of Engineered Fill pads for supporting the building foundations. The Engineered Fill pads should extend at least 1m beyond any building footprint at underside of footing elevation and extend out at a 1:1 (horizontal to vertical) slope down to the native soils. Unless the foundations are constructed immediately on the Engineered Fill pad, the Engineered Fill should be built up at least an additional 1m in elevation to serve as a protective cap of the Engineered Fill at underside of footing level from the effects of weathering.

All deleterious or otherwise unsuitable materials such as topsoil, fill, softened or disturbed materials, as well as any standing water must be removed prior to the placement of Engineered Fill. These materials do not constitute an adequate subgrade for support of Engineered Fill. After any unsuitable materials are

removed, the exposed competent native soil subgrade must be inspected and approved by Green Geotechnical prior to placement of Engineered Fill. Engineered Fill placed to raise grades must consist of clean earth, free from any organic/topsoil or deleterious matter and must be placed in maximum 150mm thick lifts and compacted to at least 98 percent Standard Proctor Maximum Dry Density (SPMDD). Any Engineered Fill construction must be completed under full time supervision by Green Geotechnical to monitor extent, lift thickness, compaction, material quality and the like.

For Engineered Fill with a thickness of at least 0.5m constructed on a native subgrade approved by Green Geotechnical, the recommended maximum net geotechnical reaction may be 150kPa (SLS) and the maximum factored geotechnical resistance at Ultimate Limit State (ULS) is 225kPa.

Prior to placing foundation concrete, all Engineered Fill should be cleaned of all deleterious materials such as softened or disturbed materials as well as any standing water. It is required that the foundations placed on Engineered Fill be inspected by Green Geotechnical in order to confirm the exposed soil conditions and recommended bearing capacities.

The minimum footing widths to be used in conjunction with the above recommended soil bearing pressures should be 0.6m for continuous footings and 1.0m for individual footings placed on Engineered Fill. The above recommended bearing capacities are based on estimated maximum total settlement of 25mm and differential settlement of 19mm.

It should be noted that for structures placed on Engineered Fill, nominal reinforcing steel (rebar) at a minimum be placed in the foundations comprising two (2) continuous 15M bars in the strip footings, and two (2) continuous 15M bars at the top and bottom of the foundation walls be provided. Any column footing will require 15M bars spaced at 0.3m on centre, in each direction of the column. The reinforcing steel requirements of the structure are to be reviewed by a structural engineer.

A copy of “Engineered Fill Earthworks Specifications” is enclosed in Appendix E of this report for reference purposes. These specifications should be included in the earthworks contract.

4.2 Slab-on-Grade or Basement Floor Design Parameters

Groundwater levels recorded at this site were recorded at approximately ±1.6 to ±3.4m below existing grades in December of 2023, January of 2024, and March of 2024. All finished floor surfaces are recommended to be at least 0.5m above the prevailing seasonally high groundwater level.

All non-structural earth fill and any other deleterious or unsuitable materials must be removed prior to placement of new fill for grade raise. These materials do not constitute an adequate subgrade for support of Engineered Fill. After any unsuitable materials are removed, the exposed soil subgrade must be inspected and approved by Green Geotechnical at the time of construction. Any structural fill placed to raise grades, must be placed in maximum 150mm thick lifts and compacted to at least 98 percent Standard

Proctor Maximum Dry Density (SPMDD). Conventional lightly loaded concrete slab-on-grade floors can be placed on the Engineered Fill. The vertical moduli of subgrade reaction for compacted fill soils at the site is 18,000 kPa/m.

It is necessary that building floor slabs be provided with a capillary moisture barrier and drainage layer. This is accomplished by placing the slab on a minimum 200mm layer of 19mm clear stone (OPSS.MUNI 1004) compacted by vibration to a dense state. The upper 50mm of the 200mm drainage layer may be replaced with 50mm of Granular A (OPSS.MUNI 1010) to provide a trafficable surface. The 19mm clear stone can be replaced in its entirety with Granular 'A' so long as a minimum 10mil poly-vapour barrier is used below the slab base. However, these do not replace the floor manufacturers' specific requirement(s) for a moisture and vapour barrier. A suitable non-woven geotextile filter (Terrafix 360R or equivalent approved by Green Geotechnical) must be installed (with a minimum 900mm overlap) below the capillary moisture break to properly filter the slab base from the subgrade. Otherwise, this could result in the loss of ground supporting the slab and clogging of the slab base.

All basement floors should be constructed at least 0.5m above the seasonally high-water level. Perimeter weeping drains (filtered) are recommended to be installed leading to positive outlets such as a sump pump in the basement. Normal basement damp proofing with Miradrain is recommended. Basement walls must be backfilled either with imported Granular "B" type backfill or drainage mediums as per the Ontario Building Code. The insitu soils are not considered to be suitable for reuse as backfill against basement walls unless damp proofing measures as specified in the Ontario Building Code are taken on foundation walls. A typical Basement Drainage Detail is provided in the attached Appendix C.

Where a basement level is within 1.0m of the water table, under-floor drains should be considered. Under floor drainage tiles should consist of placing rows of 100mm diameter perforated drainage pipe leading to a positive sump or outlet. It is recommended that the under-floor drain invert be placed at least 300mm below the underside of the floor slab. Drainage tiles should be placed in parallel rows 3m on centre in each direction. The drainage tile must be surrounded with 100mm of rounded clear stone, completely wrapped in filter fabric. It is essential that the clear stone is separated from the subgrade by using an approved geotextile fabric material (effective opening size of less than 130 microns). Typical Basement Drainage Details are provided in the attached Appendix C.

The basement drainage system is a critical structural element since it keeps water pressure from acting on the basement floor slab or on the foundation walls, in addition to keeping moisture out of the basement. The size and arrangement of the pump system and battery backup system should be designed to be adequate to accommodate the anticipated groundwater and storm event flows. The subdrain system should be outlet to a suitable discharge point under gravity flow or connected to a sump located in the lowest level of the basement. The water from the sump must be pumped out to a suitable discharge

point/positive outlet. The installation of the drains as well as the outlet must conform to the applicable plumbing code requirements.

Regardless of the approach to slab-on-grade floor construction, the floor slabs that are to have bonded floor finishes (such as tiles with adhesives) should be provided with a capillary moisture and vapour barrier and drainage layer. The floor manufacturers have specific requirements for moisture and vapour barrier; therefore, the floor designer/architect must ensure that a provision of appropriate moisture and vapour barrier conforming to specific floor finish product requirements is incorporated in the project specifications. Adequate testing must be carried out to ensure acceptable levels of moisture and relative humidity in the concrete slab prior to the installation of floor finish(es).

The under-slab vapour retarder specifications, selection and installation shall conform to ASTM E1745 and ASTM E1643. The moisture vapour measurement tests shall conform to RH: ASTM F2170, RH: ASTM F2420 and Calcium Chloride: ASTM F1869. The Surface Applied Moisture Vapour Barrier system shall meet the guidelines established in ASTM F3010-13.

4.3 Earthquake Design Parameters

The Ontario Building Code stipulates the methodology for earthquake design analysis. The determination of the type of analysis is predicated on the importance of the structure, the spectral response acceleration and the site classification.

Under Ontario Regulation 88/19, the ministry amended Ontario's Building Code (O. Reg 332/12) to further harmonize Ontario's Building Code with the 2015 National Codes. These changes will help reduce red tape for businesses and remove barriers to interprovincial trade throughout the country. The amendments are based on code change proposals the ministry consulted in 2016 and 2017. The majority of the amendments came into effect on January 1, 2020, which includes structural sufficiency of buildings to withstand external forces and improve resilience.

Seismic hazard is defined in the Ontario Building Code (OBC) by uniform hazard spectra (UHS) at spectral coordinates of 0.2s, 0.5s, 1.0s and 2.0s and a probability of exceedance of 2% in 50 years. The OBC method uses a site classification system defined by the average soil/bedrock properties (e.g., shear wave velocity (vs), Standard Penetration Test (SPT) resistance, and undrained shear strength (s_u) in the top 30 meters of the site stratigraphy below the foundation level, as set out in the Ontario Building Code. There are 6 site classes from A to F, decreasing in ground stiffness from A, hard rock, to E, soft soil; with site class F used to denote problematic soils (e.g., sites underlain by thick peat deposits and/or liquefiable soils). The site class is then used to obtain peak ground acceleration (PGA), peak ground velocity (PGV) site coefficients Fa and Fv, respectively, used to modify the UHS to account for the effects of site-specific soil conditions.

Based on the above, it is recommended that the site designation for seismic analysis be **Site Class C**, as per the Ontario Building Code. It should be noted that the above site seismic designation is estimated on the basis of rational analysis of the undrained shear strength information obtained from the boreholes advanced at the site only up to about 6.6m depth below grade. Consideration may be given to conducting a site-specific Multichannel Analysis of Surface Waves (MASW) at this site to confirm the average shear wave velocity in the top 30m of the site stratigraphy. MASW testing often determines higher seismic site class ratings than those able to be determined from SPT testing, resulting in potential project cost savings.

The values of the site coefficient for design spectral acceleration at period T, F(T), and of similar coefficients F(PGA) and F(PGV) shall conform to Tables 4.1.8.4.B. to 4.1.8.4.I. using linear interpolation for intermediate values of PGA.

4.4 Lateral Earth Pressure Design Parameters

The appropriate values for use in the design of structures subject to unbalanced earth pressures at this site are tabulated as follows:

Stratum/Parameter	γ	ϕ	K_a	K_o	K_p
Compact Granular Fill Granular 'B' (OPSS.MUNI 1010)	21	32	0.31	0.47	3.25
Earth Fill	18	28	0.36	0.53	2.76
Silty Sand to Sand and Silt Glacial Till (compact to very dense)	20	32	0.31	0.47	3.25

where: γ = bulk unit weight of soil (kN/m^3)

φ = internal angle of friction (degrees)

K_a = Rankine active earth pressure coefficient (dimensionless)

K_o = Rankine at-rest earth pressure coefficient (dimensionless)

K_p = Rankine passive earth pressure coefficient (dimensionless)

The above earth pressure parameters pertain to a horizontal grade condition behind a retaining structure. Values of earth pressure parameters for an inclined retained grade condition will vary.

Walls subject to unbalanced earth pressures must be designed to resist a pressure that can be calculated based on the following equation:

$$P = K[\gamma(h - h_w) + \gamma' h_w + q] + \gamma_w h_w$$

where, **P** = the horizontal pressure at depth, **h** (m)

K = the earth pressure coefficient

$\mathbf{h_w}$ = the depth below the groundwater level (m)

γ = the bulk unit weight of soil, (kN/m^3)

γ' = the submerged unit weight of the exterior soil, (γ - 9.8 kN/m^3)

q = the surcharge loading (kPa)

The above equation pertains to a horizontal grade condition behind a retaining structure. Values of earth pressure against retaining structures for an inclined retained grade condition will vary.

Where the wall backfill can be drained effectively to eliminate hydrostatic pressures on the wall that would otherwise act in conjunction with the earth pressure, this equation can be simplified to:

$$\boldsymbol{P = K[\gamma h + q]}$$

Resistance to sliding of retaining structures is developed by friction between the base of the footing and the soil. This friction **(R)** depends on the normal load on the soil contact **(N)** and the frictional resistance of the soil **(tan ϕ)** expressed as: **R = N tan ϕ**. This is an unfactored resistance. The factored resistance at ULS is $\mathbf{R_f = 0.8\ N \tan \phi}$.

4.5 Pavement Design

The pavement subgrade is expected to comprise of native undisturbed sandy silt to silt and sand glacial till or clean earth fill compacted to a minimum of 98% of SPMDD. The exposed subgrade should be shaped and graded with a typical 3% cross-fall, directed towards continuous subdrains with inverts at least 0.3m below subgrade level.

All topsoil, organic-rich, and otherwise deleterious material should be sub-excavated. The pavement subgrade should be assessed (proof rolled with a heavy rubber-tired vehicle, if deemed feasible by Green Geotechnical) and approved (no rutting or major deflections) by Green Geotechnical to ensure stability prior to the placement of the pavement granular courses. All unstable areas will require sub-excavation and re-compaction or increased thickness of granular subbase. It should be noted that the majority of the upper site soils are considered moderately to highly frost susceptible. Therefore, adequate subgrade drainage is recommended.

Based on the soil conditions encountered during our investigation, we recommend the following pavement structure for light duty (vehicle parking) and heavy-duty (fire route) traffic areas:

Pavement Structural Layers	Min. Thickness (mm)		Compaction Requirements
	Light Duty (Vehicle Parking) Traffic	Heavy Duty (Fire Route) Traffic	
Hot Mix Asphalt Surface Course, OPSS 1150 HL 3	40	50	as per OPSS 310
Hot Mix Asphalt Binder Course, OPSS 1150 HL 8	60	80	
Base Course, OPSS.MUNI 1010, Granular A or 19mm CRLS	150	150	100 percent of Standard Proctor Maximum Dry Density (SPMDD) (ASTM D698)
Subbase Course, OPSS.MUNI 1010, Granular B or 50mm CRLS	300	450	98 percent of Standard Proctor Maximum Dry Density (SPMDD) (ASTM D698)

The above design assumes that sub-drainage of the granular fill will be provided. This should consist of continuous subdrains leading to catch basins.

It should be reiterated that the subgrade soils are moderately to highly frost susceptible. The subdrains are considered a valuable protection against frost heave damage and subgrade softening particularly impacting the long-term performance of the pavement.

An adequate granular working surface would likely be required in order to minimize subgrade disturbance and protect its integrity in wet periods. The fill material may consist of granular type material with a moisture content within ±2 percent of optimum moisture content. Fill materials should be placed and compacted in accordance with OPSS.MUNI 501 and the subgrade should be compacted to 98 percent of SPMDD.

The granular subbase and base fill materials should be compacted to a minimum of 98% and 100% of Standard Proctor Maximum Dry Density (SPMDD), respectively, placed in lifts of 150mm or less. Asphaltic concrete materials should be rolled and compacted as per OPSS 310 based on density testing. **Due to the susceptibility of the site soils to disturbance, care should be taken that construction occurs in the driest summer periods. If this is not possible, the granular subbase may require additional thickness, or the specific use of Granular B 'Type II.'**

Control of surface water is an important factor in achieving a good pavement life. The need for adequate subgrade drainage cannot be over-emphasized. The subgrade must be free of depressions and sloped (preferably at a minimum grade of 3 percent) to provide effective drainage toward subgrade drains. Grading adjacent to pavement areas should be designed to ensure that water is not allowed to pond

adjacent to the outside edges of the pavement. Continuous pavement subdrains should be provided along both sides of the driveway and drained into respective catch basins to facilitate drainage of the subgrade and the granular materials. The subdrain inverts should be maintained at least 0.3m below subgrade level. Continuous subdrains should also be provided for pavement areas along any curb-lines/sidewalks. Two lengths of subdrain stubs (each minimum 3m long) should be installed at each catch basin (refer to Appendix D - Pavement Drainage Details).

The granular base beneath the sidewalks and concrete walkways should be extended to provide continuous drainage paths outletting to the pavement curb-line or ditch subdrains to facilitate subgrade drainage and help minimize concrete slab heaving. The concrete surface sidewalk must be supported on a minimum of 1.6m thick non-frost susceptible material provided with a provision of a subdrain with a positive outlet to help minimize slab heave due to freezing weather conditions, or consideration should be given to install a frost slab in these areas.

The above pavement design thicknesses are considered adequate for design traffic. However, if the pavement construction occurs in wet or inclement weather, it may be necessary to provide additional subgrade support for heavy construction traffic by increasing the thickness of the granular sub-base, base, or both. Further, traffic areas for construction equipment may experience unstable subgrade conditions. These areas may be stabilized utilizing additional thickness of granular materials.

The long-term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures must be maintained to ensure that uniform subgrade moisture and density conditions are achieved as much as possible when fill is placed, and the natural subgrade is not disturbed or weakened after it is exposed.

It should be noted that in addition to adherence of the above pavement design recommendations, a close control on the pavement construction process will also be required in order to obtain the desired pavement life. Therefore, it is required that regular inspection and testing by Green Geotechnical be conducted during the pavement construction to confirm material quality, stability, thickness, and to ensure adequate compaction.

4.6 Pipe Bedding

Trench bases are expected to consist primarily of native, undisturbed sandy silt to silt and sand glacial till soils, or clean earth fill compacted to a minimum of 98% of SPMDD. The native, undisturbed site soils as well as Engineered Fill will generally be suitable for support of underground services with conventional Class ‘B’ granular bedding. Additional granular bedding may be necessary for stabilization of wet trench bases or particularly soft areas. The granular bedding should consist of a well graded material such as

Granular 'A'. Excavation bases should be free of standing water prior to and during bedding and service placement.

Any soft, loose, or disturbed soils encountered as a result of groundwater seepage or construction traffic should be sub excavated and replaced with suitably compacted granular fill. Additionally, any loose or deleterious fill or organics encountered below proposed pipe inverts should be sub excavated and replaced with suitable compacted bedding material. Granular 'A' bedding material should be placed in thin lifts and compacted to a minimum of 95% of SPMDD. If HL8 coarse aggregate or 19mm clear stone is used this will require light tamping only. However, it should be cautioned that this HL8 aggregate or clear stone should not be used directly against native deposits unless a geotextile fabric is also considered as a complete wrap to prevent migration of fines into the bedding from the surrounding fine soil. Without proper filtering, this loss of ground could result in loss of support to the pipes and in possible future.

In areas where the soils become wet, unstable and dilatant (easily disturbed) such as saturated silts, clays and water bearing granular soils, careful construction techniques and dewatering should be followed. If the pipes are laid on disturbed, dilatant soil, significant post-construction settlements could occur after the trenches are backfilled. In such cases, disturbed soil must be removed. The bottom of wet trenches will have to be stabilized by dewatering. The placement of a thin layer of lean mix concrete or a 'mud slab' may be considered to prevent heaving of sensitive or easily disturbed sub-soils and prevent disturbance of sensitive sub-soils due to construction activity. If a 'mud slab' option is not used, then increasing the Class 'B' type bedding thickness in order to stabilize the subgrade soil is recommended.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Excavation and Backfill

Excavations must be carried out in accordance with the Occupational Health and Safety Act, Ontario Regulation 213/91 (as amended), Construction Projects, Part III – Excavations, Sections 222 through 242. These regulations designate four (4) broad classifications of soils to stipulate appropriate measures for excavation safety. For practical purposes, the site soils are classified as Type 3 soil above and Type 4 soil below the groundwater table.

Where workers must enter excavations advanced deeper than 1.2m, the trench walls should be suitably sloped and/or braced in accordance with the Occupational Health and Safety Act and Regulations for Construction Projects. The regulation stipulates safe slopes of excavation by soil type as follows:

Soil Type	Base of Slope	Steepest Slope Inclination
1	within 1.2 metres of bottom of trench	1 horizontal to 1 vertical
2	within 1.2 metres of bottom of trench	1 horizontal to 1 vertical
3	from bottom of trench	1 horizontal to 1 vertical
4	from bottom of trench	3 horizontal to 1 vertical

Minimum support system requirements for steeper excavations are stipulated in the Occupational Health and Safety Act and Regulations for Construction Projects, and include provisions for timbering, shoring and moveable trench boxes.

The subsurface soils can be removed by conventional excavation equipment. Larger size particles (cobbles and boulders) that are not specifically identified in the boreholes may be present in the native soils. The size and distribution of cobbles/boulders/obstructions cannot be predicted with boreholes, as the sampler size is insufficient to secure representative particles of this size. The risk and responsibility for the removal and disposal of cobbles/boulders/obstructions and appropriate use of equipment must be addressed in the contract documents for foundations, excavations and shoring contractors.

Structures such as existing buried foundations, previously backfilled excavations, existing old wells/cisterns, drainage tiles, boulders, rubble, etc. may also be present at the site. The presence of these structures if encountered, will likely affect construction methods and cost if they exist within proposed structure areas.

The surficial topsoil, earth fill, and native soil layers with amounts of organics should not be reused as backfill in settlement sensitive areas (beneath floor slabs, trench backfill and pavement areas). However, these materials may be stockpiled and reused for landscaping purposes.

Unsaturated native cohesionless soils which are free of organics, boulders, and deleterious inclusions, encountered above the groundwater table, are considered to be suitable for reuse as backfill, so long as moisture content levels are within 2 percent of the optimum moisture content level. Otherwise, consideration should be given to importing granular type fill to achieve adequate compaction in Engineered Fill and trench backfill activities, where use of the site's coarser grained soils is not feasible.

It should be noted that native soils excavated from below the prevailing groundwater level (if encountered) will likely be too wet to compact to required compaction specification.

The moisture content of the backfill soils should be within 2 percent of their optimum moisture content. Any soil material with in-situ moisture content higher than 2 percent of its optimum moisture content could be put aside to dry or be tilled to reduce the moisture content so that it can be effectively compacted. Alternatively, materials of higher moisture content could be wasted and replaced with imported material which can be readily compacted.

In settlement sensitive areas, the backfill should consist of clean earth and should be placed in lifts of 150mm thicknesses or less, and heavily compacted to a minimum of 95 percent SPMDD at a water content close to optimum. The soils encountered on the site will be best compacted with a heavy smooth drum (cohesionless) or sheep's-foot (cohesive) type roller. Imported granular type fill soils will be best compacted with a smooth-drum type roller.

It should be noted that the site soils vary greatly in their drainage properties and will be difficult to handle and compact should they become wetter as a result of inclement weather or seepage. Hence, it can be expected that earthworks will be difficult during the wet periods (i.e., spring and fall) of the year and may result in increased earthwork costs.

5.2 Groundwater Control

Groundwater levels recorded at this site were recorded at approximately ±1.4 to ±3.4m below existing grades in December of 2023, January of 2024, and March of 2024. Long term monitoring was beyond the scope of this investigation and the seasonal water table may fluctuate. Seepage at or near the groundwater levels should be handled adequately using filtered sump pumps placed at the base of the excavations for most of the site. More significant dewatering efforts will be required below the groundwater levels, and particularly in sandy/gravelly soil pockets.

Moderately permeable soils were encountered in the boreholes. These soils may yield varying amounts of groundwater seepage into the excavation depending upon the type of soil and the depth of excavation. The amount of water seepage is expected to increase with the depth of excavation. Groundwater control will be required for excavations extending into/or below the prevailing groundwater level, prior to and during the subsurface construction. Without positive groundwater control, the subgrade in wet permeable soils will become weak/disturbed and lose its integrity to support. Consideration should be given to install a skim coat of lean concrete (mud-slab) to preserve the subgrade integrity in these areas, and to provide a working platform, as deemed appropriate by the project geotechnical engineer during construction.

All finished floor surfaces are recommended to be at least 0.5m above the prevailing seasonally high groundwater level, which the proposed building is expected to comply with.

It should be noted that excavations carried through and below the water bearing soils will likely experience loosening and sloughing of the base and sides unless the groundwater level is lowered first to at least 1.0m below the bottom of the excavation.

5.3 Quality Control

The foundation installations must be reviewed in the field by Green Geotechnical, the geotechnical engineer, as they are constructed. The on-site review of the condition of the foundation subgrade as the foundations are constructed is an integral part of the geotechnical design function and is required by Section 4.2.2.2 of the Ontario Building Code. If Green Geotechnical is not retained to carry out foundation evaluations during construction, then Green Geotechnical accepts no responsibility for the performance or non-performance of the foundations, even if they are ostensibly constructed in accordance with the conceptual design advice contained in this report.

The long-term performance of the pavement is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure that uniform subgrade moisture and density conditions are achieved as much as practically possible. The design advice in this report is based on an assessment of the subgrade support capabilities as indicated by the boreholes. These conditions may vary across the site depending on the final design grades and therefore, the preparation of the subgrade and the compaction of all fill should be monitored by Green Geotechnical at the time of construction to confirm material quality, thickness, and to ensure adequate compaction.

The requirements for fill placement on this project have been stipulated relative to Standard Proctor Maximum Dry Density (SPMDD). In situ determinations of density during fill placement on site are required to demonstrate that the specified placement density is achieved. Green Geotechnical can provide sampling and testing services for the project as necessary, with our qualified technical staff.

Concrete will be specified in accordance with the requirements of CAN3 - CSA A23.1. Green Geotechnical maintains a concrete laboratory and can provide concrete sampling and testing services for the project as necessary.

6.0 LIMITATIONS AND REPORT USE

6.1 Procedures

This subsurface investigation has been carried out using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by Green Geotechnical and other engineering practitioners, working under similar conditions and subject to the time, financial and physical constraints applicable to this project. The discussions and recommendations that have been presented are based on the factual data obtained by Green Geotechnical.

It must be recognized that there are special risks whenever engineering or related disciplines are applied to identify subsurface conditions. Even a comprehensive sampling and testing programme implemented in accordance with the most stringent level of care may fail to detect certain conditions. Green

Geotechnical has assumed for the purposes of providing design parameters and advice, that the conditions that exist between sampling points are similar to those found at the sample locations. The conditions that Green Geotechnical has interpreted to exist between sampling points can differ from those that actually exist.

It may not be possible to drill a sufficient number of boreholes or sample and report them in a way that would provide all the subsurface information that could affect construction costs, techniques, equipment and scheduling. Contractors bidding on or undertaking work on the project should be directed to draw their own conclusions as to how the subsurface conditions may affect them, based on their own investigations and their own interpretations of the factual investigation results, cognizant of the risks implicit in the subsurface investigation activities so that they may draw their own conclusions as to how the subsurface conditions may affect them.

6.2 Changes in Site and Scope

It must also be recognized that the passage of time, natural occurrences, and direct or indirect human intervention at or near the site have the potential to alter subsurface conditions. Groundwater levels are particularly susceptible to seasonal fluctuations.

The discussion and recommendations are based on the factual data obtained from this investigation made at the site by Green Geotechnical and are intended for use by the owner and its retained designers in the design phase of the project. If there are changes to the project scope and development features, the interpretations made of the subsurface information, the geotechnical design parameters and comments relating to constructability issues and quality control may not be relevant or complete for the revised project. Green Geotechnical should be retained to review the implications of such changes with respect to the contents of this report.

It is recognized that the regulatory agencies in their capacities as the planning and building authorities under Provincial statues, will make use of and rely upon this report, cognizant of the limitations thereof, both expressed and implied.

We trust this report meets your requirements. Should you have any questions regarding the information presented, please do not hesitate to contact our office.

Sincerely,

Green Geotechnical Ltd.

Luke Kim, E.I.T.
Project Coordinator

Tristan Kuchar, B.A.Sc., E.I.T.
Project Manager

Steven Green, P.Eng.
President

LICENSED PROFESSIONAL ENGINEER
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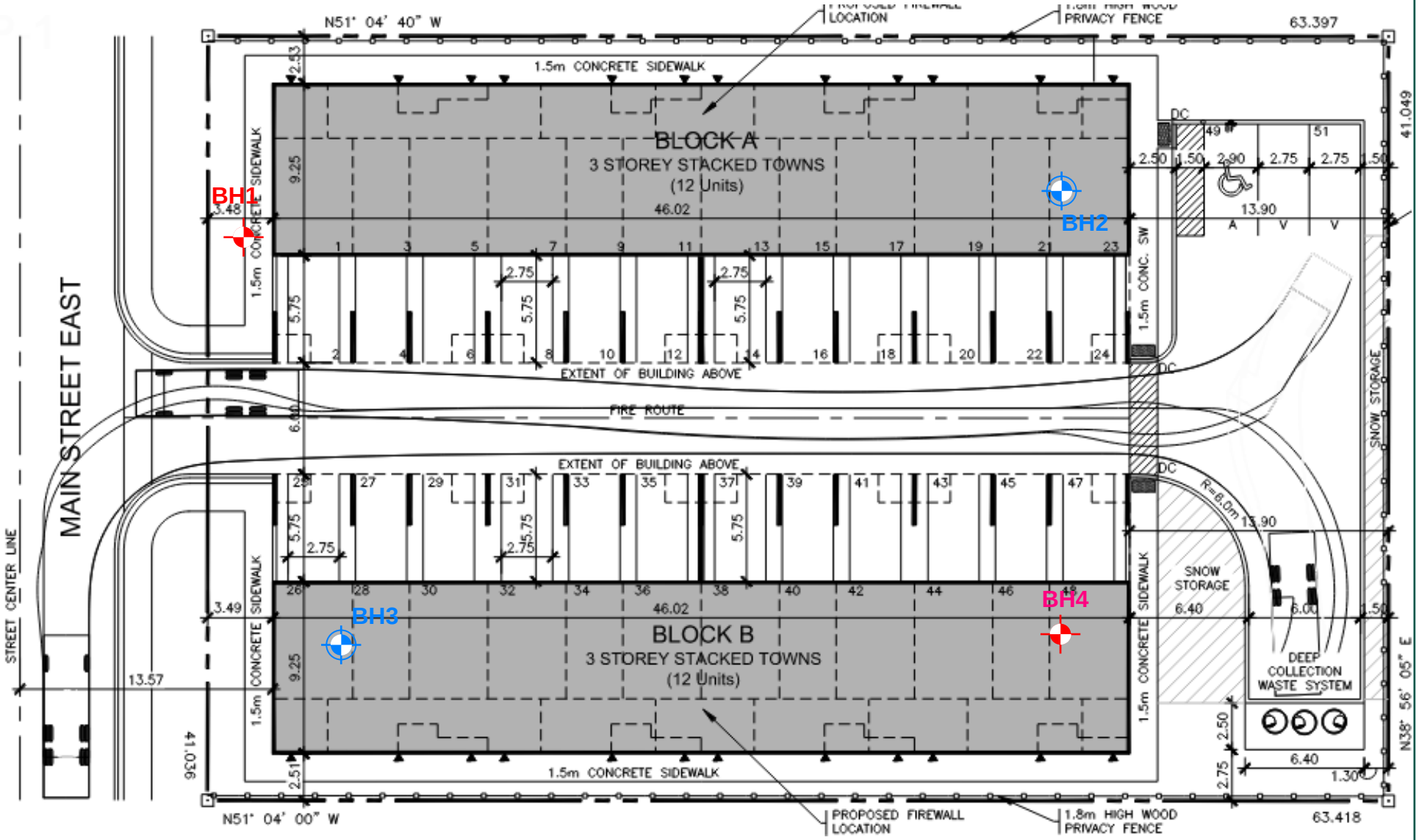
100175284
Apr. 30, 2024
PROVINCE OF ONTARIO

Enclosures: Figures and Appendices

FIGURES

Title: **Figure 1: SITE LOCATION PLAN**		Project: **271 MAIN STREET EAST, DUNDALK, ON**	
Client: **271 MAIN ST EAST INC.**	Drawn By: **NC**	Project Number: **23-115-02**	GREEN GEOTECHNICAL 576 Bryne Drive, Unit 'O', Barrie, ON 705-503-9626 info@greengeo.ca
Reference: **Map Data © 2023 Google Maps**	Reviewed By: **TK**	Date: **FEB. 2024**	

Title: **FIGURE 2A: EXISTING BOREHOLE LAYOUT PLAN (Approximate)**	Project: **271 MAIN STREET EAST, DUNDALK, ON**		
Client: **271 MAIN ST EAST INC.**	Drawn By: **NC**	Project Number: **23-115-02**	GREEN GEOTECHNICAL 576 Bryne Drive, Unit 'O', Barrie, ON 705-503-9626 info@greengeo.ca
Reference: **Map Data © 2024 Google Maps**	Reviewed By: **TK**	Date: **FEB. 2024**	



Title: **FIGURE 2B: PROPOSED BOREHOLE LAYOUT PLAN (Approximate)**		Project: **271 MAIN STREET EAST, DUNDALK, ON**	
Client: **271 MAIN ST EAST INC.**	Drawn By: **LK**	Project Number: **23-115-02**	GREEN GEOTECHNICAL 576 Bryne Drive, Unit 'O', Barrie, ON 705-503-9626 info@greengeo.ca
Reference: **"*Site Plan*," by Orchard Design Studios, dated April 29, 2024**	Reviewed By: **TK**	Date: **APR. 2024**	

APPENDICIES

APPENDIX A

SYMBOLS and ABBREVIATIONS USED ON BOREHOLE LOGS

PROPORTIONAL TERMS

Term	Proportion
trace	0 to 10%
some	10 to 20%
-y or -ey	20 to 35%
and	>35%

MOISTURE DESCRIPTION

Term	Description
dry	No observable pore moisture
moist	Inferred pore moisture, no observable free water
wet	Weakened by moisture, free water on hands when handling

CONSISTENCY of COARSE-GRAINED SOILS

Consistency	Blow Count N
very loose	< 4
loose	4 to 10
compact	10 to 30
dense	30 to 50
very dense	> 50

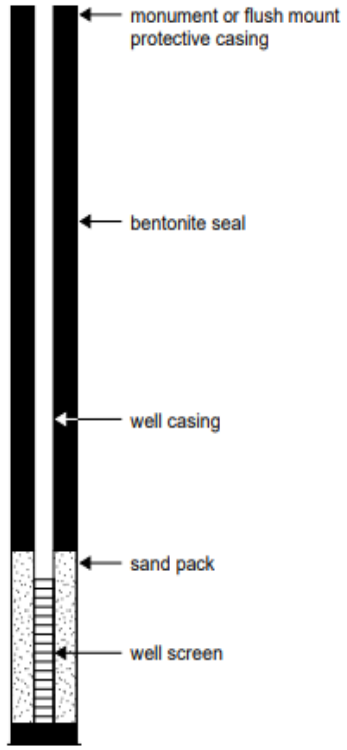
Notes: SPT/DCPT 'N' values are 'raw' field blow counts, measured for 300 mm (12 inch) of penetration.

CONSISTENCY of FINE-GRAINED SOILS

Consistency	Blow Count N	Undrained Shear Strength Su (kPa)	
very soft	< 2	< 12	Easily exudes between fingers when squeezed
soft	2 to 4	12 to 25	Easily intended by fingers
firm	4 to 8	25 to 50	Can be intended by strong finger or thumb pressure
stiff	8 to 16	50 to 100	Cannot be intended by thumb pressure
very stiff	16 to 30	100 to 200	Can be intended by thumb nail
hard	> 30	> 200	Difficult to intend by thumb nail

ASTM STANDARDS
ASTM D1568 Standard Penetration Test (SPT) - Driving a 51 mm O.D. split-barrel sampler ("split spoon") into soil with a 63.5 kg weight free falling 760mm. The blows required to drive the split spoon 300mm ("bpf") after an initial penetration of 150 mm is referred to as the N-Value.
ASTM D1568 Cone Penetration Test (CPT) - Pushing an internal still rod with a outer hollow rod ("sleeve") tipped with a cone with an apex angle of 60° and a cross-sectional area of 1000 mm^2 Into soil. The resistance is measured in the sleeve and at the tip to determine the skin friction and the tip resistance.
ASTM D2573 Field Vane Test (FVT) - Pushing a four blade vane into soil and rotating it from the surface to determine the torque required to shear a cylindrical surface with the vane. The torque is converted to the shear strength of the soil using a limit equilibrium analysis.
ASTM D1587 Shelby Tubes (ST) - Pushing a thin-walled metal tube into the in-situ soil at the bottom of a borehole, removing the tube and sealing the ends to prevent soil movement or changes in moisture content for the purposes of extracting a relatively undisturbed sample.

WELL LEGEND



SYMBOL	Description
AS	Auger Sample
CC	Continuous Core Sample
DC	Drill Cuttings
GS	Grab Sample
SS	SPT Spoon Sample
TS	Thin-walled / Shelby Sample
WS	Water Sample

SYMBOL	Description
▼	Measured in a piezometer or well
▽	Inferred water level based on observations during investigation

BOREHOLE LOG: BH1

Project: 271 Main Street East | Project No.: 23-115-01

Site Address: Dundalk, ON | Client: 271 Main St. East Inc.

Easting: 548800 | Northing: 4891044 | Elevation:518.6 m

Logged By: SO/NC | Reviewed By: TK | Investigation Date: 2023-11-27

Ground Surface at 518.6 m EL 518.6 m

TOPSOIL 0.2 m EL 518.4 m

FILL

Sandy silt, trace to some gravel to cobbles, trace clay, trace organic inclusions, loose, moist, dark brown 0.6 m EL 518 m

SANDY SILT TO SAND AND SILT

Some gravel to cobbles, occasional boulders, trace to some clay, compact, very dense, moist brown

(GLACIAL TILL)

BH1 Terminated at 6.6 m 6.6 m EL 512 m

NO.	SYMBOLS	STANDARD PENETRATION TEST (SPT)	NOTES/GRAIN SIZE (%)
1	SS	6	
2	SS	25	
3	SS	11	
4	SS	36	Gr - 29%; Sa - 24%; Si - 34%; Cl - 13%
5	SS	(61)	
6	SS	(REF)	N: 50/300mm
7	SS	(90)	

MONITORING WELL: No Data

MOISTURE PLOT: W_{PL} W W_{LL}; 20 40 60 80

Notes:
Borehole was dry and caved to 5.5 mbg upon completion of drilling.

BOREHOLE LOG: BH2

Project: 271 Main Street East | Project No.: 23-115-01

Site Address: Dundalk, ON | Client: 271 Main St. East Inc.

Easting: 548831 | Northing: 4891013 | Elevation:518.8 m

Logged By: SO/NC | Reviewed By: TK | Investigation Date: 2023-11-27

Ground Surface at 518.8 m EL 518.8 m

TOPSOIL

0.6 m
EL 518.2 m

FILL

Sandy silt, trace to some gravel to cobbles, trace to some clay, trace organic inclusions, loose, moist, dark brown

1.5 m
EL 517.3 m

SANDY SILT TO SILTY SAND

Some gravel to cobbles, occasional boulders, trace to some clay, compact to very dense, moist, brown

(GLACIAL TILL)

6.3 m
EL 512.5 m

BH2 Terminated at 6.3 m

NO.	SYMBOLS	STANDARD PENETRATION TEST (SPT)
1	SS	4
2	SS	8
3	SS	14
4	SS	(54)
5	SS	(REF) N: 50/300mm
6	SS	(REF) N: 50/300mm
7	SS	(REF) N: 50/150mm

MOISTURE PLOT: W_{PL} — W — W_{LL}; 20 40 60 80

Notes:

Borehole was dry and open upon completion of drilling. Stabilized water level measured at 2.6 mbg (elev. 516.2 m) on 01-06-24 by Green Geo. Stabilized water level measured at 2.9 mbg (elev 515.9 m) on 12-13-23 and 2.5 mbg (elev. 516.3 m) on 03-13-24 by Crozier.

BOREHOLE LOG: BH3

Project: 271 Main Street East | Project No.: 23-115-01

Site Address: Dundalk, ON | Client: 271 Main St. East Inc.

Easting: 548788 | Northing: 4891026 | Elevation:518.4 m

Logged By: SO/NC | Reviewed By: TK | Investigation Date: 2023-11-27

Ground Surface at 518.4 m EL 518.4 m

TOPSOIL 0.2 m EL 518.2 m

FILL

Sandy silt, some gravel to cobbles, trace to some clay, trace organic inclusions, loose, moist, dark brown

1.5 m EL 516.9 m

SANDY SILT TO SAND AND SILT

Some gravel to cobbles and occasional boulders, some clay, compact to very dense, moist, brown

(GLACIAL TILL)

6.3 m EL 512.1 m

BH3 Terminated at 6.3 m

NO.	SYMBOLS	STANDARD PENETRATION TEST (SPT)	NOTES/GRAIN SIZE (%)
1	SS	5	
2	SS	(REF)	N: 50/450mm
3	SS	12	
4	SS	(57)	
5	SS	(REF)	N: 50/300mm
6	SS	(REF)	N: 50/150mm
7	SS	(REF)	N: 50/150mm

MOISTURE PLOT: W_{PL} W W_{LL} (20 40 60 80)

Notes:

Borehole was dry and open upon completion of drilling. Stabilized water level measured at 1.6 mbg (elev. 516.8 m) on 01-06-24 by Green Geo. Stabilized water level measured at 3.4 mbg (elev. 515.0 m) on 12-13-23 and 1.4 mbg (elev. 517.0 m) on 03-13-24 by Crozier.

BOREHOLE LOG: BH4

Project: 271 Main Street East | Project No.: 23-115-01

Site Address: Dundalk, ON | Client: 271 Main St. East Inc.

Easting: 548820 | Northing: 4891001 | Elevation:518.6 m

Logged By: SO/NC | Reviewed By: TK | Investigation Date: 2023-11-27

Ground Surface at 518.6 m EL 518.6 m

TOPSOIL
0.35 m
EL 518.25 m

FILL
Sandy Silt, trace to some gravel to cobbles, trace clay, trace organic inclusions, loose, moist, dark brown
1.5 m
EL 517.1 m

SANDY SILT TO SAND AND SILT,
Some gravel to cobbles, occasional boulders, trace to some clay, compact to very dense, moist, brown

(GLACIAL TILL)

6.6 m
EL 512 m

BH4 Terminated at 6.6 m

NO.	SYMBOLS	STANDARD PENETRATION TEST (SPT)	NOTES/GRAIN SIZE (%)
1	SS	15	
2	SS	17	
3	SS	46	
4	SS	39	
5	SS	(REF)	Gr - 39%; Sa - 23%; Si - 28%; Cl - 10%
6	SS	(56)	N: 50/450mm
7	SS	(83)	

MONITORING WELL: No Data

MOISTURE PLOT: W_{PL} — W — W_{LL}; 20 40 60 80

Notes:
Borehole was dry and open upon completion of drilling.

APPENDIX B

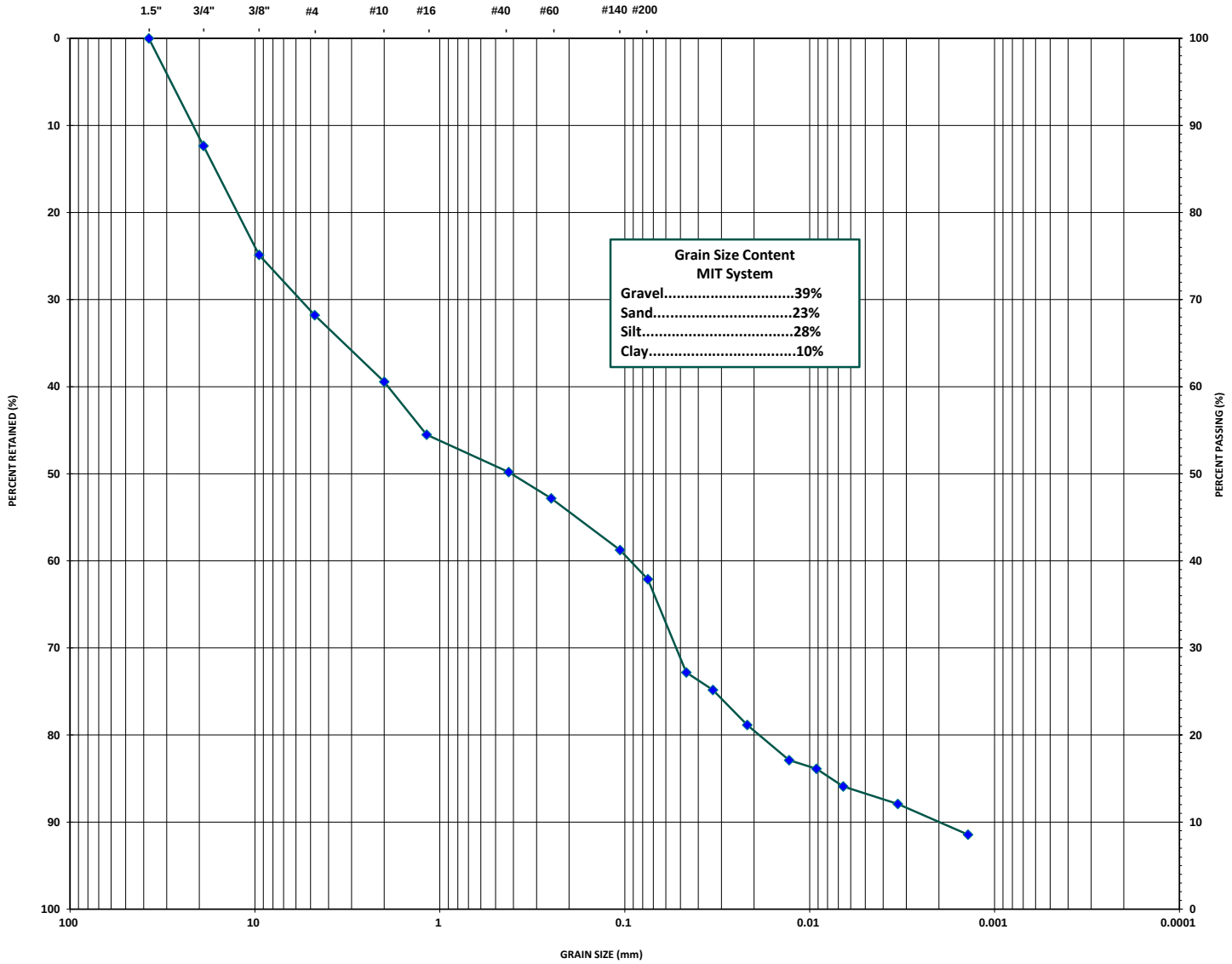
576 Bryne Drive, Unit 'O'
Barrie, ON
L4N 9P6

Hydrometer Analysis Form

Project Number:	23-115-01	Location:	Dundalk, ON		Project Name:	271 Main Street East	
Sample Date:	November 27, 2023	Test Date:	January 11, 2023		Client Name:	271 Main Street East Inc.	
Sample Description:	Silty, sandy gravel, trace clay		Lab Number:	118	Tested By:	NC	
Sample Location:	N/A	Sample Depth:	10 to 11.5'		Sampled By:	NC	
Borehole:	4		Sample Number:		5		
Estimated Septic T-Time:		N/A			Unified Soil Classification		SM

Grain Size Distribution

U.S. Standard Sieve Sizes



MIT System	Gravel	Coarse / Fine	Sand: Coarse / Medium / Fine		Silt	Clay
Unified System	Gravel: Coarse / Fine		Sand: Coarse / Medium / Fine		Silt and Clay	

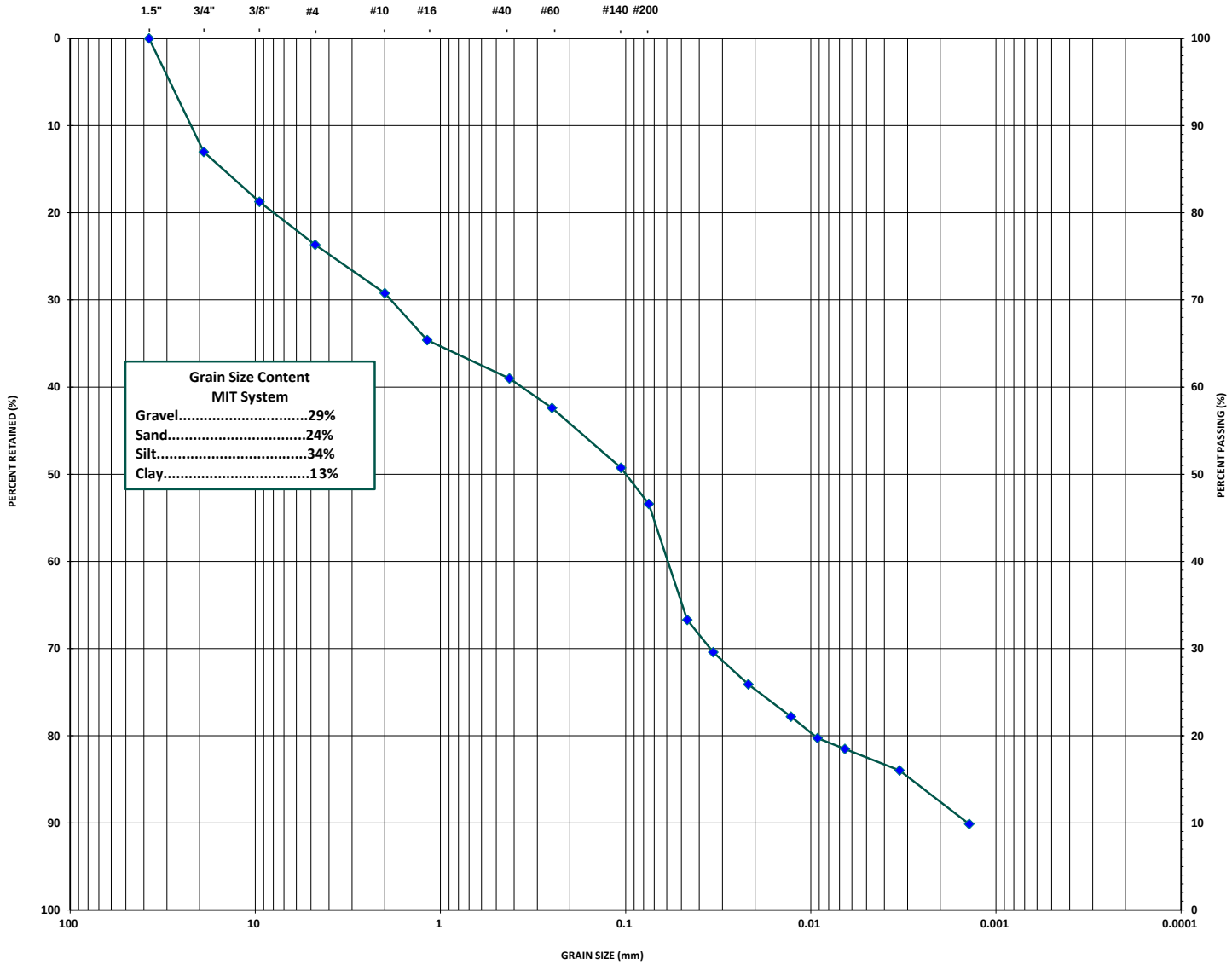
576 Bryne Drive, Unit 'O'
Barrie, ON
L4N 9P6

Hydrometer Analysis Form

Project Number:	23-115-01	Location:	Dundalk, ON	Project Name:	271 Main Street East
Sample Date:	November 27, 2023	Test Date:	January 9, 2023	Client Name:	271 Main Street East Inc.
Sample Description:	Gravelly, sandy silt, some clay	Lab Number:	117	Tested By:	NC
Sample Location:	N/A	Sample Depth:	7.5 to 9'	Sampled By:	NC
Borehole:	1	Sample Number:		4	
Estimated Septic T-Time:		N/A		Unified Soil Classification	SM

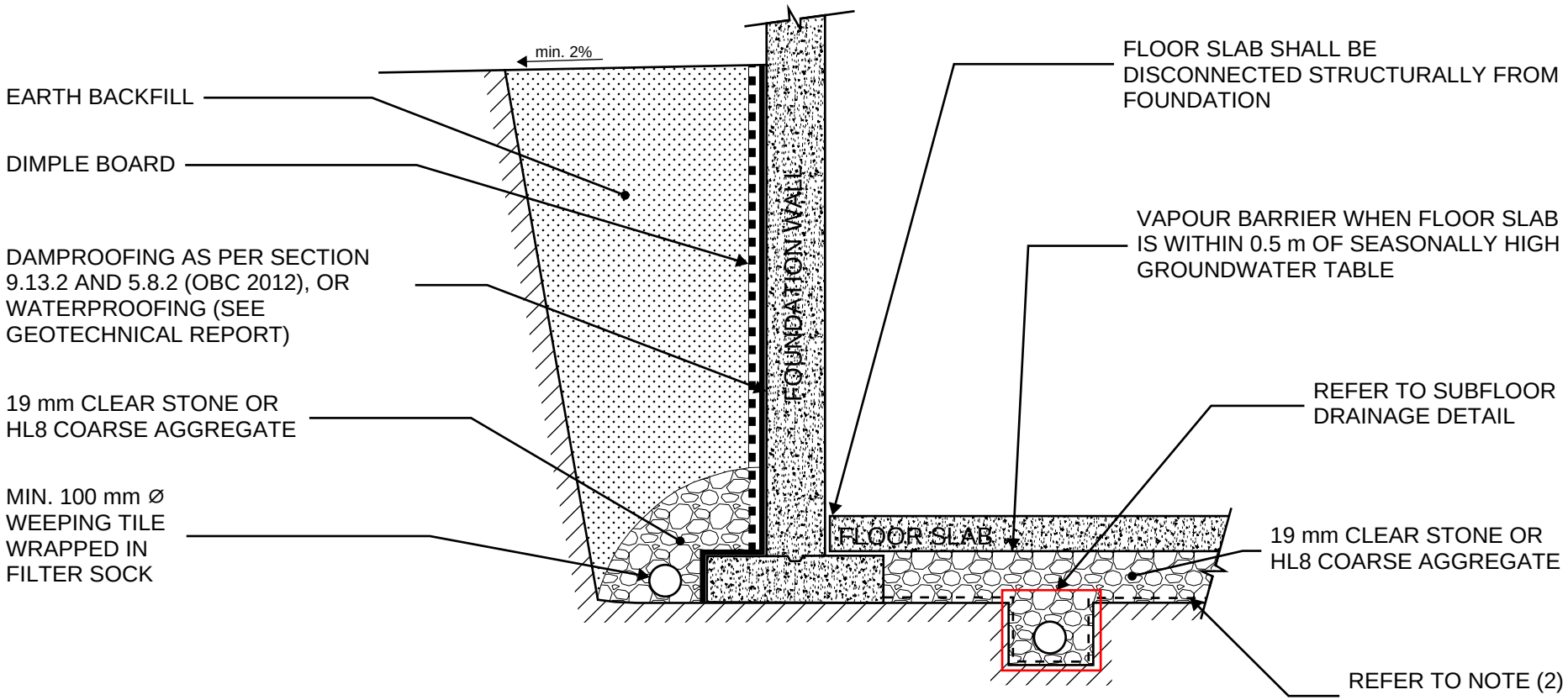
Grain Size Distribution

U.S. Standard Sieve Sizes



MIT System	Gravel			Coarse	Medium	Fine	Silt	Clay	
				Sand					
Unified System	Coarse	Fine	Coarse	Medium	Fine	Silt and Clay			
	Gravel		Sand						

APPENDIX C



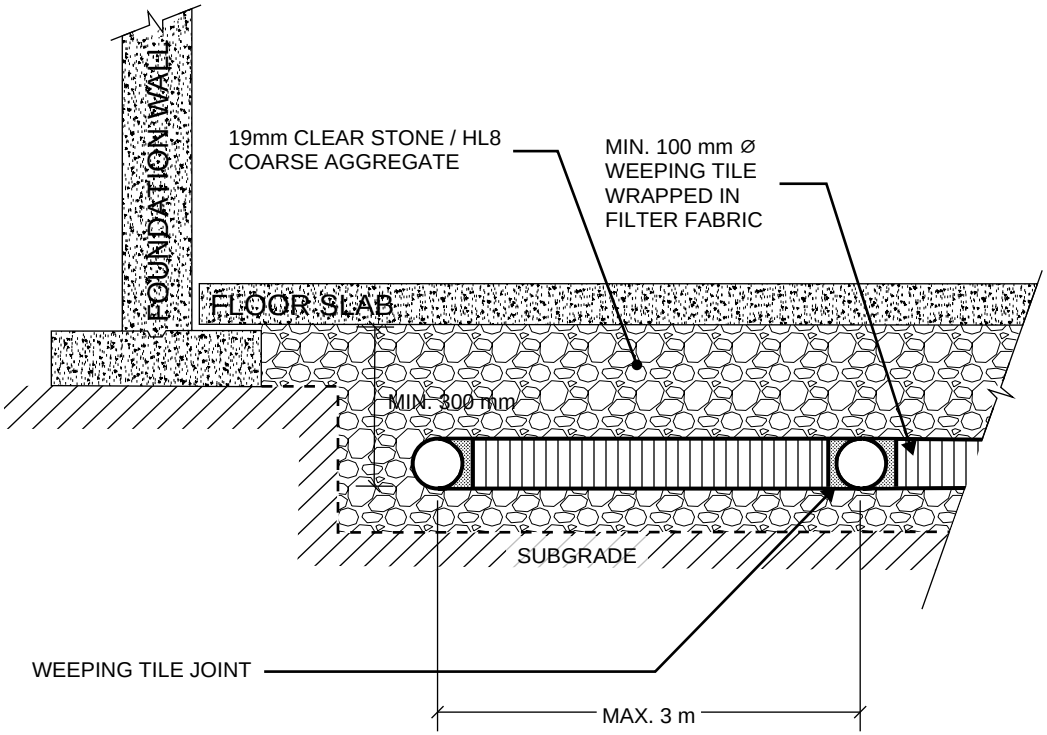
NOTES:

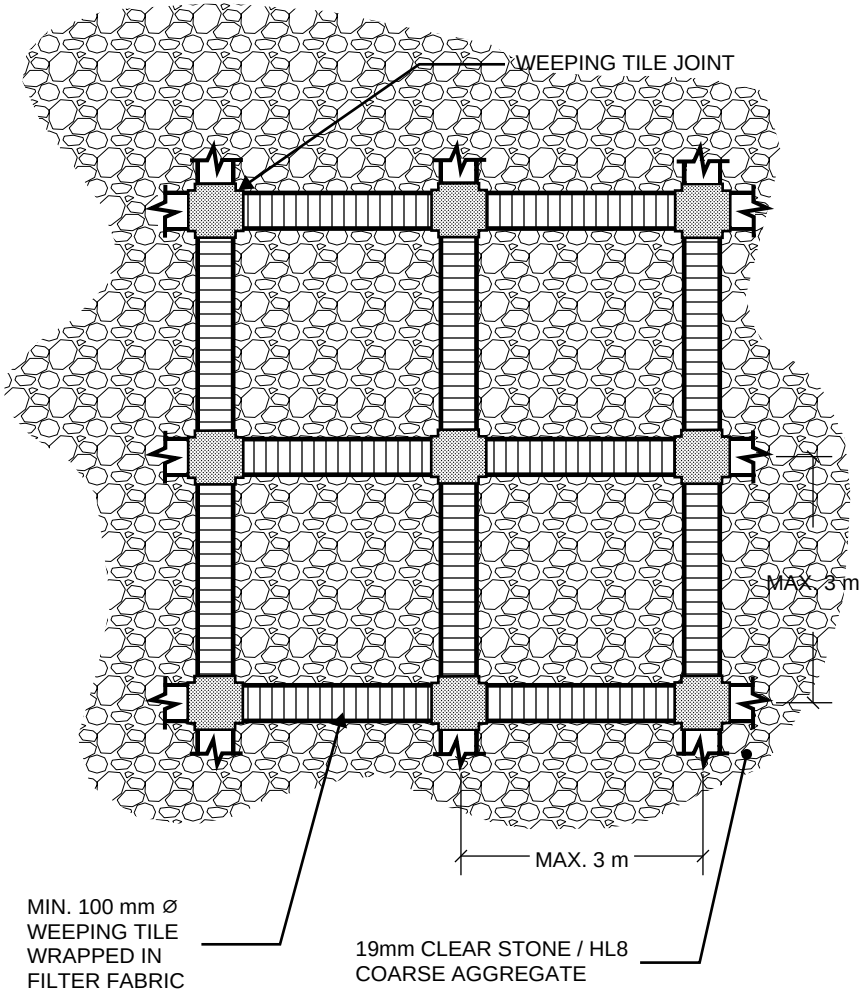
1. TYPICAL SCHEMATIC ONLY. MUST BE READ IN CONJUNCTION WITH GEOTECHNICAL REPORT.
2. WHEN THE SUBGRADE CONSISTS OF COHESIONLESS SOIL, IT MUST BE SEPARATED FROM THE SUBFLOOR DRAINAGE LAYER USING A NON-WOVEN GEOTEXTILE (TERRAFIX 360R OR EQUIVALENT)
3. NOT TO SCALE

Title:

TYPICAL BASEMENT DRAINAGE SCHEMATIC (OPEN EXCAVATION)

GREEN GEOTECHNICAL
576 Bryne Drive, Unit 'O', Barrie, ON
705-503-9626
info@greengeo.ca





NOTES:

1. TYPICAL SCHEMATIC ONLY. MUST BE READ IN CONJUNCTION WITH GEOTECHNICAL REPORT.
2. WHEN THE SUBGRADE CONSISTS OF COHESIONLESS SOIL, IT MUST BE SEPARATED FROM THE SUBFLOOR DRAINAGE LAYER USING A NON-WOVEN GEOTEXTILE (TERRAFIX 360R OR EQUIVALENT)
3. UNDERFLOOR DRAINAGE SHOULD OUTLET TO PERIMETER DRAINAGE SYSTEM AND/OR SUMP PUMP
4. NOT TO SCALE

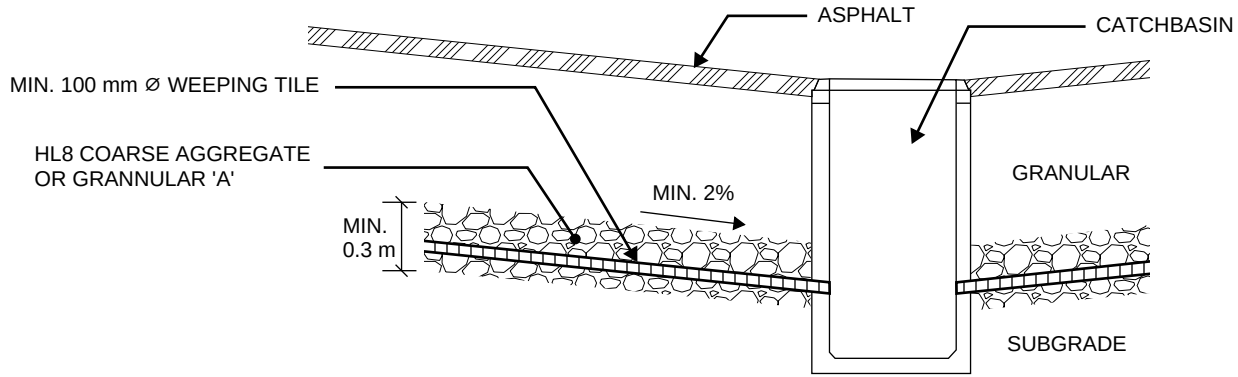
Title:

UNDERFLOOR DRAINAGE (SLAB WITHIN 1m OF SEASONALLY HIGH GWT)

GREEN GEOTECHNICAL
576 Bryne Drive, Unit 'O', Barrie, ON
705-503-9626
info@greengeo.ca

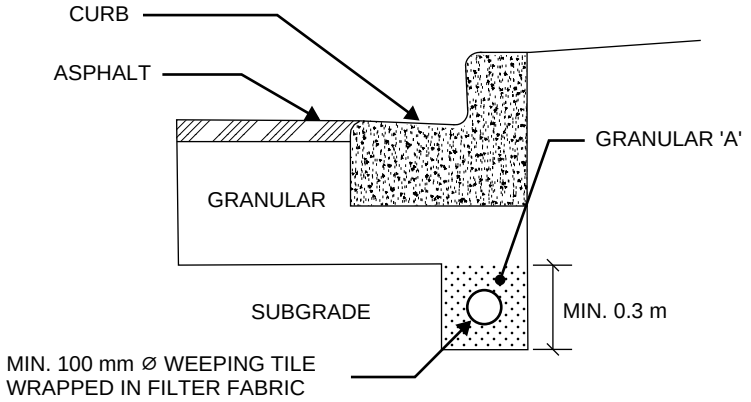
APPENDIX D

LONGITUDINAL SUBDRAIN CONNECTION TO CATCHBASIN

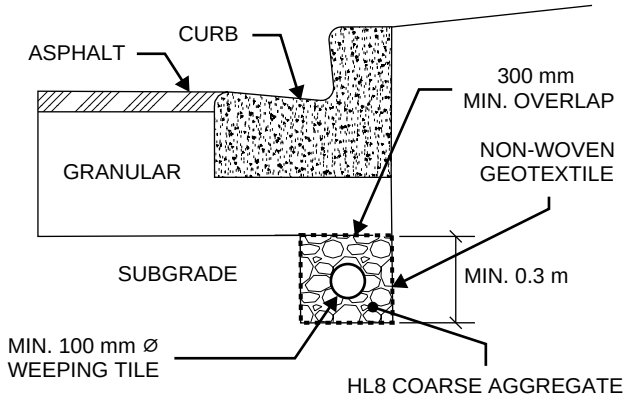


URBAN CROSS SECTIONS

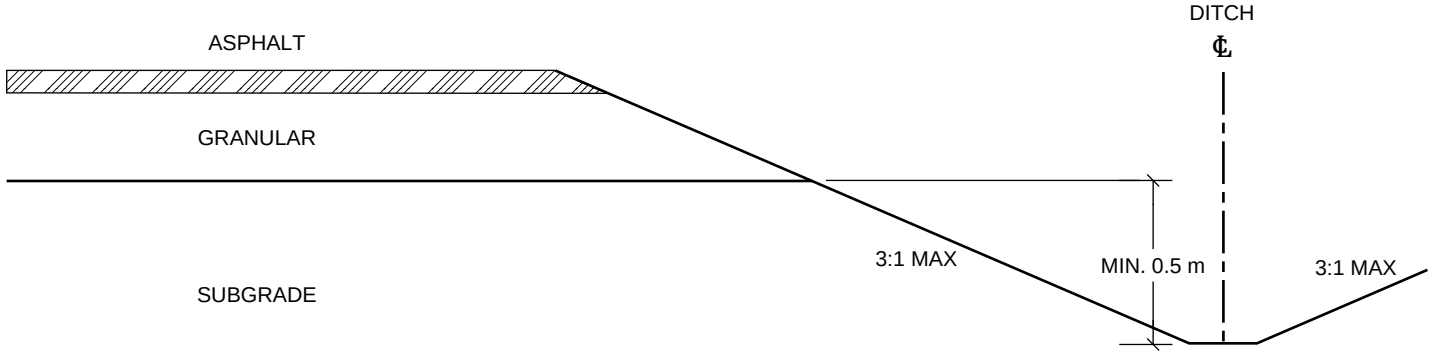
WEEPING TILE WITH FILTER FABRIC



WEEPING TILE WITHOUT FILTER FABRIC



RURAL CROSS SECTIONS



Title:

PAVEMENT DRAINAGE ALTERNATIVES

GREEN GEOTECHNICAL
576 Bryne Drive, Unit 'O', Barrie, ON
705-503-9626
info@greengeo.ca

APPENDIX E

ENGINEERED FILL SPECIFICATIONS

Overview

- Engineered Fill is a pre-approved material which has been placed under the full-time supervision of Green Geotechnical, including testing and inspection during construction to ensure subgrade stability, material quality, proper lift thickness, and adequate compaction have all been maintained.
- Engineered Fill is used to accommodate structural loads (such as for foundations, slabs, etc.) where site grades are being altered, or in order to accommodate structural design loads.
- Prior to concrete placement for footings and poured walls on Engineered Fill, Green Geotechnical must inspect the foundation subgrade soils, and reinforcing steel respectively.

Design

- Engineered fill material must be free of organic inclusions, construction debris, and any other deleterious material.
- Ideally, granular type soils, with less than 8% fines, such as OPSS 1010 Granular 'B,' are used.
- In sites where a high groundwater table or where wet conditions exist, (even with dewatering operations), in order to achieve stable layers and the specified compaction on the first one to two lifts, OPSS 1010 Granular 'B' Type II or 50 mm crusher run limestone may be advisable.
- The determination of whether the site soils are suitable for reuse as Engineered Fill, or if an imported material is to be used, is at the discretion of the opinion of the Geotechnical Engineer.
- Post construction settlement of the Engineered Fill is to be expected. The timeframe that this occurs varies based on the type of material used. Typically, time intervals of the following can be used:

	Self-Consolidation Settlement		**Foundation Loading Settlement**	
Material	**Settlement Rate**	**Time Rate**	**Settlement Rate**	**Time Rate**
Granular 'B' or Coarser	Minimal (0.2% D)	Immediate	Minor (0.5", 12mm)	Immediate
Fine Sand	Minimal (0.5% D)	1-50 hours	Minor (0.75", 19mm)	1-50 hours
Sandy Silt	Minor (0.75% D)	2-30 days	Minor (1", 25mm)	2-30 days
Clayey Silt	Moderate (1% D)	3-6 months	Moderate (1.25", 31mm)	3-6 months
Silty Clay	Major (1.5% D)	6-7 years	Major (1.5", 37mm)	6-7 years

D is the depth of the Engineered Fill

- It is imperative for avoiding excessive settlements that the construction of foundations take into account the post-construction settlement period.
- Engineered Fill is to extend a minimum of 1m beyond the base of any structure's foundations, and project down to the subgrade at a slope with a maximum steepness of 1H:1V.
- An allowable design bearing capacity of 150 kPa (SLS) can usually be used for Engineered Fill constructed on a stable, approved subgrade.
    - This is unless a different bearing capacity for the Engineered Fill has been recommended by the Geotechnical Engineer, based on the properties of the site soils.
- The Engineered Fill is to extend at least 1m above the highest foundation base elevation to provide the Engineered Fill at founding level(s) protection from frost, precipitation, runoff, wind, and weathering.
- Poured concrete footings are to be a minimum width of 0.6m for strip footings and 1.0m for individual footings.

- Reinforcing steel comprised of two (2) continuous 15M bars at the top and bottom of foundation walls, and 15M bars spaced at 0.3m in column pad footings, are required in all poured concrete foundations.

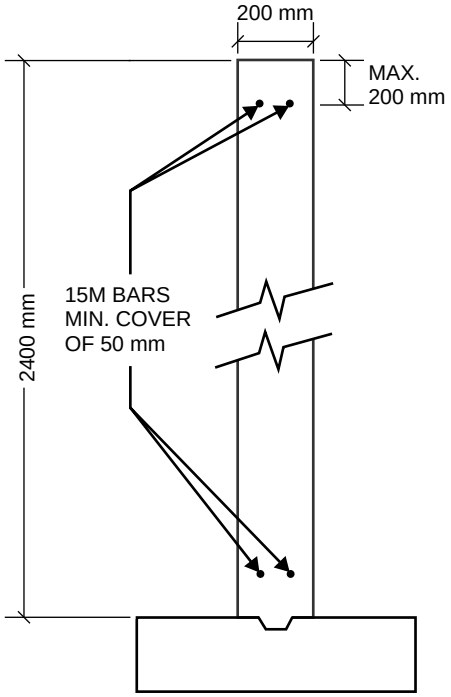
Construction

- Surveying should be done by the earthworks contractor or the surveying contractor to ensure that Engineered fill elevations and footprint are accurate and meet the specifications outlined in this document.
- The elevations should be provided to Green Geotechnical by the earthworks contractor or the surveying contractor at each placed lift of material, for recording compaction levels by elevation, and to ensure proper lift thickness.
- Topsoil and uncontrolled fill/deleterious material are to be excavated, leaving a stable, dry, native subgrade.
- Dewatering may be required, depending on the groundwater conditions at the site.
- Prior to the placement of any Engineered Fill, Green Geotechnical must approve the stability of the exposed native subgrade for Engineered Fill placement.
- Depending on the groundwater conditions and soil type at the site, a proof-roll with a heavy compaction roller or rubber-tire front-end loader with a full bucket may be required on the subgrade. Any noted unstable areas will have to be sub-excavated and brought back up with the placement of Engineered Fill.
- As previously mentioned, if wet conditions exist at the site, for the first one to two lifts of the Engineered Fill, the use of OPSS 101 Granular 'B' Type II or 50 mm crusher run limestone may be advisable.
- All material must be compacted to at least 98% SPMDD (Standard Proctor Maximum Dry Density) within 2% of OMC (Optimum Moisture Content).
- Green Geotechnical will take a sample of the Engineered Fill material to determine its SPMDD, OMC, and gradation.
- Green Geotechnical must test the compaction of the placed Engineered Fill at each lift.
- In wet site conditions, it is typically advisable that the first lift be static rolled, and that all subsequent lifts be compacted with vibration. In dry site conditions, compaction by vibration can occur at all lifts.
- Engineered Fill material shall be placed in maximum 150mm loose lifts.
    - The only exception to this is in the first one to two lifts placed in wet site conditions. Here, loose lifts shall be a maximum of 300mm-450mm.
- Engineered Fill should not be placed during months where freezing temperatures occur.

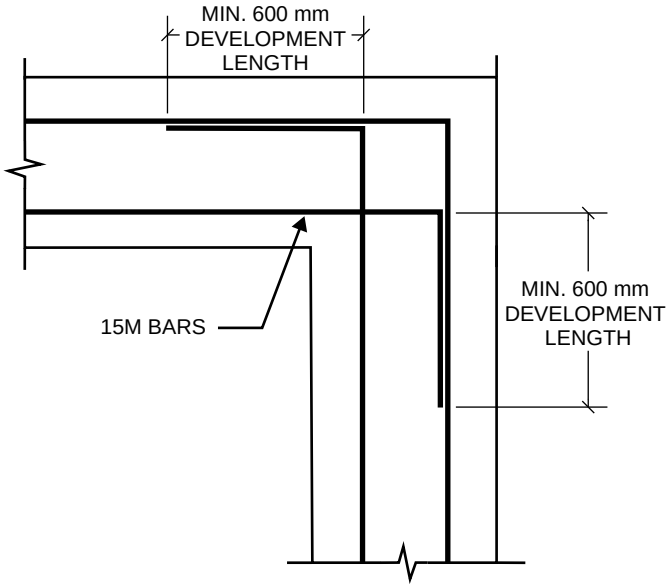
Certification

- Green Geotechnical must be present during Engineered Fill construction to approve the native subgrade, approve of and take a sample of the material, as well as record compaction and lift thickness at every lift.
    - Following this, a letter signed and sealed by a P.Eng. will be submitted certifying the Engineered Fill as being properly constructed, and displaying the field records.
- Green Geotechnical must inspect the foundation subgrade immediately prior to the placement of concrete for footings.
    - Following this, a letter signed and sealed by a P.Eng. will be submitted certifying the Engineered Fill foundation subgrade as being adequate to support the design bearing capacity.
- Green Geotechnical must inspect the reinforcing steel in the foundation walls prior to the placement of concrete. See the attached Typical Reinforced Wall Detail for more information.
    - Following this, a letter signed and sealed by a P.Eng. will be submitted certifying the reinforcing steel as being placed in accordance with the design.

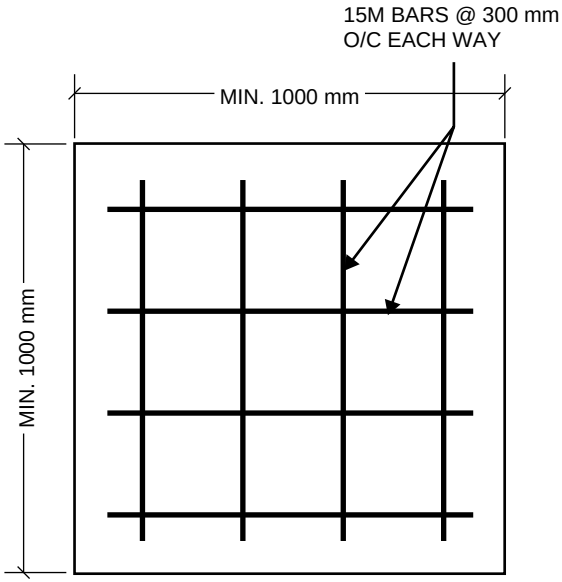
TYPICAL REINFORCED WALL



TYPICAL SPLICING AT CORNERS

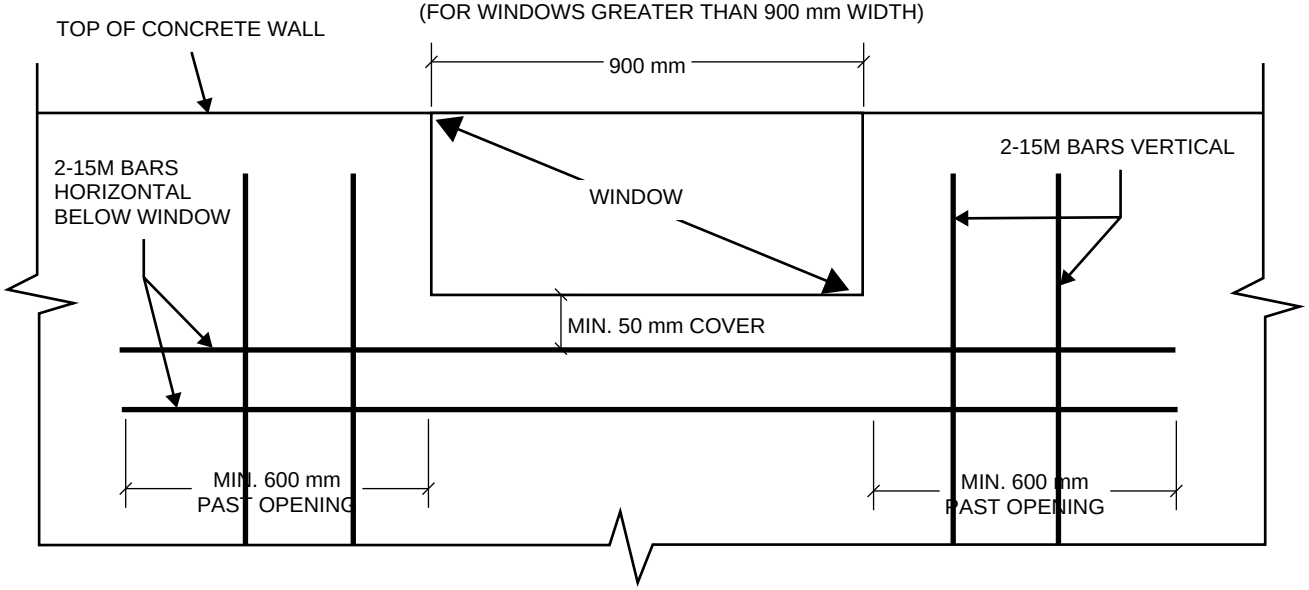


TYPICAL REINFORCEMENT OF COLUMN FOOTINGS



TYPICAL WINDOW REINFORCING

(FOR WINDOWS GREATER THAN 900 mm WIDTH)



NOTES:

1. REINFORCING STEEL C.S.A G30.18-09 GRADE 400
2. CONCRETE MINIMUM 28 DAY STRENGTH 20 MPa
3. BASE OF ALL FOOTING EXCAVATIONG TO BE INSPECTED AND APPROVED PRIOR TO PLACING FORMWORK
4. TO BE USED IN CONJUNCTION WITH STRUCTURAL REPORT
5. DRAWINGS ARE NOT TO SCALE

Title:

TYPICAL REINFORCED WALL DETAILS FOR HOUSES ON ENGINEERED FILL

GREEN GEOTECHNICAL
576 Bryne Drive, Unit 'O', Barrie, ON
705-503-9626
info@greengeo.ca

APPENDIX B

Dundalk Sanitary Infrastructure Map

TOWNSHIP OF SOUTHGATE

Township of Southgate

LEGEND:

PROPERTY
- EXISTING PROPERTY LINE
- DRAFT PLAN APPROVED DEVELOPMENT PARCEL
- DRAFT PLAN APPROVED DEVELOPMENT PHASES
- WATERCOURSES
- WETLAND (GRCA)

MANHOLES
- SANITARY MANHOLE
- MH-159 MUNICIPALLY OWNED MANHOLE NUMBER
- PMH-200 MANHOLE NOT YET ADOPTED BY MUNICIPALITY

FLOW/CAPACITY (%)
- < = 20.0
- < = 40.0
- < = 60.0
- < = 80.0
- < = 100.0

PIPE MATERIAL
- AC ASBESTOS CEMENT
- CONC CONCRETE
- PVC POLYVINYL CHLORIDE

DIAMETER / MATERIAL / LENGTH @ SLOPE — FLOW/CAPACITY

- IN-LINE CLEAN OUT AND SHUT-OFF VALVE
- FORCEMAIN

MCKENZIE ST. · FENNELL ST. · MIDDLETON ST. · MITCHISON AVE. · CORBETT ST. · COLDSTREAM AVE. · SWMF · TODD CR. · GREY COUNTY CP RAIL TRAIL · DUKE ST. · GREY ST. · BRADLEY ST. · PINE ST. · WILSON CRT. · HIGHPOINT ST. · GLENELG ST. · KEPPEL (ROW) · HIGH POINT PUBLIC SCHOOL · McAULEY (ROW) · TORONTO ST. · DUNDALK ST. · PROTON ST. · ROLLAND ST. · OWEN SOUND ST. · ALTIMESH ST. · HUSSEMAN ST. · McGREGOR CRT. · BRAEMORE ST. W. · BRAEMORE ST. E. · BRAEMORE (ROW) · MILL ST. · McCHESNEY ST. · KINGS HIGHWAY No. 10 · MAIN ST. WEST · MAIN ST. EAST · McAULEY ST. · YOUNG ST. · VICTORIA ST. · ALICE ST. · SINCLAIR ST. · SHEFFIELD ST. · RUSSELL LN. · NIKON ST. · ELM ST. · GREY COUNTY CP RAIL TRAIL · ROWE'S LN. · HANBURY ST. · GOLD ST. · HAGAN ST. · MORROW CIR. · BELL CIR. · 15.25 m EASEMENT · PRIVATE MH · PLUG · WERRY AVE. · RIDLEY CR. · SEELEY AVE. · JEZEROY AVE. · VANDUSEN AVE. · VAN DUSEN AVE. · MOODY ST. · PHASE 6 · PHASE 7 · PHASE 8 · PHASE 9 · PHASE 10 · PHASE 11 · PARK · SPS · STOCKS AVE. · COLGAN CR. · MORGAN AVE. · WRIGHT AVE. · RUSSELL ST. · McALISTER ST. · SYMINGTON ST. · MILLINER AVE. · SWMF · IDA ST. · PROTON COMMUNITY SCHOOL · FOLEY · FOLEY DRAIN · ECO-PARKWAY · 300 HDPE "DOUBLE" FORCEMAIN · WASTEWATER TREATMENT FACILITY · FUTURE ROW

NOTES:

This is a schematic representation of the sanitary sewer distribution system. While this drawing and its detail views are shown to a scale, symbols and sanitary sewers are not plotted to scale. This mapping should be used for general purposes only.

DUNDALK SANITARY COLLECTION SYSTEM

FEBRUARY 2022
SCALE 1:3,000
A4179 R02 / A4160 R44/R45

DRAFT

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers
Fergus, Ontario

APPENDIX C

Sanitary Demand Calculations

CROZIER
CONSULTING ENGINEERS

File: 2514-6796
Date: 2024-04-18
By: JGB
Check By: JL'A

271 Main Street - Sanitary Design Criteria

Site Information

Residential Area

Residential Land Area	0.12	ha
Towns	0.12	ha
Number of Residential Units	24	units
Towns	24	units
Person Per Residential Unit (per 2023 Dundalk Reserve Capacity Report)	2.61	persons/unit
Residential Population	63	persons

Residential Design Flows

Average Daily Domestic Flow per Capita (per Township of Southgate Standards)	350	L/C/day
Average Daily Domestic Flow	0.25	L/s
Harmon Peaking Factor (Township of Southgate Standards)	4.29	
Peak Flow	1.09	L/s
Towns	1.09	L/s

Inflow and Infiltration

Infiltration (per Township of Southgate Standards)	0.15	L/s/ha
Total Infiltration Allowance	0.02	L/s
Towns	0.02	L/s

Total Sanitary Residential Flow **1.11 L/sec**

APPENDIX D

Potable Water Demand and Fire Flow Calculations

CROZIER
CONSULTING ENGINEERS

File: 2514-6796
Date: 2024.04.18
By: JGB
Check By: JL'A

271 Main Street - Domestic Water Design Criteria

Number of Individual Residential Units	24	units
Persons Per Unit (Per Township of Southgate Engineering Design Standards)	2.61	persons/unit
Residential Population	63	persons
Water Design Flows		
Residential Average Day (Per Township of Southgate Standards)	350	L/C-day
Total Domestic Water Design Flows		
Average Residential Daily Flow	0.25	L/sec
Max Day Peak Factor (Per MOE Guidelines for Waterworks 2008 Table 3-3)	6.97	
Max Day Demand Flow	**1.77**	L/sec
Fire Flow (FUS)	**183.30**	L/sec
Peak Hour Factor (Per MOE Guidelines for Waterworks 2008 Table 3-3)	10.50	
Peak Hour Flow	**2.66**	L/sec
Required Domestic Water Flow (Max Day + Fire Flow)	**185.07**	L/sec

CROZIER CONSULTING ENGINEERS

Project Name: 271 Main St
Project No: 2514-6796
Prepared By: JGB/AM
Checked By: JL'A
Date: 2024-04-25

Water Supply for Public Fire Protection - 2020
Fire Underwriters Survey
Part II - Guide for Determination of Required Fire Flows for Public Fire Protection in Canada

An estimate of fire flow required for a given area may be determined by the formula:

RFF = 220 * C * sqrt A

where:

RFF = the required fire flow in litres per minute (L/min)

C = the construction coefficient is related to the type of construction of the building
= 1.5 for Type V Wood Frame Construction
= 0.8 for Type IV-A Mass Timber Construction
= 0.9 for Type IV-B Mass Timber Construction
= 1.0 for Type IV-C Mass Timber Construction
= 1.5 for Type IV-D Mass Timber Construction
= 1.0 for Type III Ordinary Construction
= 0.8 for Type II Non-combustible Construction
= 0.6 for Type I Fire Resistive Construction

A = the total effective floor area (effective building area) in square metres (excluding basements at least 50 percent below grade) in the building considered

Step A. **Construction Coefficient (C)** 1.0 = 0.8 for Type II Non-combustible Construction

	Yes/No/Unknown	
Is basement at least 50% below grade?	No	If yes, basement floor area excluded
Vertical openings protected?	Unknown	*For consideration for effective area calculations

Step B. **Proposed Building** Townhouse Row

Calculate Effective Floor Area based on the highlighted cell

-C value from 1.0 to 1.5: 100% of all floor areas are used
-C value below 1 and vertical openings are not protected: Consider two largest floors plus 50% of all floor above to a max of eight
-C value below 1 and vertical openings are protected: Consider single largest floor plus 25% of the two immediately adjoining floors

Floors Above Grade	Total Floor Area (m^2)	% of Area Considered	Effective Floor Area (m^2)	
Basement		NA	NA	
Ground Floor	65.0	100%	65.0	
Level 2	340.0	100%	340.0	*A building may be subdivided if there is a vertical firewall with a fire-resistance rating greater than 2 hours, and meets the requirements of the National Building Code.
Level 3	340.0	100%	340.0	
Level 4			0.0	
Level 5			0.0	
Level 6			0.0	
Level 7			0.0	
Level 8			0.0	
Total	**745.0**		**745.0**	

Total Effective Floor Area **745.0** m^2

Step C. **Therefore RFF =** **6,000** **L/min (rounded to nearest 1000 L/min)**

Step D. The required fire flow may be reduced by as much as -25% for occupancies having contents with very low fire hazard or may be increased by up to 25% surcharge for occupancies having a high fire hazard.

Type of Occupancy	Adjustment Factor	
Townhouse Row	Combustible	0%

0 L/min surcharge

RFF = **6,000** **L/min (not rounded)**

Occupancy and Contents Adjustment Factor	
Non-Combustible	-25%
Limited Combustible	-15%
Combustible	0%
Free Burning	15%
Rapid Burning	25%

Step E. Sprinklers - The required fire flow may be reduced by up to 50% for complete automatic sprinkler protection depending upon adequacy of system.

	Yes/No/Unknown	Possible Reduction Available	Actual Reduction Provided
Automatic sprinkler protection designed and installed in accordance with NFPA 13?	Unknown	-30%	**0%**
Water supply is standard for both the system and Fire Department hose lines?	Unknown	-10%	**0%**
Fully supervised system?	No	-10%	**0%**

*Reduction available assumes complete building coverage
*30% reduction typical for building requiring sprinkler system

Total Reduction % **0%** (reduction)

Total Reduced Flow **0** **L/min (reduction, not rounded)**

Step F. Exposure - A percentage of water for the exposures should be added to the required fire flow for the subject building to provide adequate flow rates for hose streams used to reduce the spreading of fire from the subject building to exposed risks. The required fire flow of a subject building may be increased depending on the severity of exposed risks to the subject building and the distance between the exposed risks and the subject building. This charge considers the usage of water supplies to prevent exposed risks from igniting or being damaged during a major fire incident in the subject building.

Separation Distance	Maximum Exposure Adjustment Charge
0 to 3m	25%
3.1 to 10m	20%
10.1 to 20m	15%
20.1 to 30m	10%
Greater than 30m	0%

*If a vertical fire wall is properly constructed and has a rating of no less than 2 hours, then the boundary can be treated as protected with no exposure charge
*The maximum exposure adjustment charge to be applied to a subject building is 75%

Exposed buildings

Name		Distance	Surcharge	
North	Adjacent Dwelling	0	25%	1500
East	Adjacent Dwelling	6	20%	1200
South	Adjacent Dwelling	15	15%	900
West	Adjacent Dwelling	6	20%	1200
				4,500 **L/min Surcharge (not rounded)**

Step G. Final Required Fire Flow

Step D - Occupancy Adjusted Fire Flow Demand	6,000 L/min	
Step E - Sprinkler (Reduction)	0 L/min	
Step F - Exposure Charge	4,500 L/min	
Final Required Fire Flow:	**10,500 L/min**	
	11,000 1000L/min)	or **183.3 L/s** / 2,906 USGPM

Determine Required Fire Storage Volume

Flow from above 11,000 L/min
Required duration 2.25 hours *Refer to **Table 1** for Duration*

Therefore: 1,485,000 Litres or
1,485 m^3 is the required fire storage volume.

Table 1 - FUS 2020
Required Duration of Fire Flow

Flow Required L/min	Duration (hours)
2,000 or l	2000 1.0
	3,000 1.25
	4,000 1.5
	5,000 1.75
	6,000 2.0
	8,000 2.0
	10,000 2.0
	12,000 2.5
	14,000 3.0
	16,000 3.5
	18,000 4.0
	20,000 4.5
	22,000 5.0
	24,000 5.5
	26,000 6.0
	28,000 6.5
	30,000 7.0
	32,000 7.5
	34,000 8.0
	36,000 8.5
	38,000 9.0
40,000 ar	40,000 9.5

Interpolate for intermediate figures

APPENDIX E

External Storm Sewer Design Sheet

271 MAIN ST

2514-6796

STORM SEWER DESIGN SHEET

CROZIER CONSULTING ENGINEERS

FREQUENCY - 5 YEAR - MTO LOOKUP TOOL					
Coef. A=	30.6	Coef. B=	-0.699	Coef. C=	
FREQUENCY - 100 YEAR - MTO LOOKUP TOOL					
Coef. A=	51	Coef. B=	-0.699	Coef. C=	

Foundation Services Flow		
Flow =	0.075	L/sec/unit

MATERIAL	MANNINGS "n"
PVC	0.009
CONC.	0.013
CSP	0.024

DESIGNED BY: RDM/JGB
CHECKED BY: NOC
DATE: 2024.04.18
ISUED FOR: 2024.04.18

INITIAL TIME OF CONCENTRATION (minutes) = 10.00

CATCHMENT I.D.	FROM MH	TO MH	AREA (A) (Ha)	5 YEAR RUN-OFF COEFF (C_5)	100 YEAR RUN-OFF COEFF (C_{100})	DESIGN STORM	A x C	5 YEAR CUMUL. A x C_5	100 YEAR CUMUL. A x C_{100}	TIME OF CONC. (min.)	5 YEAR I (mm/hr)	100 YEAR I (mm/hr)	CONTROLLED FLOW (L/sec)	CONTROLLED FLOW CUMUL. (L/sec)	# OF UNITS	# OF UNITS CUMUL.	FOUNDATION SERVICES FLOW (L/sec)	Q (RUNOFF) (L/sec)	DESIGN FLOW (L/sec)	SLOPE (%)	PIPE DIA. (mm)	MANNING'S "n"	VEL. (m/sec)	LENGTH (m)	TIME OF FLOW (min)	PIPE CAPACITY (L/sec)	CAPACITY (%)	PIPE INV ELEV. UPPER END	PIPE INV ELEV. LOWER END	PIPE OBV ELEV. UPPER END	PIPE OBV ELEV. LOWER END	GROUND ELEV. UPPER END	GROUND ELEV. LOWER END	COVER UPPER END	COVER LOWER END
External	CB7B	West Culvert	0.00	0.90	1.00	5 year	0.00	0.00	0.00	10.00	107.07	178.44	**20.79**	**20.79**	**1**	**1**	**0.08**	**0.67**	**21.53**	1.30%	200	0.013	1.2	52.9	0.74	**37.40**	**58%**	517.13	516.44	517.33	516.64	518.42	518.12	1.09	1.48
External	CB7B	East Cuvlert			0.00	5 year	0.00	0.00	0.00	10.00	107.07	178.44	**20.79**	**20.79**	**1**	**1**	**0.08**	**0.00**	**20.87**	1.12%	200	0.013	1.1	58.7	0.89	**34.71**	**60%**	517.02	516.36	517.22	516.56	518.42	517.98	1.20	1.42
													Total 100yr Release Rate 41.58																						

APPENDIX F

Superpipe & Structure Storage Calculations

Superpipe Volume Calculations

Stage-Storage-Discharge Calculation

CROZIER
CONSULTING ENGINEERS

271 MAIN ST RESIDENTIAL DEVELOPMENT - SUPERPIPE STORAGE CALCULATIONS

Storm Sewer Network Parameters							
Sewer #	**From**	**To**	**Length (m)**	**Slope (%)**	**US Invert**	**DS Invert**	**Size (mm)**
#0	CB200	CBMH100	14.80	1.00	518.03	517.88	525
#1	CB201	CBMH100	15.50	1.00	518.04	517.88	525
#2	CBMH100	CBMH101	32.30	0.50	517.80	517.64	375
#3	CBMH101	STMH102	22.60	0.50	517.61	517.46	375

Sewer #	**Water Depth at DS Invert of Sewer (m) for each Storm Event**															**Water Depth at US Invert of Sewer (m) for each Storm Event**													
Event	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Water Level (m)	**517.46**	**517.93**	**518.02**	**518.08**	**518.16**	**518.27**	**518.32**	**518.44**	**518.55**	**518.66**	**518.75**	**518.86**	**518.97**	**519.14**	**519.31**	**517.46**	**517.93**	**518.02**	**518.08**	**518.16**	**518.27**	**518.32**	**518.44**	**518.55**	**518.66**	**518.75**	**518.86**	**518.97**	**519.14**	**519.31**
#0	0.00	0.05	0.14	0.20	0.28	0.39	0.44	0.56	0.67	0.78	0.87	0.98	1.09	1.26	1.43	0.00	0.00	0.00	0.05	0.13	0.24	0.29	0.41	0.52	0.63	0.72	0.83	0.94	1.11	1.28
#1	0.00	0.05	0.14	0.20	0.28	0.39	0.44	0.56	0.67	0.78	0.87	0.98	1.09	1.26	1.43	0.00	0.00	0.00	0.04	0.12	0.23	0.28	0.40	0.51	0.62	0.71	0.82	0.93	1.10	1.27
#2	0.00	0.29	0.38	0.44	0.52	0.63	0.68	0.80	0.91	1.02	1.11	1.22	1.33	1.50	1.67	0.00	0.13	0.22	0.28	0.36	0.47	0.52	0.64	0.75	0.86	0.95	1.06	1.17	1.34	1.51
#3	0.00	0.47	0.56	0.62	0.70	0.81	0.86	0.98	1.09	1.20	1.29	1.40	1.51	1.68	1.85	0.00	0.32	0.41	0.47	0.55	0.66	0.71	0.83	0.94	1.05	1.14	1.25	1.36	1.53	1.70

Note: Water Depth in each sewer is calculated as Storm Event Water Elevation - Invert Elevation (DS or US). In cases where the sewer invert is above the storm water elevation, the water depth is equal to 0.

Sewer #	**Water-Filled Area at DS Invert of Sewer (m^2) for each Storm Event**															**Water-Filled Area at US Invert of Sewer (m^2) for each Storm Event**													
Event	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Water Level (m)	**517.46**	**517.93**	**518.02**	**518.08**	**518.16**	**518.27**	**518.32**	**518.44**	**518.55**	**518.66**	**518.75**	**518.86**	**518.97**	**519.14**	**519.31**	**517.46**	**517.93**	**518.02**	**518.08**	**518.16**	**518.27**	**518.32**	**518.44**	**518.55**	**518.66**	**518.75**	**518.86**	**518.97**	**519.14**	**519.31**
#0	0.00	0.01	0.05	0.08	0.12	0.17	0.19	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.00	0.00	0.00	0.01	0.04	0.10	0.12	0.18	0.22	0.22	0.22	0.22	0.22	0.22	0.22
#1	0.00	0.01	0.05	0.08	0.12	0.17	0.19	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.00	0.00	0.00	0.01	0.04	0.09	0.12	0.18	0.21	0.22	0.22	0.22	0.22	0.22	0.22
#2	0.00	0.09	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.00	0.03	0.07	0.09	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
#3	0.00	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.00	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11

Note: Water-Filled Areas are calculated using the following equation, where R = Sewer radius (m) and h = Water depth in sewer (m):
In cases where the sewer cross-section is full, the Water-Filled Area is calculated as $\pi * R^2$.

$$\text{Area} = R^2 \cos^{-1}\left(\frac{R-h}{R}\right) - (R-h)\sqrt{2Rh-h^2}$$

Sewer #	**Storage Volume in Sewer (m^3) for each Storm Event**														
Return Period	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Water Level (m)	**517.46**	**517.93**	**518.02**	**518.08**	**518.16**	**518.27**	**518.32**	**518.44**	**518.55**	**518.66**	**518.75**	**518.86**	**518.97**	**519.14**	**519.31**
#0	0.00	0.08	0.34	0.64	1.18	1.99	2.34	2.94	3.20	3.20	3.20	3.20	3.20	3.20	3.20
#1	0.00	0.08	0.36	0.65	1.20	2.04	2.41	3.05	3.34	3.36	3.36	3.36	3.36	3.36	3.36
#2	0.00	2.03	2.87	3.21	3.54	3.57	3.57	3.57	3.57	3.57	3.57	3.57	3.57	3.57	3.57
#3	0.00	2.38	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
TOTAL	**0.0**	**4.6**	**6.1**	**7.0**	**8.4**	**10.1**	**10.8**	**12.1**	**12.6**	**12.6**	**12.6**	**12.6**	**12.6**	**12.6**	**12.6**

Note: Storage Volume is calculated as the Sewer Length multiplied by the average of the DS and US Water-Filled Areas. Total Storage in the system is calculated as the sum of the storage volume in each sewer.

CROZIER CONSULTING ENGINEERS

Project: 271 Main Street
Project No.: 2514-6796
Design by: JGB
Date: 2024.04.12

Superpipe Storage Data - Conveyance System (W)

Storm Structure Storage Data

CB Structures	Area (m^2)	T/G Elevation (m)	Inv Elev (m)	Volume (m^3)	Max Ponding Area (m^2)	Max Ponding Volume (m^3)
CBMH200	2.54	519.16	518.07	2.774	21.92	1.03
CBMH201	2.54	519.16	518.08	2.748	35.05	1.48
CBMH100	2.54	519.12	517.84	3.257	109.56	5.08
CBMH101	2.54	518.81	517.65	2.952	87.38	2.97
STMH102	2.69	518.82	517.46	3.652	-	-
Total Structure Storage (m^3)				**15.4**		**10.6**

Pipe Storage Data

From MH#	To MH#	Length (m)	Diameter (mm)	Storage Vol. (m^3)
CB200	CBMH100	14.8	525	3.20
CB201	CBMH100	15.5	525	3.36
CBMH100	CBMH101	32.3	375	3.57
CBMH101	STMH102	24	375	2.65
Total Pipe Storage (m^3) =				**12.8**

Stage-Storage-Discharge Table - Conveyance System

Orifice A	Orifice Invert	517.470	m	Orifice A Diameter	0.095	m
Orifice B	Orifice Invert	518.220	m	Orifice B Diameter	0.080	m

Superpipe Stage-Storage-Discharge Data

Comments	Water Level Elevation	Water Depth above Lower Orifice Invert	Total Pipe Storage	Structure Storage					Surface Ponding					Total	Orifice A Discharge	Orifice B Discharge	Total Discharge
			CBMH100-STMH104	CB200	CB201	CBMH100	CBMH101	STMH104	CB200	CB201	CBMH100	CBMH101	STMH102	Storage			
	(m)	(m)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)	ha.m	(m^3/s)	(m^3/s)	(m^3/s)
	517.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.0000**	**0.0000**	**0.0000**
	517.93	0.47	4.57	0.00	0.00	0.23	0.71	1.26	0.00	0.00	0.00	0.00	0.00	**6.77**	**0.0131**	**0.0000**	**0.0131**
	518.02	0.56	6.07	0.00	0.00	0.46	0.94	1.50	0.00	0.00	0.00	0.00	0.00	**8.97**	**0.0144**	**0.0000**	**0.0144**
	518.08	0.62	6.99	0.03	0.00	0.61	1.09	1.67	0.00	0.00	0.00	0.00	0.00	**10.39**	**0.0152**	**0.0000**	**0.0152**
2 yr Design	518.16	0.70	8.42	0.23	0.20	0.81	1.30	1.88	0.00	0.00	0.00	0.00	0.00	**12.84**	**0.0162**	**0.0000**	**0.0162**
	518.27	0.81	10.10	0.51	0.48	1.09	1.58	2.18	0.00	0.00	0.00	0.00	0.00	**15.94**	**0.0175**	**0.0014**	**0.0190**
5 yr Design	518.32	0.86	10.82	0.64	0.61	1.22	1.70	2.31	0.00	0.00	0.00	0.00	0.00	**17.30**	**0.0181**	**0.0035**	**0.0216**
10 yr Design	518.44	0.98	12.06	0.94	0.92	1.53	2.01	2.63	0.00	0.00	0.00	0.00	0.00	**20.08**	**0.0194**	**0.0060**	**0.0254**
	518.55	1.09	12.61	1.22	1.20	1.81	2.29	2.93	0.00	0.00	0.00	0.00	0.00	**22.05**	**0.0205**	**0.0077**	**0.0282**
	518.66	1.20	12.62	1.50	1.48	2.09	2.57	3.22	0.00	0.00	0.00	0.00	0.00	**23.48**	**0.0216**	**0.0090**	**0.0306**
25 yr Design	518.75	1.29	12.62	1.73	1.70	2.32	2.80	3.46	0.00	0.00	0.00	0.00	0.00	**24.64**	**0.0224**	**0.0100**	**0.0324**
	518.86	1.40	12.62	2.01	1.98	2.60	2.95	3.65	0.00	0.00	0.00	1.46	0.00	**27.27**	**0.0234**	**0.0110**	**0.0344**
	518.97	1.51	12.62	2.29	2.26	2.88	2.95	3.65	0.00	0.00	0.00	2.97	0.00	**29.63**	**0.0243**	**0.0120**	**0.0363**
50 yr Design	519.14	1.68	12.62	2.72	2.70	3.26	2.95	3.65	0.00	0.00	0.73	2.97	0.00	**31.60**	**0.0257**	**0.0134**	**0.0390**
100 yr Design + Max Ponding Depth	519.31	1.85	12.62	2.77	2.75	3.26	2.95	3.65	1.03	1.48	5.08	2.97	0.00	**38.57**	**0.0270**	**0.0146**	**0.0416**

**Please refer to Pipe Volume Calculations Spreadsheet

APPENDIX G

Modified Rational Method Calculations

RC Value Calculations

Uncontrolled Area Rational Method Calculation

Modified Rational Method Calculation

CROZIER
CONSULTING ENGINEERS

PROJECT: 271 Main Street
PROJECT No.: 2514-6796
DATE: 2024.04.03
DESIGN: JGB
CHECK:

Pre Development Runoff Coefficient

PRE-1

	Pre Development		
Drainage Area	**RC**	**Area (ha)**	**Weighted RC**
Pervious	0.14	0.09	0.10
Impervious	0.8	0.03	0.21
TOTAL		**0.12**	**0.31**

PRE-2

	Pre Development		
Drainage Area	**RC**	**Area (ha)**	**Weighted RC**
Pervious	0.14	0.05	0.09
Impervious	0.8	0.03	0.28
TOTAL		**0.08**	**0.37**

PRE-3

	Pre Development		
Drainage Area	**RC**	**Area (ha)**	**Weighted RC**
Pervious	0.14	0.02	0.09
Impervious	0.8	0.01	0.29
TOTAL		**0.03**	**0.38**

PRE-4

	Pre Development		
Drainage Area	**RC**	**Area (ha)**	**Weighted RC**
Pervious	0.14	0.02	0.09
Impervious	0.8	0.01	0.27
TOTAL		**0.03**	**0.36**

PRE TOTAL

	Pre Development	
Drainage Area	**Area (ha)**	**Weighted RC**
Pre-1	0.12	0.31
Pre-2	0.08	0.37
Pre-3	0.03	0.38
Pre-4	0.03	0.36
TOTAL	**0.26**	**0.37**

CROZIER
CONSULTING ENGINEERS

PROJECT: 271 Main Street
PROJECT No.: 2514-6796
DATE: 02/20/2024
DESIGN: AM
CHECK:

Post Development Runoff Coefficient

	Post Development		
Drainage Area	**RC**	**Area (ha)**	**Weighted RC**
Impervious	0.8	0.20	0.80
TOTAL		**0.20**	**0.80**

CROZIER
CONSULTING ENGINEERS

PROJECT: 271 Main Street
PROJECT No.: 2514-6796
FILE: Rational Method - Peak Flow
DATE: 2024.04.09
DESIGN: JGB

Rational Method for 271 Main Street

Rational Method Q=0.0028*C*i*A (cms)
Intensity i=A/ (Tc+b)^c (mm/hr)

Frequency -	Owen Sound IDF	
Storm Return	Coef. A	Coef. B
2	23.1	-0.699
5	30.6	-0.699
10	35.6	-0.699
25	41.8	-0.699
50	46.4	-0.699
100	51	-0.699

Post-Development Uncontrolled Peak Flows

Storm Return	Area (ha)	Runoff Coef. - C	Time of Concentration - Tc	Intensity - i	Peak Flow - Q
2	0.06	0.36	10.0	80.82	0.0049
5	0.06	0.36	10.0	107.07	0.0065
10	0.06	0.36	10.0	124.56	0.0075
25	0.06	0.40	10.0	146.25	0.0097
50	0.06	0.43	10.0	162.35	0.0118
100	0.06	0.45	10.0	178.44	0.0135

CROZIER CONSULTING ENGINEERS

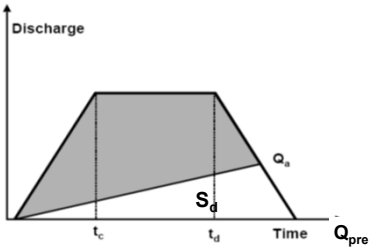
PROJECT: 271 Main Street
PROJECT No.: 2514-6796
DATE: 2024-04-12
DESIGN: JGB
CHECK: NOC

Modified Rational Method Storage Sizing

Peak Flow
$Q_{post} = 0.0028 \cdot C_{post} \cdot i_{(Td)} \cdot A$

Intensity
$i_{(Td)} = A\ (T_d)^{B}$

Storage
$S_d = Q_{post} \cdot T_d - Q_{pre}\ (T_d + T_c) / 2$



Pre-Development Scenario Data			
Inputs		**Outputs**	
IDF Location	Dundalk	Intensity (mm/hr):	80.82
Return Period	2 yr		
Time of Concentration (min)	10		
Coeff A	23.10		
Coeffic B	-0.699		
Runoff Coeff (Unadjusted)	0.37	Flow (m^3/s)	0.022
Runoff Coefficient (Adjusted)	0.37		
Area (ha)	0.26		

Post-Development Scenario Data (Controlled Area)			
Inputs		**Outputs**	
IDF Location	Dundalk	Intensity (mm/hr):	80.82
Return Period	2 yr		
Time of Concentration (min)	10		
Coeff A	23.10		
Coeffic B	-0.699		
Runoff Coeff (unadjusted)	0.80	Flow (m^3/s)	0.04
Runoff Coefficient (Adjusted)	0.80		
Controlled Area (ha)	0.20		

Target Flow (m^3/s)*	0.017
Release Rate (m^3/s)**	0.016

REQUIRED STORAGE VOLUME:	**12.4**

Storage Volume Determination (Detailed)				
T_d	i	T_d	Q_{Uncont}	S_d
min	*mm/hr*	*sec*	m^3/s	m^3
10	80.82	600	0.036	12.0
15	60.88	900	0.027	12.4
20	49.79	1200	0.022	12.2
25	42.60	1500	0.019	11.6
30	37.50	1800	0.017	10.8
35	33.67	2100	0.015	9.8
40	30.67	2400	0.014	8.6
45	28.25	2700	0.013	7.4
50	26.24	3000	0.012	6.0
55	24.55	3300	0.011	4.6
60	23.10	3600	0.010	3.2
65	21.84	3900	0.010	1.6
70	20.74	4200	0.009	0.1
75	19.76	4500	0.009	-1.5
80	18.89	4800	0.008	-3.2
85	18.11	5100	0.008	-4.9

*Target Flow = Allowable Peak Flow - Uncontrolled Peak Flow. See Uncontrolled Rational Method Sheet for detailed calculation

**See Superpipe Spreadsheet for detailed calculation on release rate and storage provided

CROZIER CONSULTING ENGINEERS

PROJECT: 271 Main Street
PROJECT No.: 2514-6796
DATE: 2024-04-12
DESIGN: JGB
CHECK: NOC

Modified Rational Method Storage Sizing

Peak Flow

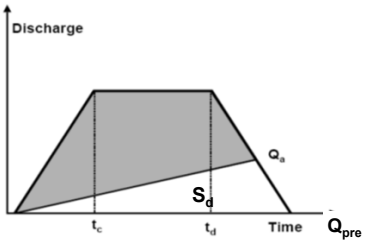
$$Q_{post} = 0.0028 \cdot C_{post} \cdot i_{(Td)} \cdot A$$

Intensity

$$i_{(Td)} = A\ (T_d)^{B}$$

Storage

$$S_d = Q_{post} \cdot T_d - Q_{pre}\ (T_d + T_c) / 2$$



Pre-Development Scenario Data			
Inputs		**Outputs**	
IDF Location	Dundalk	Intensity (mm/hr):	107.07
Return Period	5 yr		
Time of Concentration (min)	10		
Coeff A	30.60		
Coeffic B	-0.699		
Runoff Coeff (Unadjusted)	0.37	Flow (m^3/s)	0.0288
Runoff Coefficient (Adjusted)	0.37		
Area (ha)	0.26		

Post-Development Scenario Data (Controlled Area)			
Inputs		**Outputs**	
IDF Location	Dundalk	Intensity (mm/hr):	107.07
Return Period	5 yr		
Time of Concentration (min)	10		
Coeff A	30.60		
Coeffic B	-0.699		
Runoff Coeff (unadjusted)	0.80	Flow (m^3/s)	0.05
Runoff Coefficient (Adjusted)	0.80		
Controlled Area (ha)	0.20		

Target Flow (m^3/s)*	0.022
Release Rate (m^3/s)**	0.022

REQUIRED STORAGE VOLUME:	**16.3**

Storage Volume Determination (Detailed)				
T_d	i	T_d	Q_{Uncont}	S_d
min	*mm/hr*	*sec*	m^3/s	m^3
10	107.07	600	0.048	15.8
15	80.64	900	0.036	16.3
20	65.95	1200	0.030	16.0
25	56.43	1500	0.025	15.2
30	49.68	1800	0.022	14.1
35	44.60	2100	0.020	12.8
40	40.63	2400	0.018	11.3
45	37.42	2700	0.017	9.6
50	34.76	3000	0.016	7.8
55	32.52	3300	0.015	6.0
60	30.60	3600	0.014	4.0
65	28.93	3900	0.013	1.9
70	27.47	4200	0.012	-0.2
75	26.18	4500	0.012	-2.3
80	25.03	4800	0.011	-4.5
85	23.99	5100	0.011	-6.8

*Target Flow = Allowable Peak Flow - Uncontrolled Peak Flow. See Uncontrolled Rational Method Sheet for detailed calculation

**See Superpipe Spreadsheet for detailed calculation on release rate and storage provided

CROZIER CONSULTING ENGINEERS

PROJECT: 271 Main Street
PROJECT No.: 2514-6796
DATE: 2024-04-12
DESIGN: JGB
CHECK: NOC

Modified Rational Method Storage Sizing

Peak Flow

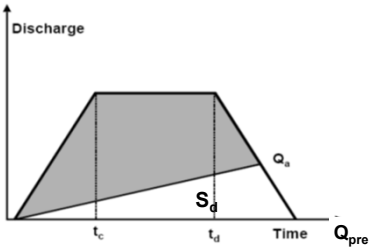
$$Q_{post} = 0.0028 \cdot C_{post} \cdot i_{(Td)} \cdot A$$

Intensity

$$i_{(Td)} = A\,(T_d)^{B}$$

Storage

$$S_d = Q_{post} \cdot T_d - Q_{pre}\,(T_d + T_c)/2$$



Pre-Development Scenario Data			
Inputs		**Outputs**	
IDF Location	Dundalk	Intensity (mm/hr):	124.56
Return Period	10 yr		
Time of Concentration (min)	10		
Coeff A	35.60		
Coeffic B	-0.699		
Runoff Coeff (Unadjusted)	0.37	Flow (m^3/s)	0.034
Runoff Coefficient (Adjusted)	0.37		
Area (ha)	0.26		

Post-Development Scenario Data (Controlled Area)			
Inputs		**Outputs**	
IDF Location	Dundalk	Intensity (mm/hr):	124.56
Return Period	10 yr		
Time of Concentration (min)	10		
Coeff A	35.60		
Coeffic B	-0.699		
Runoff Coeff (unadjusted)	0.80	Flow (m^3/s)	0.06
Runoff Coefficient (Adjusted)	0.80		
Controlled Area (ha)	0.20		

Target Flow (m^3/s)*	0.025
Release Rate (m^3/s)**	0.025

REQUIRED STORAGE VOLUME:	**18.9**

Storage Volume Determination (Detailed)				
T_d	i	T_d	Q_{Uncont}	S_d
min	*mm/hr*	*sec*	m^3/s	m^3
10	124.56	600	0.056	18.3
15	93.82	900	0.042	18.9
20	76.73	1200	0.034	18.5
25	65.65	1500	0.029	17.6
30	57.79	1800	0.026	16.3
35	51.89	2100	0.023	14.7
40	47.26	2400	0.021	12.9
45	43.53	2700	0.020	10.9
50	40.44	3000	0.018	8.8
55	37.83	3300	0.017	6.6
60	35.60	3600	0.016	4.3
65	33.66	3900	0.015	1.9
70	31.96	4200	0.014	-0.5
75	30.46	4500	0.014	-3.1
80	29.12	4800	0.013	-5.6
85	27.91	5100	0.013	-8.3

*Target Flow = Allowable Peak Flow - Uncontrolled Peak Flow. See Uncontrolled Rational Method Sheet for detailed calculation

**See Superpipe Spreadsheet for detailed calculation on release rate and storage provided

CROZIER CONSULTING ENGINEERS

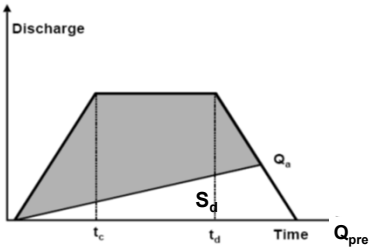
PROJECT: 271 Main Street
PROJECT No.: 2514-6796
DATE: 2024-04-12
DESIGN: JGB
CHECK: NOC

Modified Rational Method Storage Sizing

Peak Flow
$Q_{post} = 0.0028 \cdot C_{post} \cdot i_{(Td)} \cdot A$

Intensity
$i_{(Td)} = A\ (T_d)^{B}$

Storage
$S_d = Q_{post} \cdot T_d - Q_{pre}\ (T_d + T_c) / 2$



Pre-Development Scenario Data			
Inputs		**Outputs**	
IDF Location	Dundalk	Intensity (mm/hr):	146.25
Return Period	25 yr		
Time of Concentration (min)	10		
Coeff A	41.8		
Coeffic B	-0.699		
Runoff Coeff (Unadjusted)	0.37	Flow (m^3/s)	0.0433
Runoff Coefficient (Adjusted)	0.41		
Area (ha)	0.26		

Post-Development Scenario Data (Controlled Area)			
Inputs		**Outputs**	
IDF Location	Dundalk	Intensity (mm/hr):	146.25
Return Period	25 yr		
Time of Concentration (min)	10		
Coeff A	41.8		
Coeffic B	-0.699		
Runoff Coeff (unadjusted)	0.80	Flow (m^3/s)	0.07
Runoff Coefficient (Adjusted)	0.88		
Controlled Area (ha)	0.20		

Target Flow (m^3/s)*	0.033
Release Rate (m^3/s)**	0.032

REQUIRED STORAGE VOLUME:	**24.6**

Storage Volume Determination (Detailed)				
T_d	i	T_d	Q_{Uncont}	S_d
min	*mm/hr*	*sec*	m^3/s	m^3
10	146.25	600	0.072	23.8
15	110.16	900	0.054	24.6
20	90.09	1200	0.044	24.1
25	77.08	1500	0.038	23.0
30	67.86	1800	0.033	21.3
35	60.93	2100	0.030	19.3
40	55.50	2400	0.027	17.1
45	51.11	2700	0.025	14.6
50	47.48	3000	0.023	11.9
55	44.42	3300	0.022	9.1
60	41.80	3600	0.021	6.2
65	39.53	3900	0.019	3.1
70	37.53	4200	0.018	0.0
75	35.76	4500	0.018	-3.2
80	34.19	4800	0.017	-6.5
85	32.77	5100	0.016	-9.9

*Target Flow = Allowable Peak Flow - Uncontrolled Peak Flow. See Uncontrolled Rational Method Sheet for detailed calculation

**See Superpipe Spreadsheet for detailed calculation on release rate and storage provided

CROZIER CONSULTING ENGINEERS

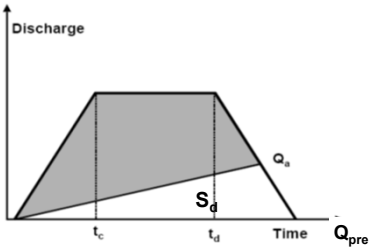
PROJECT: 271 Main Street
PROJECT No.: 2514-6796
DATE: 2024-04-12
DESIGN: JGB
CHECK: NOC

Modified Rational Method Storage Sizing

Peak Flow
$Q_{post} = 0.0028 \cdot C_{post} \cdot i_{(Td)} \cdot A$

Intensity
$i_{(Td)} = A\ (T_d)^{B}$

Storage
$S_d = Q_{post} \cdot T_d - Q_{pre}\ (T_d + T_c) / 2$



Pre-Development Scenario Data			
Inputs		**Outputs**	
IDF Location	Dundalk	Intensity (mm/hr):	162.35
Return Period	50 yr		
Time of Concentration (min)	10		
Coeff A	46.4		
Coeffic B	-0.699		
Runoff Coeff (Unadjusted)	0.37	Flow (m^3/s)	0.05
Runoff Coefficient (Adjusted)	0.44		
Area (ha)	0.26		

Post-Development Scenario Data (Controlled Area)			
Inputs		**Outputs**	
IDF Location	Dundalk	Intensity (mm/hr):	162.35
Return Period	50 yr		
Time of Concentration (min)	10		
Coeff A	46.4		
Coeffic B	-0.699		
Runoff Coeff (unadjusted)	0.80	Flow (m^3/s)	0.09
Runoff Coefficient (Adjusted)	0.96		
Controlled Area (ha)	0.20		

Target Flow (m^3/s)*	0.040
Release Rate (m^3/s)**	0.039

REQUIRED STORAGE VOLUME:	**29.9**

Storage Volume Determination (Detailed)				
T_d	i	T_d	Q_{Uncont}	S_d
min	*mm/hr*	*sec*	m^3/s	m^3
10	162.35	600	0.087	28.9
15	122.28	900	0.066	29.9
20	100.01	1200	0.054	29.4
25	85.56	1500	0.046	28.0
30	75.32	1800	0.040	26.0
35	67.63	2100	0.036	23.6
40	61.60	2400	0.033	20.9
45	56.73	2700	0.031	17.9
50	52.71	3000	0.028	14.7
55	49.31	3300	0.027	11.3
60	46.40	3600	0.025	7.8
65	43.88	3900	0.024	4.1
70	41.66	4200	0.022	0.4
75	39.70	4500	0.021	-3.5
80	37.95	4800	0.020	-7.5
85	36.37	5100	0.020	-11.5

*Target Flow = Allowable Peak Flow - Uncontrolled Peak Flow. See Uncontrolled Rational Method Sheet for detailed calculation

**See Superpipe Spreadsheet for detailed calculation on release rate and storage provided

CROZIER CONSULTING ENGINEERS

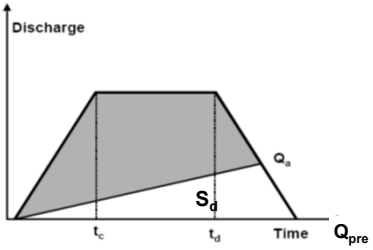
PROJECT: 271 Main Street
PROJECT No.: 2514-6796
DATE: 2024-04-12
DESIGN: JGB
CHECK: NOC

Modified Rational Method Storage Sizing

Peak Flow
$Q_{post} = 0.0028 \cdot C_{post} \cdot i_{(Td)} \cdot A$

Intensity
$i_{(Td)} = A\ (T_d)^{B}$

Storage
$S_d = Q_{post} \cdot T_d - Q_{pre}\ (T_d + T_c) / 2$



Pre-Development Scenario Data			
Inputs		**Outputs**	
IDF Location	Dundalk	Intensity (mm/hr):	178.44
Return Period	100 yr		
Time of Concentration (min)	10		
Coeff A	51		
Coeffic B	-0.699		
Runoff Coeff (Unadjusted)	0.37	Flow (m^3/s)	0.06
Runoff Coefficient (Adjusted)	0.46		
Area (ha)	0.26		

Post-Development Scenario Data (Controlled Area)			
Inputs		**Outputs**	
IDF Location	Dundalk	Intensity (mm/hr):	178.44
Return Period	100 yr		
Time of Concentration (min)	10		
Coeff A	51		
Coeffic B	-0.699		
Runoff Coeff (unadjusted)	0.80	Flow (m^3/s)	0.10
Runoff Coefficient (Adjusted)	1.00		
Controlled Area (ha)	0.20		

Target Flow (m^3/s)*	0.046
Release Rate(m^3/s)**	0.042

REQUIRED STORAGE VOLUME:	**36.6**

Storage Volume Determination (Detailed)				
T_d	i	T_d	Q_{Uncont}	S_d
min	*mm/hr*	*sec*	m^3/s	m^3
10	178.44	600	0.100	35.0
15	134.40	900	0.075	36.6
20	109.92	1200	0.062	36.4
25	94.05	1500	0.053	35.3
30	82.79	1800	0.046	33.6
35	74.34	2100	0.042	31.3
40	67.71	2400	0.038	28.6
45	62.36	2700	0.035	25.7
50	57.93	3000	0.032	22.5
55	54.20	3300	0.030	19.1
60	51.00	3600	0.029	15.5
65	48.22	3900	0.027	11.8
70	45.79	4200	0.026	7.9
75	43.63	4500	0.024	3.9
80	41.71	4800	0.023	-0.1
85	39.98	5100	0.022	-4.3

*Target Flow = Allowable Peak Flow - Uncontrolled Peak Flow. See Uncontrolled Rational Method Sheet for detailed calculation

**See Superpipe Spreadsheet for detailed calculation on release rate and storage provided

APPENDIX H

FlowMaster Output

Worksheet for Safe Conveyance

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03200	m/m
Discharge	0.10	m³/s

Section Definitions

Station (m)	Elevation (m)
0+00	519.05
0+05	519.02
0+06	519.00
0+06	519.02
0+09	518.93
0+12	519.02
0+12	519.00
0+12	519.02
0+18	519.05

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 519.05)	(0+18, 519.05)	0.013

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.05	m
Elevation Range	518.93 to 519.05 m	
Flow Area	0.08	m²
Wetted Perimeter	3.35	m

Worksheet for Safe Conveyance

Results

Hydraulic Radius		0.03	m
Top Width		3.35	m
Normal Depth		0.05	m
Critical Depth		0.07	m
Critical Slope		0.00511	m/m
Velocity		1.18	m/s
Velocity Head		0.07	m
Specific Energy		0.12	m
Froude Number		2.38	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.05	m
Critical Depth	0.07	m
Channel Slope	0.03200	m/m
Critical Slope	0.00511	m/m

Cross Section for Safe Conveyance

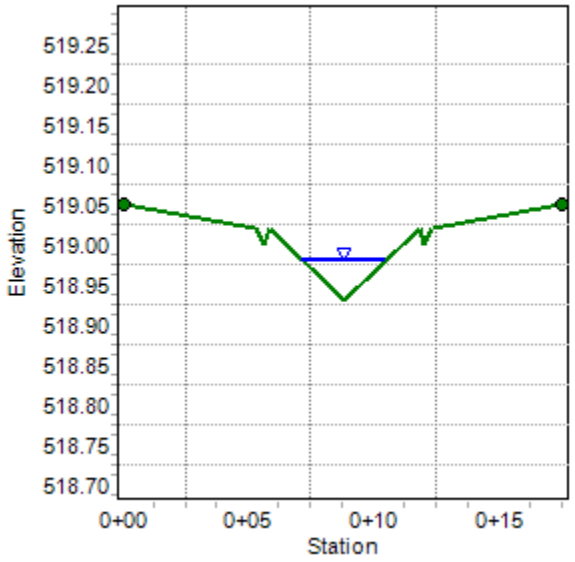
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03200	m/m
Normal Depth	0.05	m
Discharge	0.10	m³/s

Cross Section Image



APPENDIX I

Treatment Unit Sizing Calculations and Technical Specifications

ADS OGS Sizing Summary

Project Name: New Dundalk Project

Consulting Engineer: Crozier

Location: Dundalk, ON

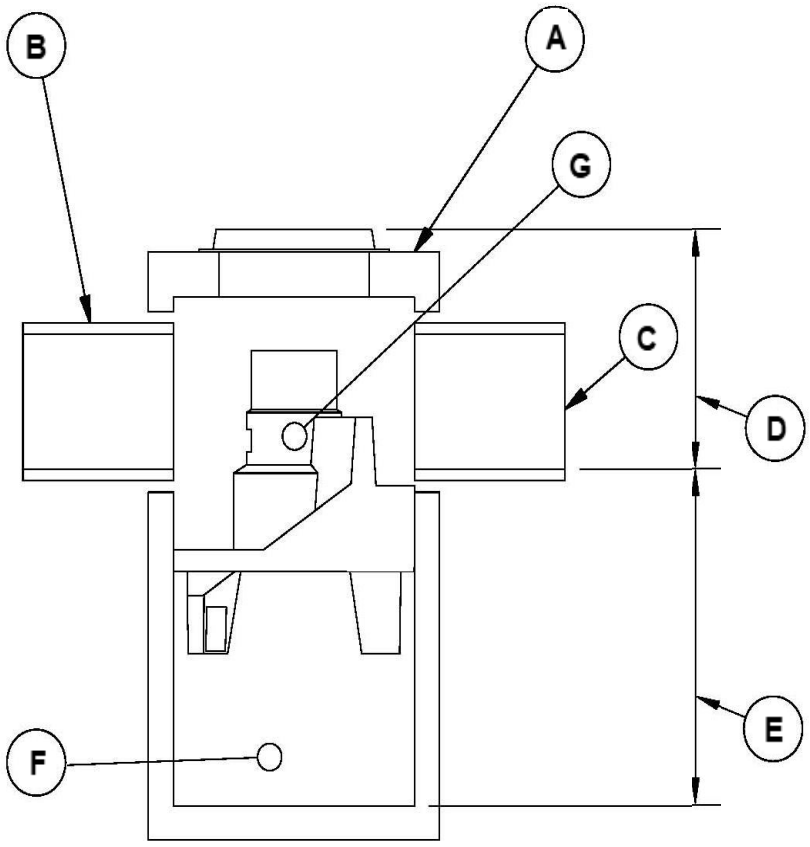
Sizing Completed By: C. Neath **Email:** cody.neath@ads-pipe.com

Treatment Requirements		
Treatment Goal:	Enhanced (MOE)	
Selected Parameters:	80% TSS	90% Volume
Selected Unit:	**FD-4HC**	

Site Details	
Site Area:	0.26 ha
% Impervious:	100%
Rational C:	0.90
Rainfall Station:	Owen Sound
Particle Size Distribution:	Fine
Peak Flowrate:	100 L/s

Summary of Results		
Model	**TSS Removal**	**Volume Treated**
FD-4HC	94.0%	>90%
FD-5HC	96.0%	>90%
FD-6HC	97.0%	>90%
FD-8HC	98.0%	>90%
FD-10HC	98.0%	>90%

FD-4HC Specification	
Unit Diameter (A):	1,200 mm
Inlet Pipe Diameter (B):	600 mm
Outlet Pipe Diameter (C):	600 mm
Height, T/G to Outlet Invert (D):	1000 mm
Height, Outlet Invert to Sump (E):	1515 mm
Sediment Storage Capacity (F):	0.78 m³
Oil Storage Capacity (G):	723 L
Recommended Sediment Depth for Maintenance:	440 mm
Max. Pipe Diameter:	600 mm
Peak Flow Capacity:	510 L/s



Site Elevations:	
Rim Elevation:	100.00
Inlet Pipe Elevation:	99.00
Outlet Pipe Elevation:	99.00

Notes:

Removal efficiencies are based on NJDEP Test Protocols and independently verified.

All units supplied by ADS have numerous local, provincial, and international certifications (copies of which can be provided upon request). The design engineer is responsible for ensuring compliance with applicable regulations.

Project Name: New Dundalk Project
Consulting Engineer: Crozier
Location: Dundalk, ON

Net Annual Removal Efficiency Summary: FD-4HC

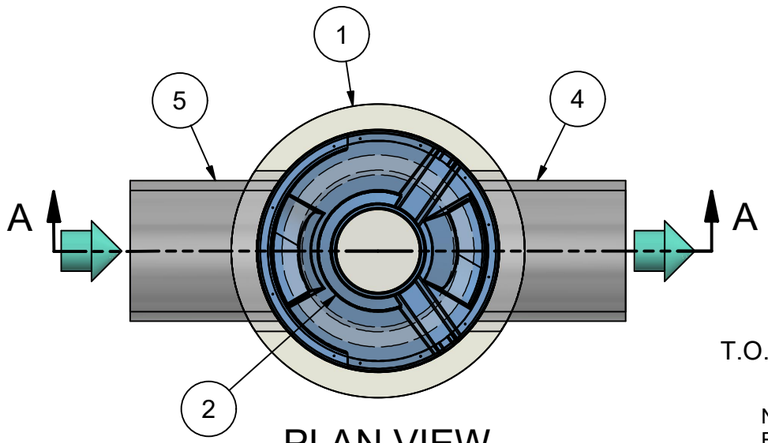
Rainfall Intensity[1]	Fraction of Rainfall[1]	FD-4HC Removal Efficiency[2]	Weighted Net-Annual Removal Efficiency
mm/hr	%	%	%
0.50	10.1%	100.0%	10.1%
1.00	10.7%	100.0%	10.7%
1.50	10.0%	100.0%	10.0%
2.00	8.4%	100.0%	8.4%
2.50	6.6%	99.4%	6.6%
3.00	6.2%	97.7%	6.1%
3.60	4.1%	96.1%	3.9%
4.10	4.2%	94.9%	4.0%
4.60	3.7%	93.9%	3.5%
5.10	3.8%	93.0%	3.5%
6.40	6.4%	91.1%	5.8%
7.60	4.6%	89.6%	4.1%
8.90	3.3%	88.3%	2.9%
10.20	2.4%	87.2%	2.1%
11.40	2.6%	86.3%	2.2%
12.70	1.5%	85.5%	1.3%
15.20	2.1%	84.0%	1.8%
19.10	2.3%	82.3%	1.9%
25.40	3.9%	80.1%	3.1%
38.10	1.4%	77.2%	1.1%
50.80	0.6%	75.1%	0.5%
		Total Net Annual Removal Efficiency:	93.6%
		Total Runoff Volume Treated:	>90%

Notes:

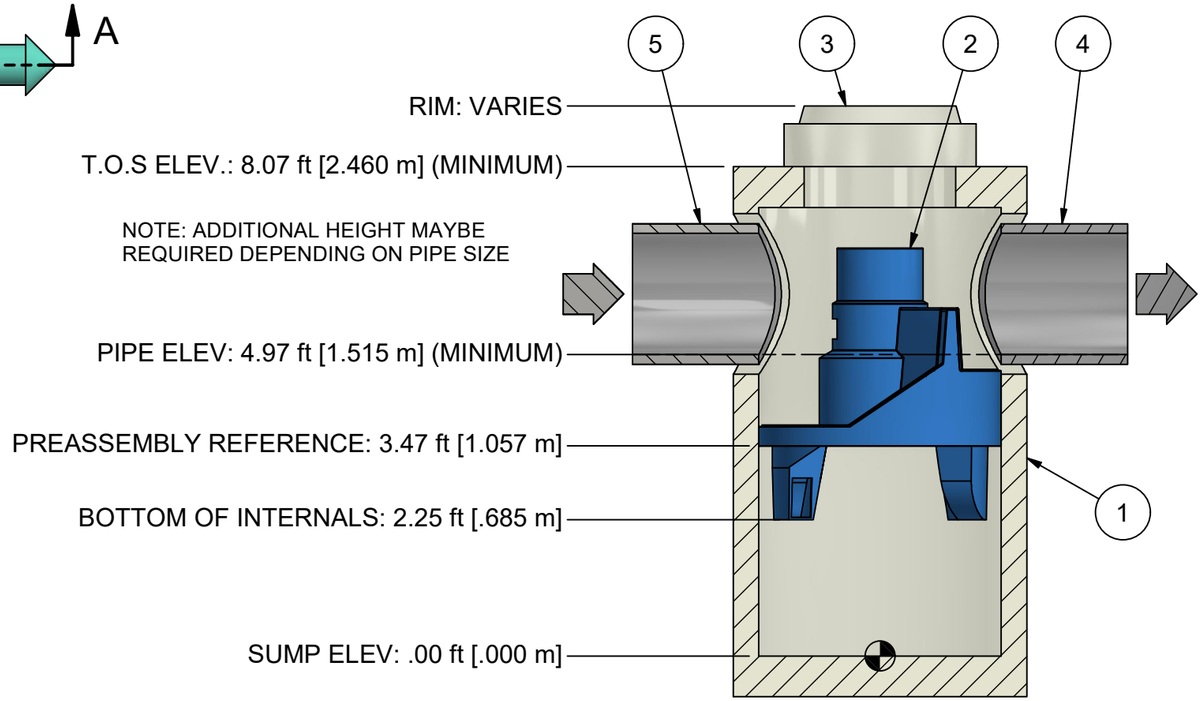
(1) Rainfall data based on 37 years of rainfall data for Canada Station Owen Sound, Owen Sound, Ontario, Canada.

(2) Based on third party verified data and appoximating the removal of a PSD similar to the STC Fine distribution

(3) Rainfall adjusted to 5 min peak intensity based on hourly average.



PLAN VIEW



SECTION A-A

HYDRO FRAME AND COVER (INCLUDED)

GRADE RINGS BY OTHERS AS REQUIRED

1. MANHOLE WALL AND SLAB THICKNESSES ARE NOT TO SCALE.

2. CONTACT HYDRO INTERNATIONAL FOR A BOTTOM OF STRUCTURE ELEVATION PRIOR TO SETTING FIRST DEFENSE MANHOLE.

3. CONTRACTOR TO CONFIRM RIM, PIPE INVERTS, PIPE DIA. AND PIPE ORIENTATION PRIOR TO RELEASE OF UNIT TO FABRICATION.

PRODUCT SPECIFICATION:

1. Peak Hydraulic Flow: 18.0 cfs (510 l/s)
2. Min Sediment Storage Capacity: 0.7 cu. yd. (0.5 cu. m.)
3. Maximum Inlet/Outlet Pipe Diameters: 24 in. (600 mm)
4. The Treatment System Shall Use An Induced Vortex To Separate Pollutants From Stormwater Runoff.
5. For More Product Information Including Regulatory Acceptances, Please Visit https://hydro-int.com/en/products/first-defense

GENERAL NOTES:
1. General Arrangement drawings only. Contact Hydro International for site specific drawings.
2. The diameter of the inlet and outlet pipes may be no more than 24".
3. Multiple inlet pipes possible (refer to project plan).
4. Inlet/outlet pipe angle can vary to align with drainage network (refer to project plan.s)
5. Peak flow rate and minimum height limited by available cover and pipe diameter.
6. Larger sediment storage capacity may be provided with a deeper sump depth.

PARTS LIST

ITEM	QTY	SIZE (in)	SIZE (mm)	DESCRIPTION
1	1	48	1200	I.D. PRECAST MANHOLE
2	1			INTERNAL COMPONENTS (PRE-INSTALLED)
3	1	30	750	FRAME AND COVER (ROUND)
4	1	24 (MAX)	600 (MAX)	OUTLET PIPE (BY OTHERS)
5	1	24 (MAX)	600 (MAX)	INLET PIPE (BY OTHERS)

PROJECTION

IF IN DOUBT ASK

DATE:	SCALE:
10/7/2019	1:30

DRAWN BY:	CHECKED BY:	APPROVED BY
ER	MRJ	

Title
4-ft DIAMETER
FIRST DEFENSE

GENERAL ARRANGEMENT

Hydro International®
hydro-int.com
HYDRO INTERNATIONAL

WEIGHT:	MATERIAL:
19448 lbmass	

STOCK NUMBER:

DRAWING NO.: FD GA-4

SHEET SIZE:	SHEET:	Rev:
B	1 OF 1	-

FIGURES

Figure 1: Site Location Plan

Figure 2: Site Plan

Drawings

Drawing C100: Title Page

Drawing C101: Grading Plan

Drawing C102A: General Servicing Plan

Drawing C102B: Connections to Existing Main St Infrastructure

Drawing C103: Pre-Development Drainage Plan

Drawing C104: Post-Development Drainage Plan

Drawing C105: Erosion and Sediment Control Plan

Drawing C106: Erosion and Sediment Control Plan Note & Details

Drawing C107: Construction Notes and Detail 1 Of 2

Drawing C108: Construction Notes and Detail 2 Of 2

Legend

= SUBJECT LANDS

Project

271 MAIN STREET EAST DUNDALK
TOWNSHIP OF SOUTHGATE

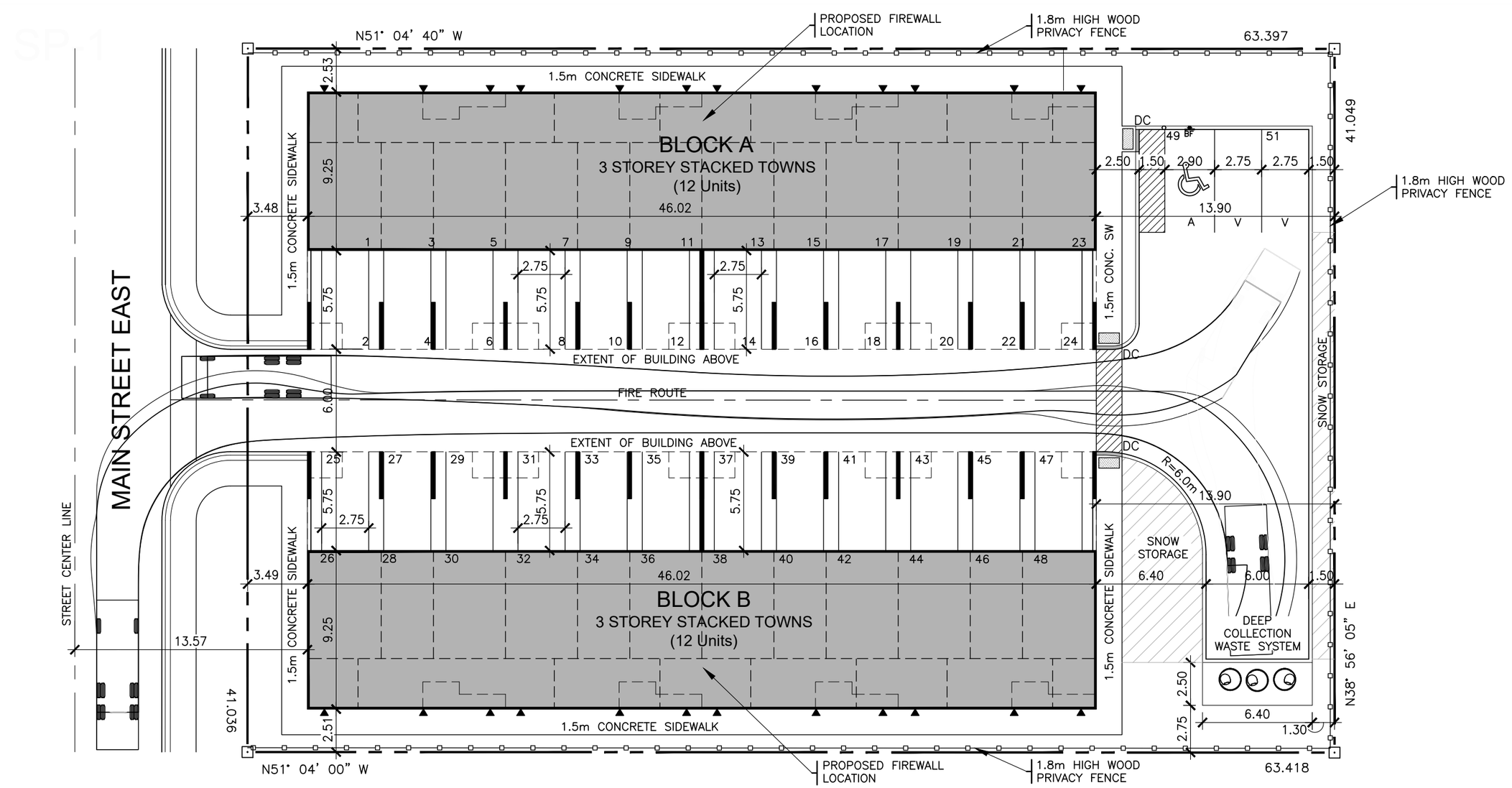
Drawing

SITE LOCATION PLAN

CROZIER CONSULTING ENGINEERS

Drawn By	Design By	Project
R.D.M./M.S.	J.L.A./A.M.	2514-6796

Scale	Date	Check By	Drawing
N.T.S.	MMM/DD/YYYY	C.C.C.	FIG. 1



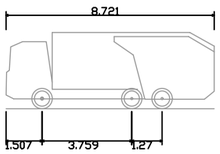
UNITS BREAKDOWN		
NUMBER OF BEDROOMS	AREA	NUMBER OF UNITS
2 BEDROOM UNIT	105.8 sq. m (1,139 sq. ft.)	16
3 BEDROOM UNIT	155.3 sq. m (1,672 sq. ft.)	8

PARKING		
NUMBER OF PARKING SPACES	REQUIRED	PROPOSED
	2.0 PER UNIT = 48 SPACES	24 WITHIN GARAGE 24 DRIVEWAYS + 2 VISITOR + 1 B.F. SPACE= 51 SPACES

EXISTING ZONING R3 - 10.1 (e)
PROPOSED SITE SPECIFIC ZONING

REGULATION	REQUIRED	PROPOSED
LOT FRONTAGE	40 m	41.036 m
LOT AREA	1,200 sq.m	2,602.3 sq.m
UNITS ALLOWED (MAXIMUM)	LOT AREA (2,602.3 sq.m) / 300 = 8 UNITS	* 24 UNITS
LOT COVERAGE (MAXIMUM)	910.8 sq.m (35%)	* 1,391.0 sq.m (53.1%)
FRONT YARD (MINIMUM)	7.5 m	*3.48 m
INTERIOR SIDE YARD (MINIMUM)	4.0 m	*2.51 m
REAR YARD (MINIMUM)	10.0 m	13.9 m
FLOOR AREA (MINIMUM)	2 BEDROOM: 70 sq.m 3 BEDROOM: 83 sq.m	2 BEDROOM: 105.8 sq.m 3 BEDROOM: 155.3 sq.m
BUILDING HEIGHT (MAXIMUM)	3 STOREYS	3 STOREYS
PLAY SPACE (MINIMUM)	104.0 sq.m	*75.4 sq.m
AMENITY SPACE (MINIMUM)	1120.0 sq.m	* 0.0 sq.m

*DENOTES ZONING VARIANCE REQUIRED



Mack TerraPro Cabover 6x4 MRU613 + Wayne Curbtender 31cu yd

Overall Length	8.721m
Overall Width	2.438m
Overall Body Height	3.195m
Min Body Ground Clearance	0.400m
Track Width	2.438m
Lock-to-lock time	6.00s
Curb to Curb Turning Radius	10.211m

North Arrow
True North:

ORCHARD DESIGN STUDIO INC.
marketingmeetsarchitecture

CALE BARNES

MAIN ST. EAST STACKED TOWNS
271 MAIN STREET EAST, DUNDALK, ON

Set Issuance

No.	Date	Description
1	2024-01-25	REVISED AS PER CLIENT
2	2024-03-25	REVISED PER MHBC
2	2024-04-29	ISS. TO CONSULTANTS

Sheet Information

SITE PLAN

Project No. 15572
Project Start Date: 2024-01-25
File: 271 Main Street - Site Plan.dwg
Drawn by: J.P.
Scale: 1:250

SPA

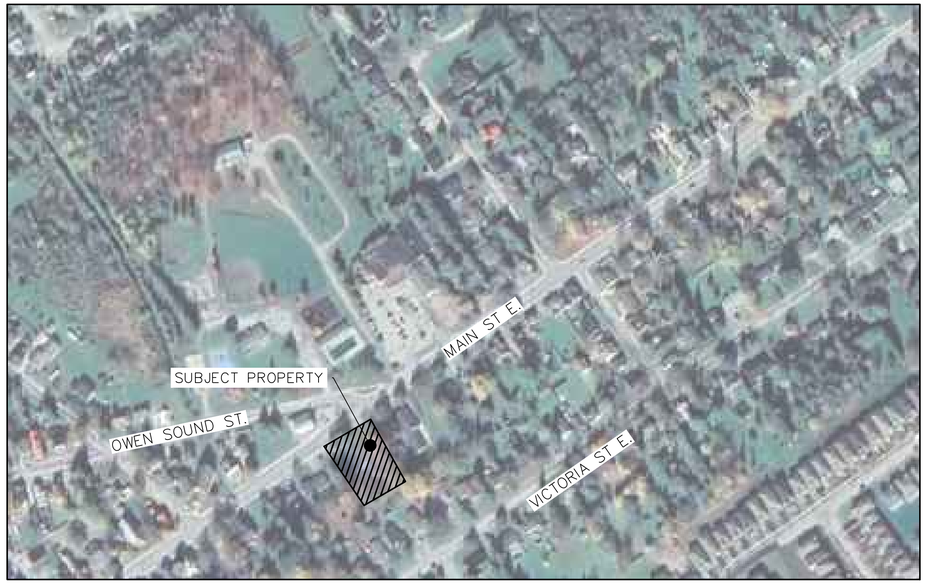
A1.01

Plot Date|Time - 2024-04-29 11:22:54 AM

P:\1-Projects\Cale Barnes\15572_271 Main Street\2-Drawings\

271 MAIN STREET
EAST DUNDALK

TOWNSHIP OF SOUTHGATE
GREY COUNTY



DRAWING	TITLE
C100	TITLE PAGE
C101	GRADING PLAN
C102A	GENERAL SERVICING PLAN
C102B	CONNECTIONS TO EXISTING MAIN ST INFRASTRUCTURE
C103	PRE-DEVELOPMENT DRAINAGE PLAN
C104	POST-DEVELOPMENT DRAINAGE PLAN
C105	EROSION & SEDIMENT CONTROL PLAN
C106	EROSION & SEDIMENT CONTROL PLAN NOTES & DETAILS
C107	CONSTRUCTION NOTES & DETAILS 1 OF 2
C108	CONSTRUCTION NOTES & DETAILS 2 OF 2

MUNICIPALITY

TOWNSHIP OF SOUTHGATE
185667 GREY RD 9
DUNDALK, ONTARIO, N0C 1B0

DEVELOPER

COUNTRYSIDE COMMUNITIES INC.
22746 RICHMOND ST N
LONDON, ONTARIO, N5X 4B2

DEVELOPER'S ENGINEER

CROZIER
CONSULTING ENGINEERS
70 HURON STREET, SUITE 100
COLLINGWOOD, ON, L9Y 4L4
705-446-3510
WWW.CFCROZIER.CA

LANDSCAPE ARCHITECT

MASTER LEGEND

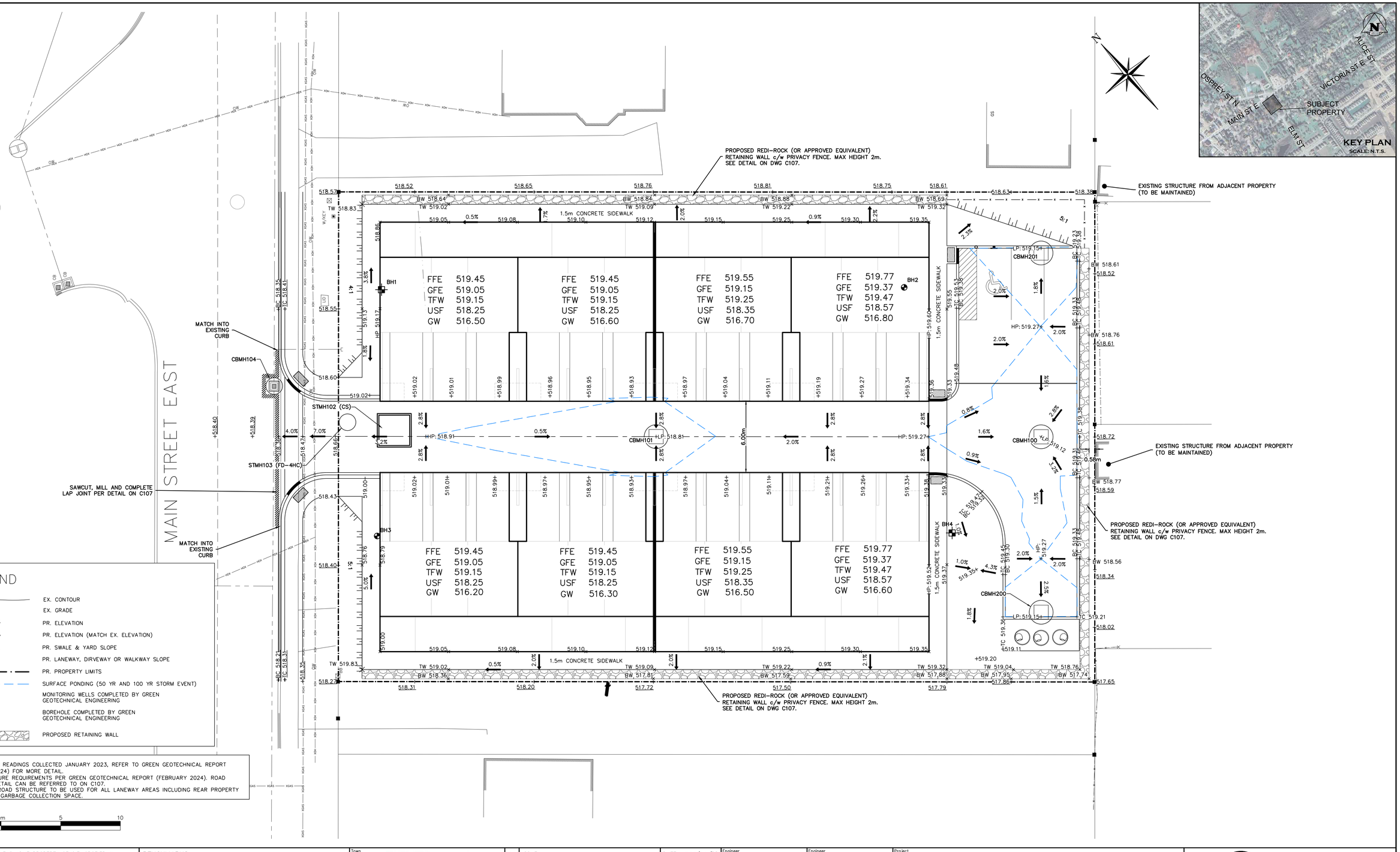
EXISTING FEATURES (EX.)

- EX. CONTOUR
- EX. GRADE
- EX. TREELINE
- EX. WATERCOURSE
- EX. DITCH
- EX. WATERMAIN
- EX. WATER SERVICE
- EX. FIRE HYDRANT & VALVE
- EX. SANITARY SEWER & MANHOLE
- EX. SANITARY FORCEMAIN
- EX. SANITARY SERVICE
- EX. STORM SEWER & MANHOLE
- EX. STORM CATCHBASIN
- EX. STORM DOUBLE CATCHBASIN
- EX. STORM CATCHBASIN MANHOLE
- EX. STORM DOUBLE CATCHBASIN MANHOLE
- EX. GAS MAIN
- EX. BELL LINE
- EX. BELL PEDESTAL
- EX. CABLE TELEVISION PEDESTAL
- EX. HYDRO POLE
- EX. LIGHT STANDARD
- EX. SIGN
- EX. BUILDING
- EX. BENCHMARK NUMBER & LOCATION
- EX. BOREHOLE NUMBER & LOCATION

PROPOSED FEATURES (PR.)

- PR. PROPERTY LIMITS
- PR. ELEVATION
- PR. ELEVATION (MATCH EX. ELEVATION)
- PR. SWALE & SLOPE
- PR. DITCH DRAINAGE
- PR. WATERMAIN & VALVE
- PR. WATER SERVICE
- PR. FIRE HYDRANT & VALVE
- PR. WATER VALVE CHAMBER
- PR. WATER QUALITY TESTING STATION
- PR. SANITARY SEWER & MANHOLE
- PR. SANITARY FORCEMAIN
- PR. SANITARY SERVICE
- PR. SANITARY CATCHMENT
  - CATCHMENT AREA ID
  - AREA (ha)
  - POPULATION (3.5 p.p.u.)
- PR. STORM SEWER & MANHOLE
- PR. CATCHBASIN
- PR. DOUBLE CATCHBASIN
- PR. CATCHBASIN MANHOLE
- PR. DOUBLE CATCHBASIN MANHOLE
- PR. STORM CATCHMENT
  - CATCHMENT AREA ID
  - RUNOFF COEFFICIENT
  - DRAINAGE AREA (ha)
- PR. CURB CUT
- PR. CANADA POST COMMUNITY MAIL BOX
- PR. TRANSFORMER
- PR. STOP SIGN
- PR. NAME SIGN
- PR. NO PARKING SIGN
- PR. FENCE
- PR. BUILDING ENVELOPE
- PR. LIGHT DUTY SILT FENCE
- PR. HEAVY DUTY SILT FENCE
- PR. STRAW BALE CHECK FLOW
- PR. ROCK CHECK DAM
- PR. SLOPE (3:1 MAX.)
- PR. TREE PRESERVATION AREA
- PR. TOPSOIL STOCKPILE LOCATION

PROJECT No.: 2514-6796
1ST SUBMISSION SITE PLAN APPLICATION



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BENCHMARKS

SURVEY COMPLETED BY SCHAEFFER DZALDOV PURCELL LIMITED ON NOVEMBER 16TH, 2023. ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED TO THE ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY CONTROL No. 00819688527 HAVING A PUBLISHED ELEVATION OF 515.566 METRES (CGVD28:78)

Town: Township of Southgate

No.	ISSUE	DATE: YYYY/MM/DD
0	ISSUED FOR 1ST SUBMISSION SPA	2024/04/26

Engineer

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

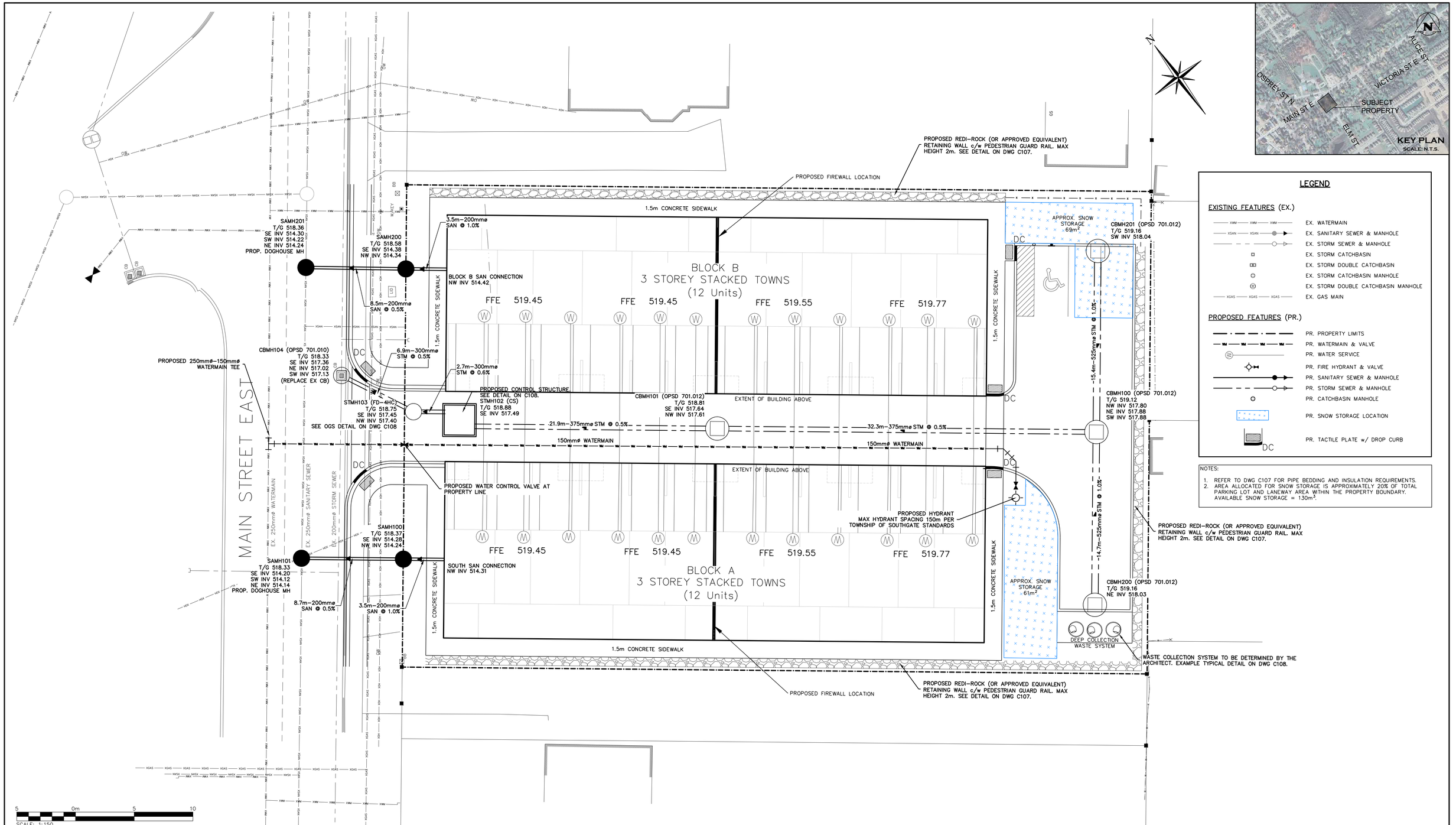
Engineer

Project: 271 MAIN STREET EAST DUNDALK
TOWNSHIP OF SOUTHGATE

Drawing: GRADING PLAN

CROZIER CONSULTING ENGINEERS

Drawn By	Design By	Project
R.D.M./M.C.	J.L.A./A.M.	2514-6796
Check By	Check By	Drawing
J.L'A.	N.C.O.	C101



LEGEND

EXISTING FEATURES (EX.)

- EX. WATERMAIN
- EX. SANITARY SEWER & MANHOLE
- EX. STORM SEWER & MANHOLE
- EX. STORM CATCHBASIN
- EX. STORM DOUBLE CATCHBASIN
- EX. STORM CATCHBASIN MANHOLE
- EX. STORM DOUBLE CATCHBASIN MANHOLE
- EX. GAS MAIN

PROPOSED FEATURES (PR.)

- PR. PROPERTY LIMITS
- PR. WATERMAIN & VALVE
- PR. WATER SERVICE
- PR. FIRE HYDRANT & VALVE
- PR. SANITARY SEWER & MANHOLE
- PR. STORM SEWER & MANHOLE
- PR. CATCHBASIN MANHOLE
- PR. SNOW STORAGE LOCATION
- PR. TACTILE PLATE w/ DROP CURB

NOTES:

1. REFER TO DWG C107 FOR PIPE BEDDING AND INSULATION REQUIREMENTS.
2. AREA ALLOCATED FOR SNOW STORAGE IS APPROXIMATELY 20% OF TOTAL PARKING LOT AND LANEWAY AREA WITHIN THE PROPERTY BOUNDARY. AVAILABLE SNOW STORAGE = 130m².

BENCHMARKS

SURVEY COMPLETED BY SCHAEFFER DZALDOV PURCELL LIMITED ON NOVEMBER 16TH, 2023. ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED TO THE ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY CONTROL No. 00819688527 HAVING A PUBLISHED ELEVATION OF 515.566 METRES (CGVD28: 78)

Town: Township of Southgate

No.	ISSUE	DATE: YYYY/MM/DD
0	ISSUED FOR 1ST SUBMISSION SPA	2024/04/26

Engineer

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Engineer

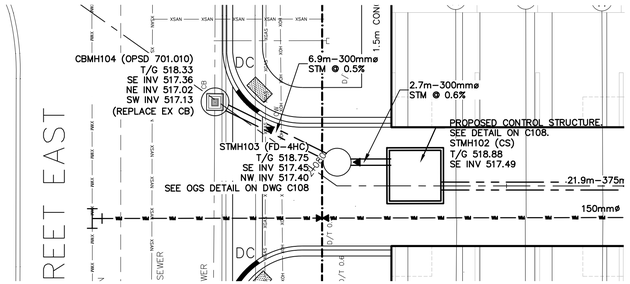
Project: 271 MAIN STREET EAST DUNDALK
TOWNSHIP OF SOUTHGATE

Drawing: GENERAL SERVICING PLAN

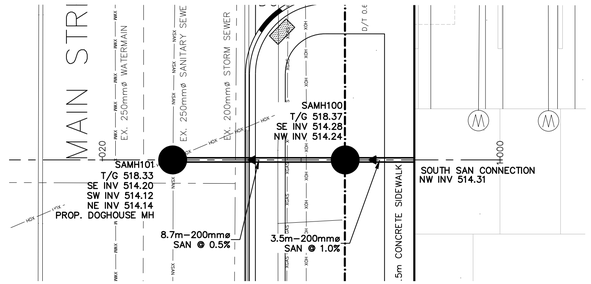
CROZIER CONSULTING ENGINEERS

Drawn By	Design By	Project
R.D.M./M.C.	J.L.A./A.M.	2514–6796
Check By	Check By	Drawing
J.L'A.	N.C.O.	C102A

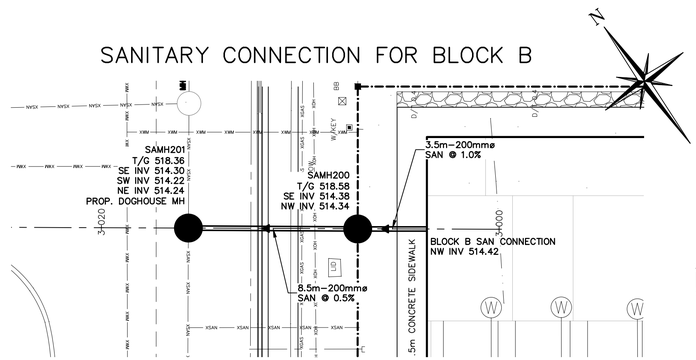
STORM CONNECTION ON MAIN STREET

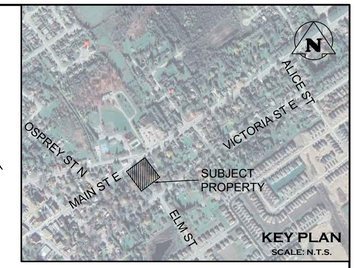


SANITARY CONNECTION FOR BLOCK A



SANITARY CONNECTION FOR BLOCK B





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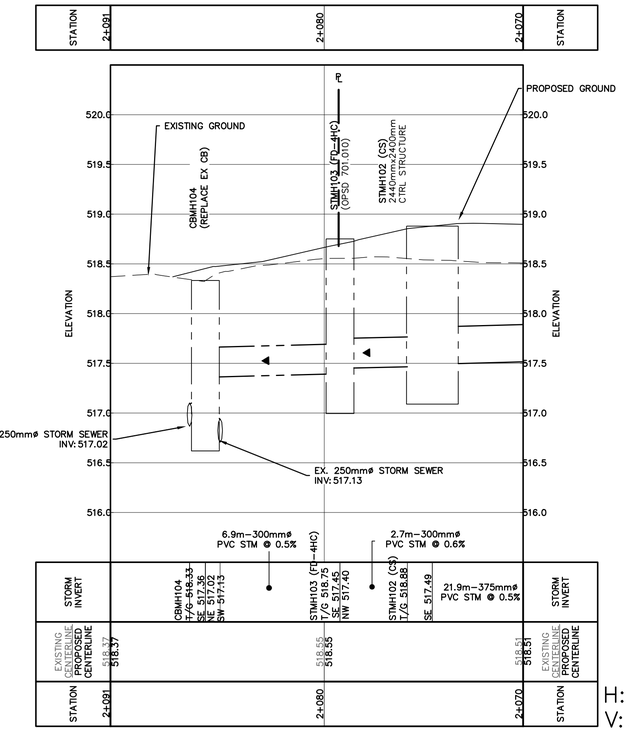

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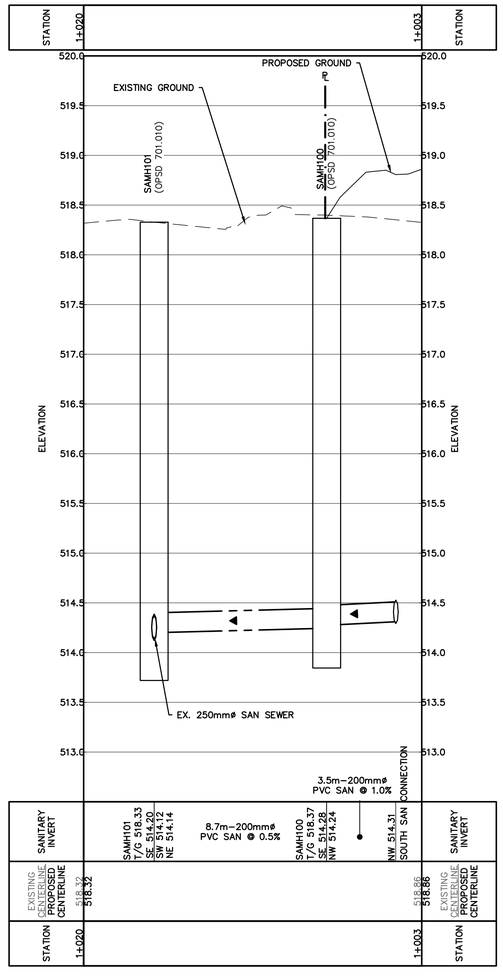

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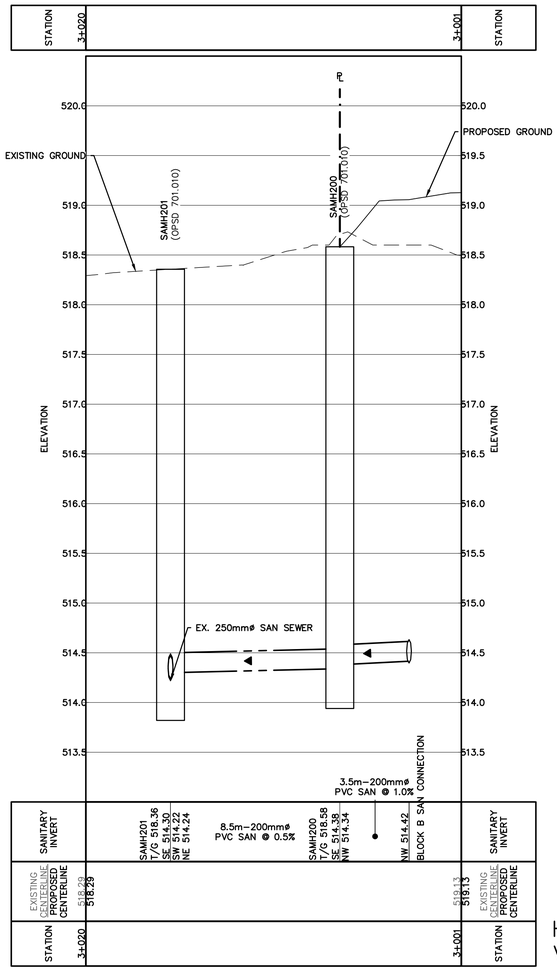

H: 150
V: 30

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BENCHMARKS

SURVEY COMPLETED BY SCHAEFFER DZALDOV PURCELL LIMITED ON NOVEMBER 16TH, 2023. ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED TO THE ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY CONTROL No. 00819688527 HAVING A PUBLISHED ELEVATION OF 515.566 METRES (CGVD28: 78)

Town: Township of Southgate

No.	ISSUE	DATE: YYYY/MM/DD
0	ISSUED FOR 1ST SUBMISSION SPA	2024/04/26

Engineer

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Engineer

Project: 271 MAIN STREET EAST DUNDALK
TOWNSHIP OF SOUTHGATE

Drawing: CONNECTIONS TO EXISTING
MAIN STREET INFRASTRUCTURE

CROZIER CONSULTING ENGINEERS

Drawn By R.D.M./M.C.	Design By J.L.A./A.M.	Project	2514–6796
Check By J.L'A.	Check By N.C.O.	Drawing	C102B

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BENCHMARKS

SURVEY COMPLETED BY SCHAEFFER DZALDOV PURCELL LIMITED ON NOVEMBER 16TH, 2023. ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED TO THE ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY CONTROL No. 00819688527 HAVING A PUBLISHED ELEVATION OF 515.566 METRES (CGVD28:78)

Town

Township of Southgate

No.	ISSUE	DATE: YYYY/MM/DD
0	ISSUED FOR 1ST SUBMISSION SPA	2024/04/26

Engineer | Engineer

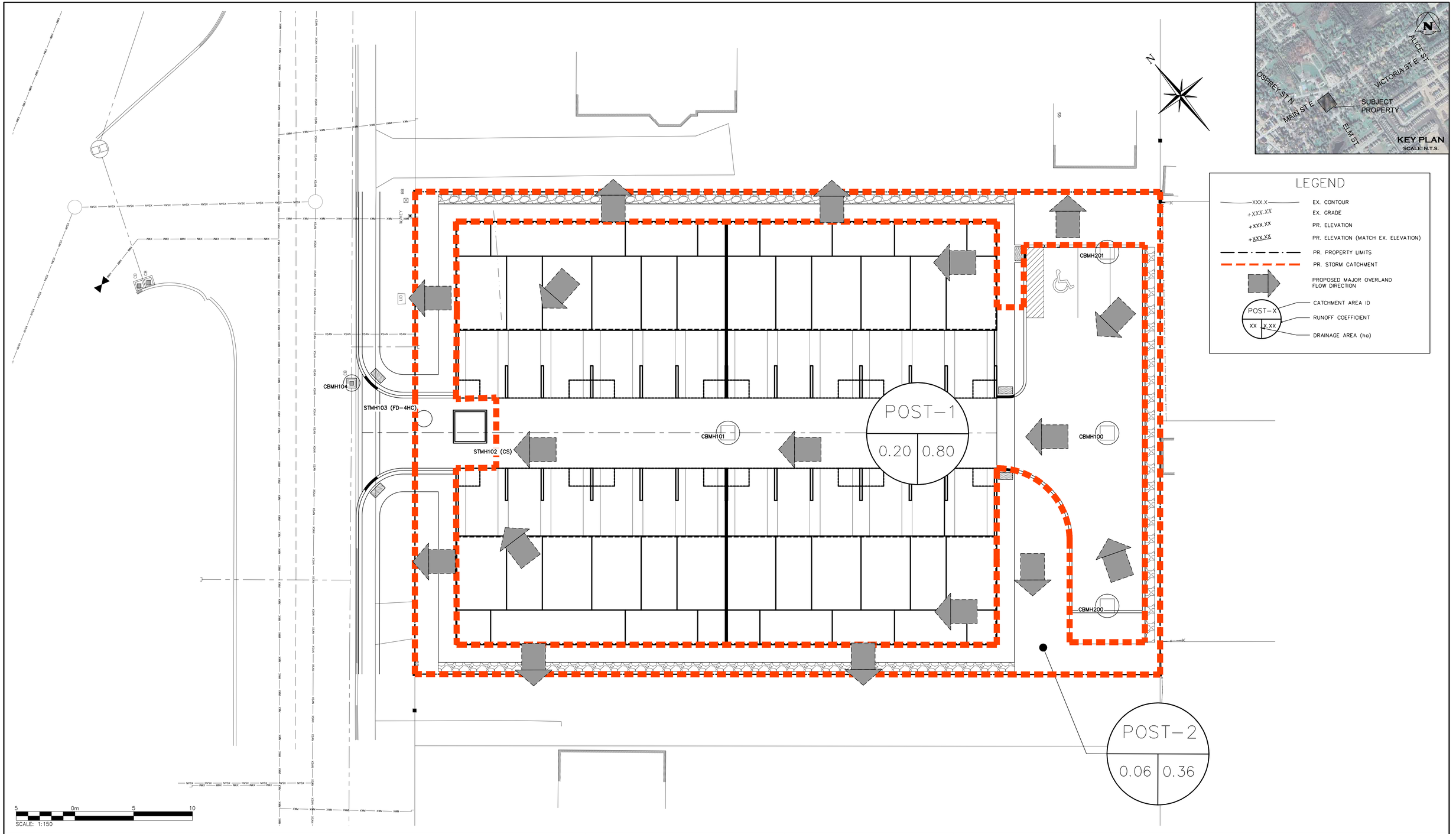
PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Project
271 MAIN STREET EAST DUNDALK
TOWNSHIP OF SOUTHGATE

Drawing
PRE-DEVELOPMENT DRAINAGE PLAN

CROZIER
CONSULTING ENGINEERS

Drawn By	R.D.M./M.C.	Design By	J.L.A./A.M.	Project	2514-6796
Check By	J.L'A.	Check By	N.C.O.	Drawing	C103



LEGEND

- XXX.X — EX. CONTOUR
- +XXX.XX — EX. GRADE
- +XXX.XX — PR. ELEVATION
- +XXX.XX — PR. ELEVATION (MATCH EX. ELEVATION)
- PR. PROPERTY LIMITS
- PR. STORM CATCHMENT
- PROPOSED MAJOR OVERLAND FLOW DIRECTION
- POST-X — CATCHMENT AREA ID
- XX — X.XX — RUNOFF COEFFICIENT / DRAINAGE AREA (ha)

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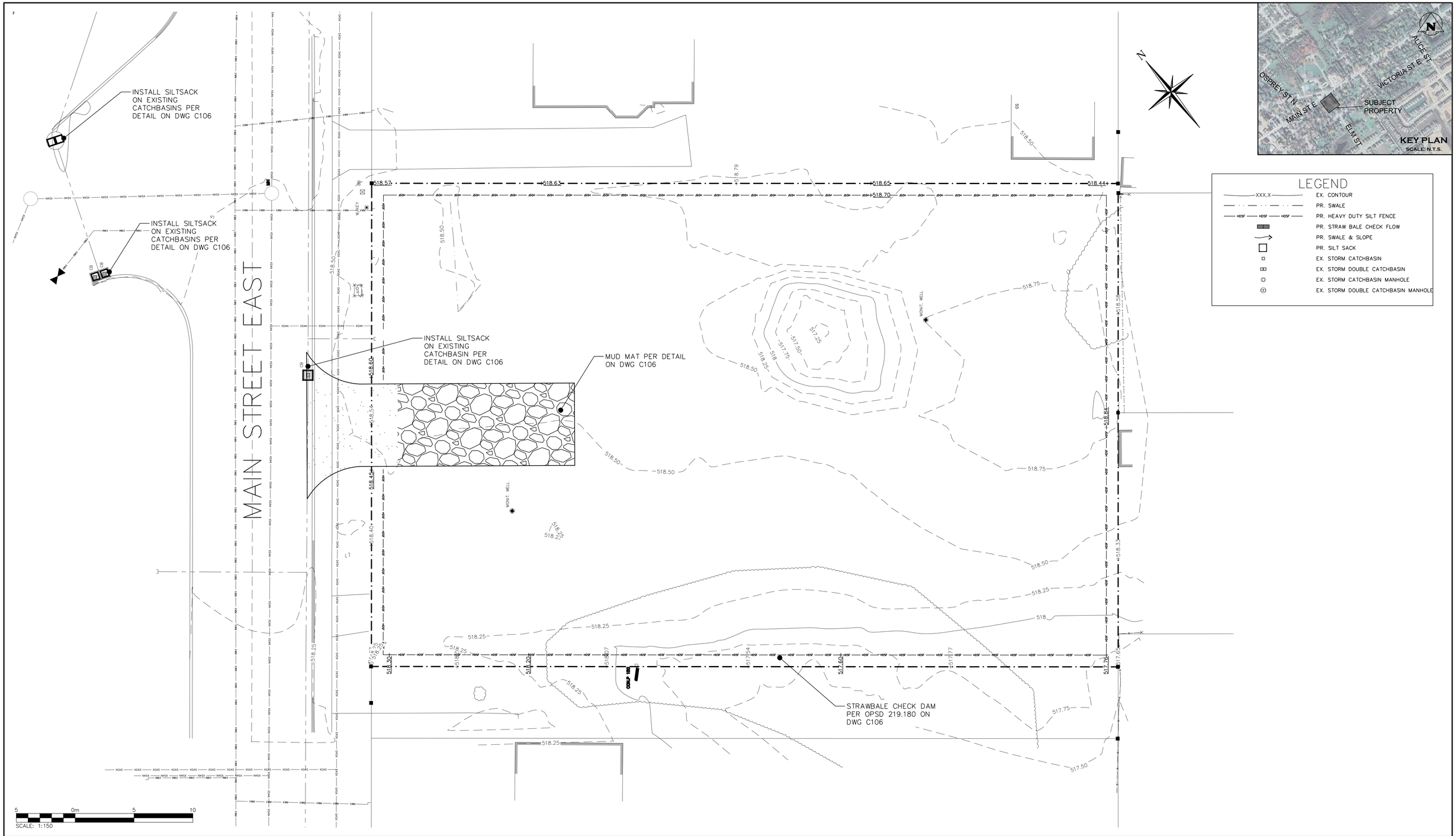
TOWNSHIP OF SOUTHGATE

Drawing: POST-DEVELOPMENT DRAINAGE PLAN

CROZIER CONSULTING ENGINEERS

Drawn By	Design By	Project
R.D.M./M.C.	J.L.A./A.M.	2514-6796
Check By	Check By	Drawing
J.L'A.	N.C.O.	C104



LEGEND

- XXX.X — EX. CONTOUR
- PR. SWALE
- HDSF — PR. HEAVY DUTY SILT FENCE
- PR. STRAW BALE CHECK FLOW
- PR. SWALE & SLOPE
- PR. SILT SACK
- EX. STORM CATCHBASIN
- EX. STORM DOUBLE CATCHBASIN
- EX. STORM CATCHBASIN MANHOLE
- EX. STORM DOUBLE CATCHBASIN MANHOLE

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Project: 271 MAIN STREET EAST DUNDALK
TOWNSHIP OF SOUTHGATE

Drawing: EROSION & SEDIMENT CONTROL PLAN

C CROZIER CONSULTING ENGINEERS

Drawn By	Design By	Project
R.D.M./M.C.	J.L.A./A.M.	2514-6796
Check By	Check By	Drawing
J.L'A.	N.C.O.	C105

GENERAL NOTES:

1. CONSTRUCTION EQUIPMENT TO USE ACCESS POINT, LOCATED AT MAIN STREET, AS INDICATED ON DRAWING C105. MUD MAT TO BE MAINTAINED AT ACCESS POINT.
2. ALL WORKS SHALL BE COMPLETED IN ACCORDANCE WITH THE OCCUPATIONAL HEALTH AND SAFETY ACT. THE GENERAL CONTRACTOR SHALL BE DEEMED TO BE THE "CONSTRUCTOR" AS DEFINED IN THE ACT.
3. ALL SEDIMENT AND EROSION CONTROL FACILITIES AND WORKS ARE TO BE CONSTRUCTED AND IN PLACE TO THE APPROVAL OF THE SITE ENGINEER PRIOR TO ANY GRADING OPERATIONS COMMENCING. TYPICAL WORKS INCLUDE SILT FENCES, INTERCEPTOR SWALES, STRAW BALE CHECK DAMS AND SEDIMENT TRAPS.
4. ALL TEMPORARY TOPSOIL STOCKPILES ARE TO BE PROVIDED WITH THE NECESSARY SEDIMENT AND EROSION CONTROL FEATURES.
5. ALL INTERCEPTOR SWALES ARE TO BE SEEDED TO STABILIZE THEIR BANKS IMMEDIATELY FOLLOWING CONSTRUCTION.
6. REFER TO APPLICATION FORM FOR GRUBBING OF TREES WITHIN LIMITS OF FILL AREA.
7. NO GRADING OF LANDS WILL OCCUR WITHIN SPECIFIED BUFFERS ALONG PROPERTY LINES AND INTERNAL TO SITE.
8. THE LOCATION OF ALL UNDERGROUND AND ABOVEGROUND UTILITIES AND STRUCTURES ARE NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE LOCATION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND SHALL ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
9. NON-WOVEN GEOTEXTILE TO BE TERRAFIX 270R OR APPROVED EQUIVALENT

MAINTENANCE & OPERATIONS OF SEDIMENT CONTROLS

SILT FENCE

1. SILT FENCE MUST BE INSPECTED WEEKLY FOR RIPS OR TEARS, BROKEN STAKES, BLOW-OUTS AND ACCUMULATION OF SEDIMENT.
2. SILT FENCE MUST BE INSPECTED FOLLOWING ALL 15MM OR GREATER RAIN STORM EVENT OR AS DIRECTED BY SITE ENGINEER.
3. SEDIMENT MUST BE REMOVED FROM SILT FENCE WHEN ACCUMULATION REACHES 50% OF THE HEIGHT OF THE FENCE.
4. ALL SILT FENCES MUST BE REMOVED ONLY WHEN THE ENTIRE SITE IS STABILIZED AND AS DIRECTED BY THE SITE ENGINEER.

STRAW BALE / ROCK CHECK DAM

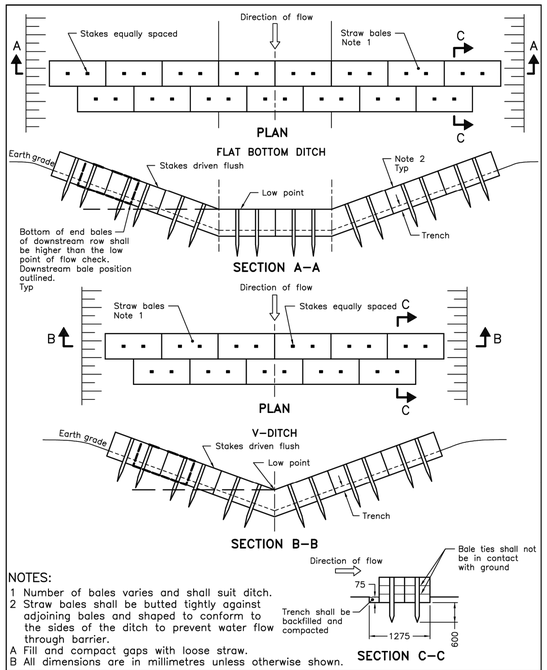
1. REMOVE ACCUMULATED SEDIMENT UP STREAM OF THE CHECK DAM IF GREATER THAN ONE HALF OF DAM HEIGHT.
2. SILT REMOVAL MUST BE UNDERTAKEN WITH CARE TO MINIMIZE DOWN STREAM SEDIMENTATION IN SWALE OR DITCH.
3. STRAW BALE CHECK DAM AND ALL ACCUMULATED SEDIMENT MUST BE REMOVED WITH CARE ONCE THE CONSTRUCTION SITE IS STABILIZED AND AS DIRECTED BY THE SITE ENGINEER.

MUD MAT MAINTENANCE

1. INSPECT MUD MAT WEEKLY TO ASSESS CONDITION AND ENSURE OPERATION EFFICIENCY.
2. SUPPLY AND PLACE ADDITIONAL CLEAR STONE AS DIRECTED BY SITE ENGINEER.
3. MAT TO REMAIN IN PLACE UNTIL SITE IS STABILIZED OR AS DIRECTED BY SITE ENGINEER.
4. CONTRACTOR TO COMPLETE REGULAR STREET SWEEPING ON MAIN STREET EAST.

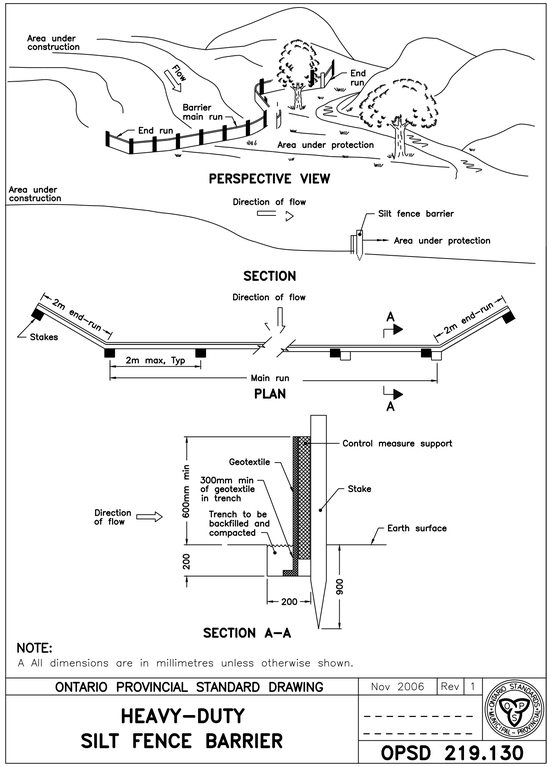
DECOMMISSIONING / RESTORATION

1. FOLLOWING COMPLETION OF CONSTRUCTION AND AS DIRECTED BY SITE ENGINEER, ALL EROSION AND SEDIMENT CONTROL WORKS ARE TO BE REMOVED INCLUDING ANY ACCUMULATED SEDIMENT.
2. ALL WORKS LOCATED ON LANDS OUTSIDE THE PROPOSED DEVELOPMENT AREA ARE TO BE GRADED TO MATCH EXISTING SURROUNDING GROUND AND HYDROSEEDED.
3. ALL SEDIMENT BUILD-UP TO BE REMOVED FROM SEDIMENT BASINS. CUT AREAS AND SEDIMENT BASINS TO BE TREATED WITH 25mm OF TOPSOIL AND HYDROSEEDED AS DIRECTED BY SITE ENGINEER.



NOTES:
1 Number of bales varies and shall suit ditch.
2 Straw bales shall be butted tightly against adjoining bales and shaped to conform to the sides of the ditch to prevent water flow through barrier.
A Fill and compact gaps with loose straw.
B All dimensions are in millimetres unless otherwise shown.

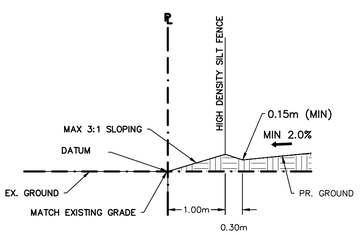
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2021	Rev	3
STRAW BALE FLOW CHECK DAM		OPSD 219.180	



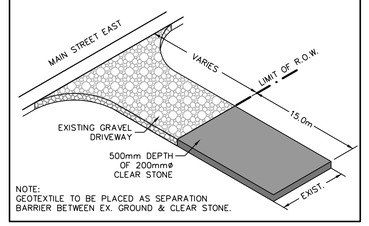
NOTE:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2006	Rev	1
HEAVY-DUTY SILT FENCE BARRIER		OPSD 219.130	

INTERCEPTOR SWALE (TYP.)
N.T.S.

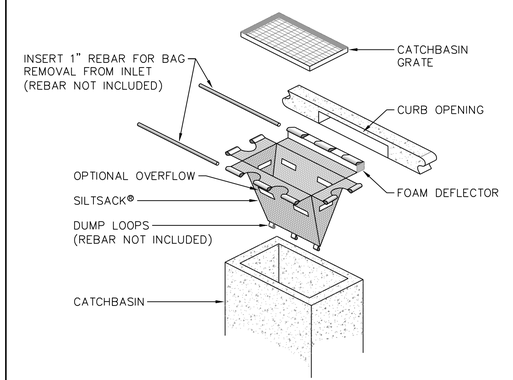


PROPOSED MUD MAT DETAIL
N.T.S.



NOTE:
GEOTEXTILE TO BE PLACED AS SEPARATION BARRIER BETWEEN EX. GROUND & CLEAR STONE.

'SILTSACK' DETAIL
SCALE: N.T.S.



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Drawing: EROSION & SEDIMENT CONTROL PLAN
NOTES & DETAILS

CROZIER CONSULTING ENGINEERS

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Check By	J.L'A.	Check By	N.C.O.	Drawing	C106

CONSTRUCTION NOTES:

A) GENERAL – CONSTRUCTION

1. ALL WORK TO BE CARRIED OUT IN ACCORDANCE WITH TOWNSHIP OF SOUTHGATE STANDARDS, OPSD AND OPSS. WHERE CONFLICT OCCURS, TOWNSHIP OF SOUTHGATE TO GOVERN.
2. TRENCH BACKFILL (OPSD 802.010 & 802.013) TO BE SELECT NATIVE MATERIAL OR IMPORTED SELECT SUBGRADE TO OPSS 1010. BACKFILL TO BE PLACED IN MAXIMUM 200mm THICK LIFTS AND COMPACTED TO 95% OF THE MATERIAL'S STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMDD).
3. PIPE COVER AND BEDDING TO BE CLASS 'B' COMPOSED OF COMPACTED GRANULAR IF EXTENSIVE DEWATERING IS REQUIRED CLASS 'A'.
4. ALL TOPSOIL AND EARTH EXCAVATION TO BE STOCK PILED OR REMOVED TO AN APPROVED SITE AS DIRECTED BY ENGINEER.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DETAILED LAYOUT OF THE WORK. THE DEVELOPER'S ENGINEER WILL CONFIRM ALL BENCH MARK ELEVATIONS AND HORIZONTAL ALIGNMENT FOR THE CONTRACTOR.
6. ALL PROPERTY BARS TO BE PRESERVED AND REPLACED BY O.L.S. AT CONTRACTOR'S EXPENSE IF REMOVED DURING CONSTRUCTION.
7. THE CONTRACTOR SHALL MAKE HIS OWN ARRANGEMENTS FOR THE SUPPLY OF TEMPORARY WATER AND POWER.
8. DEWATERING TO BE CARRIED OUT IN ACCORDANCE WITH OPSS-517 AND 518 TO MAINTAIN ALL TRENCHES IN A DRY CONDITION.
   CONTRACTOR RESPONSIBLE FOR OBTAINING MECP PERMIT IF REQUIRED.
9. ALL ENGINE DRIVEN PUMPS TO BE ADEQUATELY SILENCED, SUITABLE FOR OPERATION IN A RESIDENTIAL DISTRICT.
10. DISTURBED AREAS OUTSIDE THE DEVELOPABLE LANDS TO BE REINSTATED TO PREVIOUS CONDITION OR BETTER.
11. THE CONTRACTOR IS RESPONSIBLE TO NOTIFY ALL UTILITY COMPANIES PRIOR TO COMMENCING WORK AND CO-ORDINATE CONSTRUCTION ACCORDINGLY.
12. ALL EXCAVATION MUST BE CARRIED OUT IN FULL COMPLIANCE WITH MOST RECENT GUIDELINES OF OHSA. NATIVE SOILS ARE CLASSIFIED AS TYPE 3 & 4 SOIL AS PER GEOTECHNICAL REPORT (GREEN GEOTECHNICAL LIMITED, FEBUARY 2024)

B) ROADS

1. ALL EXCAVATION SHALL CONFORM TO THE CURRENT ONTARIO PROVINCIAL SPECIFICATION FOR GRADING OPSS 206
2. THE DEVELOPER SHALL RETAIN A QUALIFIED SOILS CONSULTANT TO CARRY OUT COMPACTION TESTS ON THE COMPLETED SUBGRADE AND SUBSEQUENT LIFTS
   OF GRANULAR BASE MATERIAL BEFORE PLACEMENT OF NEXT GRANULAR OR ASPHALT LIFT.
3. ALL VEGETATION, BOULDERS OVER 150mmø, TOPSOIL AND ORGANIC OR FROST-SUSCEPTABLE MATERIALS SHALL BE REMOVED FROM THE ROAD BASE TO A
   DEPTH OF AT LEAST 1.2m BELOW FINISHED GRADE AND REPLACED WITH SUITABLE MATERIAL.
4. BOULEVARD MATERIAL TO BE COMPACTED TO A MINIMUM DRY DENSITY OF AT LEAST 95% SPMDD. IN THE ZONE WITHIN 1.0m BELOW THE PAVEMENT SUBGRADE, THE BACKFILL SHOULD BE COMPACTED TO AT LEAST 98% SPMDD WITH THE WATER CONTENT 2% TO 3% DRIER THAN THE OPTIMUM. IN THE LOWER ZONE, A 95% OR GREATER COMPACTION IS ADEQUATE.
5. GRANULAR 'A' AND 'B' ROAD BASE TO BE COMPACTED TO 100% OF THE MATERIAL'S RESPECTIVE SPMDD AND PLACED IN MAX. 150mm LIFTS. REFER TO GEOTECHNICAL REPORT FOR FURTHER DETAILS.
6. PROPOSED LANEWAY TO BE CONSTRUCTED WITH MINIMUM 450mm GRANULAR 'B' TYPE 1, 150mm GRANULAR 'A', 80mm HL8 BASE COURSE ASPHALT, & 50mm HL3 SURFACE COURSE ASPHALT (HEAVY DUTY PAVEMENT STRUCTURE, SEE DETAIL ON THIS DRAWING. BOULEVARD FROM PROPERTY LINE TO THE BACK OF CURB TO BE TREATED WITH A TOPSOIL DEPTH OF 200mm AND SOD. PER RECOMMENDATIONS INCLUDED IN GEOTECH REPORT (GREEN, 2024)/PER TOWNSHIP STANDARDS DATED JUNE, 2022.
7. SELECT SUBGRADE MATERIAL, OR IMPORTED GRANULAR MATERIAL APPROVED BY THE ENGINEER, COMPACTED TO 98% SPMDD TO BE USED AS FILL IN ALL AREAS WHERE PROPOSED PIPE INVERTS ARE HIGHER THAN EXISTING GRADE OR AS INSTRUCTED BY THE ENGINEER.
8. ALL GRANULARS AND ASPHALT MATERIALS AND PLACEMENT TO BE IN ACCORDANCE WITH OPSS 314 AND OPSS 310.
9. JOINTS WITH EXISTING ASPHALT TO BE SAW CUT STRAIGHT WITH MIN. 0.3m LAP JOINT PRIOR TO PLACING NEW ASPHALT AND TACK COAT APPLIED TO EXISTING ASPHALT.
10. STOP SIGNS AND STREET SIGNS TO TOWNSHIP STANDARDS.
11. REINSTATEMENT OF ALL DISTURBED BOULEVARDS TO INCLUDE REGRADING, 200mm TOPSOIL AND SOD TO OPSS 570 AND 571.
12. 100mm ø PIPE SUBDRAINS SHALL BE PROVIDED UNDER EDGE OF PAVEMENT ON LOWER (GUTTER) SIDE OF THE ROAD.
13. ALL SUBDRAINS TO BE CONSTRUCTED IN ACCORDANCE WITH OPSS 405. SUBDRAIN TO BE INSTALLED IN GRANULAR 'A' TRENCH AND CONNECTED TO EACH CB OR CBMH.
14. SUBDRAINS TO BE PERFORATED OTHER THAN THE 2m SECTION IMMEDIATELY UPSTREAM OF ALL STRUCTURES WHICH SHALL BE NON-PERFORATED.
15. ALL CONCRETE SIDEWALKS TO BE CONSTRUCTED AS PER OPSD 310.010. ALL SIDEWALK RAMPS SHALL CONFORM WITH OPSD 310.030, 033, 039 AND COMPLETE WITH TACTILE PLATES.

C) SANITARY SEWERS

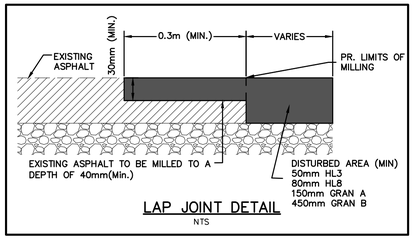
1. M.H.'S TO OPSD – 701.010, 701.030, & 704.010.
2. BENCHING TO OPSD – 701.021.
3. STEPS TO OPSD – 405.010.
4. BACKFILL AND EMBEDMENT TO OPSD – 802.010 CLASS 'B', GRANULAR 'A' BEDDING. IF EXTENSIVE DEWATERING IS REQUIRED, A CLASS 'A' BEDDING
   MAY BE REQUIRED (SUBJECT TO GEOTECHNICAL RECOMMENDATIONS.)
5. TRENCH BACKFILL TO BE SELECT NATIVE MATERIAL AS APPROVED BY ENGINEER OR IMPORTED GRANULAR MATERIAL.
6. FRAMES AND COVERS TO OPSD – 401.01 TYPE 'A' (CLOSED COVER).
7. SERVICE CONNECTIONS TO OPSD – 1006.020 (125mm), GRANULAR 'A' BEDDING, TERMINATE AT SERVICING CORRIDOR LIMITS WITH A TEST FITTING, PLUG AND 2x4 MARKER POST PAINTED GREEN REFER TO TOWNSHIP STANDARD S3. MINIMUM GRADE TO BE 2.0% SERVICE CONNECTIONS TO TOWNSHIP STD S4.
8. RADIUS BENDS TO BE USED ON SANITARY SEWER CONNECTIONS WHERE THE ANGLE OF CONNECTION BETWEEN THE SERVICE AND SEWER EXCEEDS 90°.
9. BACKFILL AND EMBEDMENT MATERIAL TO BE COMPACTED TO A DRY DENSITY OF AT LEAST 95% OF THE MATERIAL'S STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMDD).
10. MANHOLES FRAMES TO BE SET TO BASE COURSE ASPHALT ELEVATION AND RAISED BY ADDING RISER RINGS PRIOR TO PLACING SURFACE COURSE ASPHALT.
11. PIPE SUPPORT AT MAINTENANCE HOLES AS PER OPSD 708.020.
12. ALL MAINTENANCE HOLES, UNLESS EXPRESSLY IDENTIFIED ARE 1200mm ø. SANITARY MANHOLE JOINTS TO BE SEALED WITH "MEL-ROL" AS PER MUNICIPAL STANDARD.
13. GENERAL INSTALLATION AND TESTING OF SEWERS AND APPURTENANCES TO BE IN ACCORDANCE WITH OPSS 407, 408, 409 (CCTV), 410, 421 AND ALL SPECIFICATIONS REFERENCED WITHIN THESE SECTIONS.
14. SANITARY SEWER – SDR 35 PVC.
15. SANITARY SERVICE – SDR 28 PVC – 125mm.
16. FROST STRAPS PER OPSD 701.100.
17. ALL PIPE JOINTS MUST BE LEAK-PROOF AND /OR ALL JOINTS SHOULD BE WRAPPED IN A WATERPROOF MEMBRANE (SUBJECT TO GEOTECHNICAL RECOMMENDATIONS). ALL MANHOLE JOINTS ARE TO BE SEALED USING MEL-ROL OR RISE-WRAP.

D) WATERMAINS

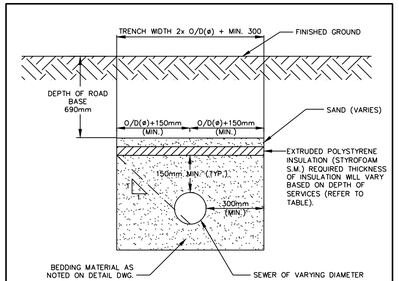
1. BACKFILL AND EMBEDMENT TO OPSD – 802.010 CLASS 'B', GRANULAR 'A' EMBEDMENT. REFER TO GENERAL NOTES.
2. TRENCH BACKFILL TO BE SELECT NATIVE MATERIAL AS APPROVED BY ENGINEER OR IMPORTED GRANULAR MATERIAL.
3. THRUST BLOCKS TO OPSD – 1103.010 AND 1103.020 WHERE SUITABLE SOILS ARE ENCOUNTERED.
4. SERVICE CONNECTIONS TO OPSD – 1104.010, 100mm GRANULAR 'A' EMBEDMENT AND COVER OVER PIPE. TERMINATE AT SERVICING CORRIDOR LIMITS C/W CURB STOP AND BOX.
5. HYDRANTS AS PER OPSD 1105.010 ARE TO BE EQUIPPED WITH ANCHOR TEE's & VALVES. DRAIN PLUGS SHALL BE INSTALLED WHERE HIGH WATER TABLE IS ENCOUNTERED. ANCHOR TEE AND VALVE TO BE USED AT HYDRANTS
6. BACKFILL AND EMBEDMENT MATERIAL TO BE COMPACTED TO A DRY DENSITY OF AT LEAST 95% OF THE MATERIAL'S STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMDD).
7. MINIMUM COVER ON WATERMAIN AND SERVICES TO BE 2.0m.
8. GATE VALVES, BENDS AND HYDRANT LEADS AND FITTINGS TO BE CONNECTED WITH ROLMAC GRIPPER RING RESTRAINING GLANDS. MECHANICAL RESTRAINTS ARE TO BE ONE OF THE FOLLOWING:
   o. UNI-FLANGE SERIES 1300 MANUFACTURED BY FORD METER BOX COMPANY INC.
   b. MEGALUG SERIES 1100 FOR DUCTILE IRON PIPE
   c. MEGALUG SERIES 2000 PV FOR PVC C900 PIPE
   d. STARGRIP SERIES 3000 FOR DUCTILE IRON PIPE
   e. PVC STARGRIP SERIES 4000 FOR PVC C900 PIPE
9. ALL SERVICES TO BE DIRECT TAPPED.
10. FOLLOWING TESTING, CONTRACTOR SHALL OPERATE EACH WATER SERVICE TO VERIFY FULL FLOW AND PRESSURE AT THE CURB
    STOP TO THE SATISFACTION OF THE ENGINEER.
11. GENERAL INSTALLATION AND TESTING OF WATERMAIN AND APPURTENANCES TO BE IN ACCORDANCE WITH OPSS 701 AND ALL SPECIFICATIONS REFERENCED WITHIN THESE SECTIONS. COMPLETE WATER SYSTEM SHALL BE DISINFECTED IN ACCORDANCE WITH REQUIREMENTS OF AWWA STANDARD C651-99. REFER TO DETAIL ON DWG 113D FOR TYPICAL TEMPORARY CONNECTION. ALL WATERMAIN TESTING & CHLORINATION WILL BE CONDUCTED BY THE TOWNSHIP AT CONTRACTORS COST. WATERMAINS ARE NOT TO BE CONNECTED TO EXISTING WATERMAINS UNTIL BACTERIOLOGICAL TESTING HAS BEEN SUCCESSFULLY COMPLETED & CERTIFIED BY CPU.
12. COMPLETE WATER SYSTEM SHALL BE DISINFECTED IN ACCORDANCE WITH REQUIREMENTS OF O. REG. 459/00 & SATISFACTION OF THE TOWNSHIP.
13. WATERMAIN – C900 PVC CLASS 235 (DR 18), B 137.3 WITH RING-TITE JOINTS AND TRACER WIRE. TRACER WIRE IS TO BE #12 AWG CLAD STEEL, HIGH STRENGTH WITH MINIMUM 450LB BREAK BURIAL AND COLOR CODED BLUE. DIRECT BURY WIRE SHOULD HAVE 3-WAY LOCABLE CONNECTORS. ABOVE GROUND TRACER WIRE ACCESS BOXES SHALL BE ATTACHED TO UNDERSIDE OF BOTTOM FLANGE OF FIRE HYDRANTS.
14. SINGLE WATERMAIN SERVICES (25mmø) – COPPER SEAMLESS TYPE 'K' FOR SERVICES LESS THAN OR EQUAL TO 20.0m IN LENGTH. CROSS-LINKED POLYETHYLENE ("MUNICIPEX" BY REHAU AND "BLUE 904" BY IPEX) FOR SERVICES GREATER THAN 20.0m IN LENGTH.
15. MAIN STOPS ARE TO BE ONE OF THE FOLLOWING:
    a. CAMBRIDGE BRASS, BALL STYLE, SERIES 301NL (NO LEAD), AWWA X CB COMPRESSION ASSEMBLY
    b. MUELLER CANADA, MUELLER 300, BALL TYPE, NO LEAD, B-25008, AWWA X MUELLER "CC" COMPRESSION ASSEMBLY
    c. FORD METER BOX COMPANY, BALL STYLE, FB-1000-NL, NO LEAD, AWWA X "CC" COMPRESSION ASSEMBLY
17. CURB STOPS TO 203-H3H3, BALL STYLE WITH DRAIN. BLOW OFFS AS PER TOWNSHIP STD W1.
    CURB STOPS ARE TO BE ONE OF THE FOLLOWING:
    a. CAMBRIDGE BRASS, BALL STYLE, SERIES 202NL (NO LEAD), CB COMPRESSION X CB COMPRESSION ASSEMBLY
    b. MUELLER CANADA, MUELLER 300, BALL TYPE, NO LEAD, MUELLER "CC" X MUELLER "CC" COMPRESSION ASSEMBLY
    c. FORD METER BOX COMPANY, BALL STYLE, B44 SERIES, NO LEAD, "CC" COMPRESSION ASSEMBLY
18. A CURB STOP & EXTENSION SERVICE BOX & MAIN STOP MUST BE INSTALLED ON EACH SERVICE USING COMPRESSION JOINT FITTINGS.
19. ALL CURB STOPS FOR SERVICES WITHIN ASPHALT TO BE LOCATED IN VALVE BOXES INSTALLED FLUSH TO FINISHED GRADE OF
    ASPHALT. CAP FOR VALVE BOX TO BE MARKED WITH 'W' & PAINTED BLUE.
20. SERVICE BOXES TO NUMBER 7, D-I CLOW OR MUELLER, 24" BLACK ROADS STRAIGHT C/W CAP PAINTED BLUE.
21. ALL SERVICES SHALL BE METERED AS PER TOWNSHIP STD W7. METERS TO BE COMPLETE WITH REMOTE READOUT OR RADIO READ AS DETERMINED BY THE TOWNSHIP.
22. HYDRANTS – CENTURY NUMBER 1, OPEN LEFT (O/L), 2 HOSE, 33B PLUMBER PORT. 6" MJ BASE, SELF-DRAINING RED WITH RED STORZ CAP. CANADA VALVE CENTURY COMPRESSION TYPE VALVE SEALS OR CLOW CANADA BRIGADIER HERITAGE STYLE HYDRANT WITH MCAVITY M59M SHAPE, BOTH WITH STORZ PUMPER CONNECTION.
23. VALVES – RESILIENT SEATED, RSGV MECHANICAL JOINT, OPEN LEFT CLOW OR MUELLER WITH 5-SL-48 SLIDING VALVE BOX C/W
    CAP PAINTED BLUE. VALVE AND VALVE BOX PER TOWNSHIP STD W2.
24. MECHANICAL JOINT DUCTILE FITTINGS – AWWA/ANSI C153/A21.53.
25. HYDRANTS TO BE INSTALLED C/W HYDRANT MARKER STAKES PER TOWN & CPU STANDARD "FLEX STAKE HYDRANT MARKER MODEL FHV804, 48" LONG, COLOUR YELLOW WITH REFLECTIVE HYDRANT GRAPHIC ON BOTH SIDES". MARKER TO BE POSITIONED ON THE RIGHT PORT AS VIEWED FROM STREET.
26. ALL VALVES TO BE OPERATED BY THE TOWNSHIP (IF REQUIRED). CONTRACTOR TO PROVIDE MIN. 48hr NOTIFICATION FOR REQUEST.
27. HYDRANTS ARE TO BE 1.67m (5'6") LONG. MAKE-UP PIECES, IF REQUIRED, ARE TO BE INSTALLED BELOW THE HYDRANT.
28. ALL WATERMAIN FITTINGS TO BE LEAD FREE.
29. MECHANICAL JOINT RESTRAINTS TO BE USED DURING TRANSITION OF WATERMAIN INSTALLATION IN NATIVE SOILS TO ENGINEERED FILL. MECHANICAL JOINT RESTRAINTS TO BE UNI-FLANGE SERIES 1300, MANUFACTURED BY FORD METER BOX COMPANY INC. OR APPROVED EQUAL. FINAL LIMITS TO BE FIELD DECISION.
30. MECHANICAL JOINTS ARE REQUIRED ON ALL FITTINGS AND BENDS.
31. WATER SAMPLING STATION – THE KUPFERLE FOUNDRY COMPANY ECLIPSE #88 FOR FREEZING CLIMATES ON A PEDESTAL.
32. CATHODIC PROTECTION REQUIRED ON ALL METALLIC FITTING AND PIPE AS PER OPSS 702 & TOWNSHIP STANDARDS
33. THE PVC PIPE INSTALLATION SHALL INCLUDE TRACER WIRE. TRACER WIRE TO BE 12 GAUGE, MULTI-STRAND SHALL BE PLACED ON TOP & ATTACHED IN WO PLACES ON EACH LENGTH OF PVC WATERMAIN. ALL CONNECTIONS SHALL BE MADE WITH "DRYCONN WATERPROOF CONNECTORS" OR APPROVED EQUAL.
    MUNICIPALITY MUST BE ON SITE DURING ANY TRACER WIRE CONTINUITY TESTING. ABOVE GROUND TRACER WIRE ACCESS BOXES SHALL BE ATTACHED TO UNDERSIDE OF BOTTOM FLANGE OF FIRE HYDRANTS.
34. CLEARANCE BETWEEN WATERMAINS AND SEWER TO BE AS PER MOE GUIDELINES. THE MINIMUM HORIZONTAL SEPARATION BETWEEN THE WATER MAIN AND ANY SEWER SHALL BE 2.5m. A MINIMUM VERTICAL SEPARATION OF 0.5m MUST BE MAINTAINED BETWEEN WATER MAIN AND SEWERS. CLEARANCES ARE MEASURED FROM OUTSIDE EDGES OF PIPES.
35. 75mm PVC SLEEVES SHALL BE PROVIDED WHERE CURB-STOPS ARE LOCATED IN DRIVEWAYS.

E) STORM SEWERS

1. MH TO OPSD 701.010 AND DCBMH TO OPSD – 701.011, 701.012, 701.013.
2. SUMPS – 450mm PIPES AND UNDER REQUIRE 600mm SUMP IN CATCHBASINS AND MAINTENANCE HOLES
3. BENCHING – REQUIRED FOR PIPES OVER 450mm DIAMETER.
4. STEPS TO OPSD 405.010.
5. M.H. FRAMES AND GRATES TO OPSD – 401.01 OPEN COVER.
6. DICB'S TO OPSD – 705.030, 705.040 (TYPE A).
7. DCBMH FRAMES AND GRATES TO BE OPSD – 400.100, & OPSD-400.110 (SQUARE)
8. PIPE SUPPORT AT DCBMH'S TO OPSD – 708.020.
9. DCB LEADS MINIMUM 300mm ø CONNECTION FOR RIGID & FLEXIBLE MAIN PIPE SEWER AS PER OPSD – 708.010, 708.030.
10. PROTECTION DURING CONSTRUCTION TO OPSD – 808.010.
11. BACKFILL AND EMBEDMENT TO OPSD – 802.010 (FLEXIBLE PIPE) CLASS 'B', GRANULAR 'A' EMBEDMENT OR OPSD – 802.030, 802.031 AND 802.032 (RIGID PIPE) GRANULAR 'A' EMBEDMENT. REFER TO GENERAL NOTES.
12. BACKFILL AND EMBEDMENT MATERIAL TO BE COMPACTED TO A DRY DENSITY OF AT LEAST 95% OF THE MATERIAL'S SPMDD.
13. FROST STRAPS PER OPSD 701.100.
14. STORM SEWERS 375mmø OR LESS TO BE PVC DR35. STORM SEWERS 450mm OR MORE TO BE CONCRETE CL-65D UNLESS OTHERWISE NOTED.
15. STORM SERVICES TO BE 100mmø PVC DR28 COLORED WHITE, WHERE SHARED STORM SERVICES ARE USED, SERVICE BETWEEN STORM SEWER CONNECTION AND PIPE TO BE 125mmø. MINIMUM SLOPE TO BE 1% AND MINIMUM COVER 1.2m.
16. CATCHBASIN LEADS TO REAR YARD CATCHBASINS TO BE CONCRETE CL-100D.
17. INLINE AREA DRAINS (AD) TO BE NYLOPLAST 15" (DWG No. 7003-110-026).

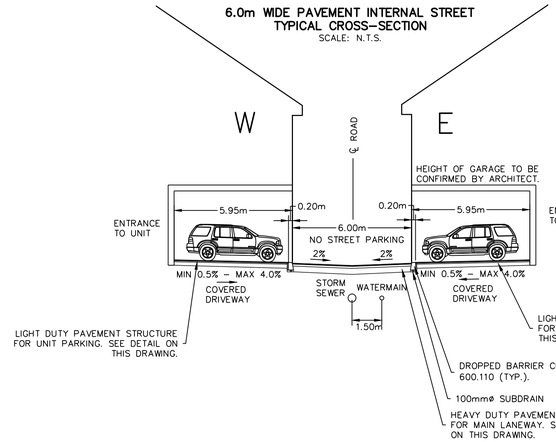


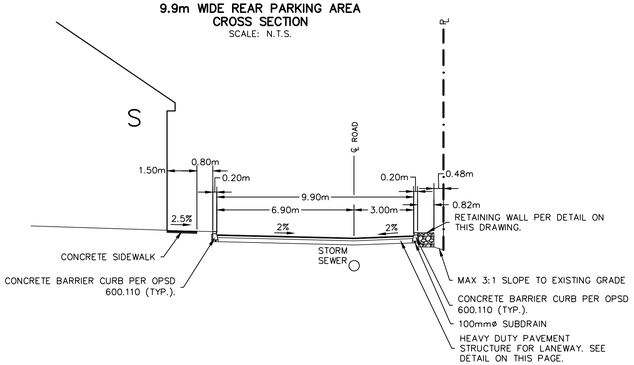
LAP JOINT DETAIL
NTS



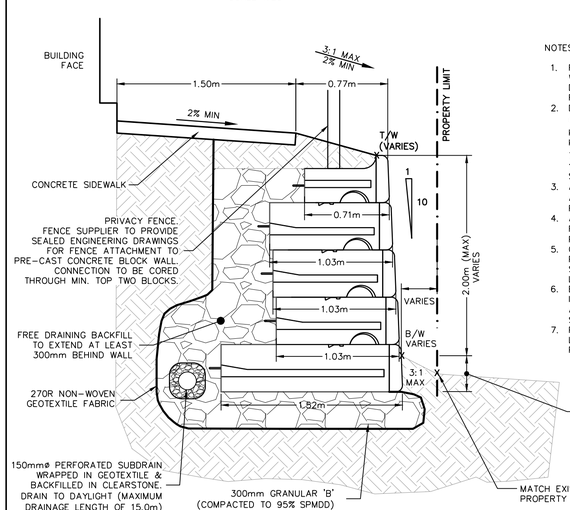
NOTES:
1. AS PER O.B.C. A.7.3.5.4.
   COVER OVER THE INSULATION IS BETWEEN 0.6 TO 0.9m – USE 50mm INSULATION
   COVER OVER THE INSULATION IS BETWEEN 0.9 TO 1.2m – USE 40mm INSULATION
   COVER OVER THE INSULATION IS BETWEEN 1.2 TO 1.8m – USE 25mm INSULATION
2. MIN. COVER REQUIREMENTS:
   STORM SEWER – 1.2m (TO CROWN)
   WATERMAINS – 2.0m (TO CROWN)
   SANITARY SEWER – 2.4m (TO CROWN OF PIPE)
3. INSULATION SHALL BE PLACED WITH ENDS CLOSELY LOCATED TOGETHER.
4. ALL JOINTS SHALL BE STAGGERED WHEN MORE THAN ONE LAYER OF INSULATION IS BEING INSTALLED.

INSULATION FOR VARIOUS INFRASTRUCTURE
N.T.S.



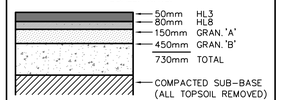


TYPICAL PRE-ENGINEERED RETAINING WALL
SCALE 1:25



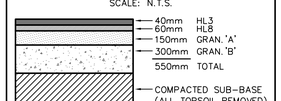
NOTES:
1. RETAINING WALL TO BE CONSTRUCTED IN ACCORDANCE WITH PROPOSED GRADES ON DWG C102A & C101. DIVERGENCE FROM PROPOSED GRADES SHALL BE REVIEWED AND APPROVED BY ENGINEER OF RECORD.
2. DESIGN PARAMETERS (GREEN GEOTECHNICAL, 2024):
   Φ BACKFILL SOIL = 32°
   Ka = 0.36
   Kp = 2.76
   γ soil = 18kN/m³
   γ block = 24kN/m³
   SURCHARGE = 3.6 kPa
3. A NON-WOVEN GEOTEXTILE (TERRAFIX 270R OR APPROVED EQUIVALENT) SHALL BE PLACED BEHIND THE RETAINING WALL AS INDICATED.
4. ALL BACKFILL USED BEHIND RETAINING WALL SHALL BE FREE DRAINING GRANULAR 'B' MATERIAL AND SHALL BE PLACED AT A MINIMUM OF 300mm BEHIND THE WALL.
5. CONTRACTOR TO PROVIDE SHOP DRAWINGS FOR PRE-ENGINEERED RETAINING WALL. SHOP DRAWINGS SHALL BE SEALED BY A PROFESSIONAL ENGINEER LICENSED IN THE PROVINCE OF ONTARIO.
6. BLOCK SHOWN IS REDI-ROCK. CONTRACTOR TO ENSURE INSTALLATION OF BLOCK WALL IS IN STRICT ACCORDANCE WITH MANUFACTURER'S INSTALLATION SPECIFICATIONS.
7. PROVIDE MINIMUM 850mm SETBACK FROM PROPERTY LINE. NO ENCROACHMENT IS ALLOWED ONTO ADJACENT PROPERTIES DURING CONSTRUCTION.

PAVEMENT STRUCTURE (HEAVY DUTY)
SCALE: N.T.S.



NOTE:
REFER TO CONSTRUCTION NOTES FOR DETAILS ON COMPACTION. PAVEMENT STRUCTURE BASED ON GEOTECHNICAL CONSULTANTS RECOMMENDATIONS.

PAVEMENT STRUCTURE (LIGHT DUTY)
SCALE: N.T.S.



NOTE:
REFER TO CONSTRUCTION NOTES FOR DETAILS ON COMPACTION. PAVEMENT STRUCTURE BASED ON GEOTECHNICAL CONSULTANTS RECOMMENDATIONS.

Engineer

PRELIMINARY

Town: Township of Southgate

No.	ISSUE	DATE: YYYY/MM/DD
0	ISSUED FOR 1ST SUBMISSION SPA	2024/04/26

Engineer

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Engineer

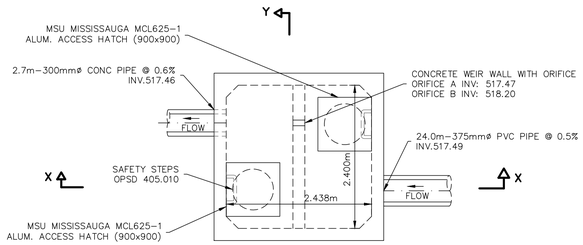
Project: 271 MAIN STREET EAST DUNDALK
TOWNSHIP OF SOUTHGATE

Drawing: CONSTRUCTION NOTES & DETAILS (1 OF 2)

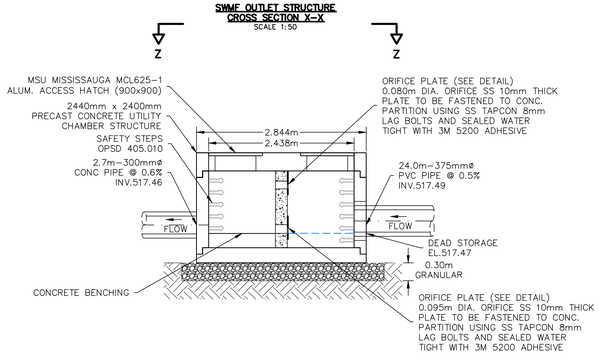
CROZIER CONSULTING ENGINEERS

Drawn By	Design By	Project
R.D.M.	J.L.A./A.M.	2514-6796
Check By	Check By	Drawing
J.L'A.	N.C.O.	C107

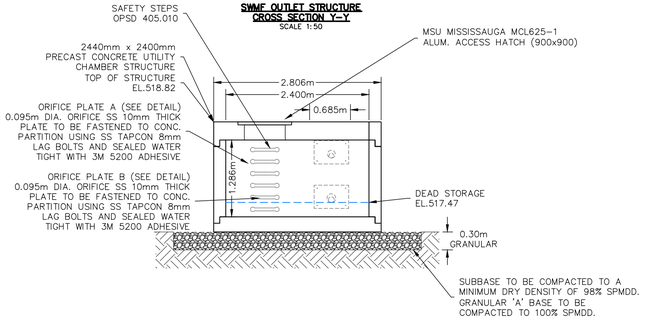
SWMF OUTLET STRUCTURE CROSS SECTION Z-Z
SCALE 1:50



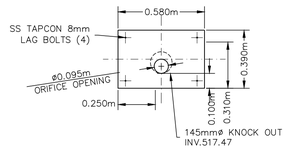
SWMF OUTLET STRUCTURE CROSS SECTION X-X
SCALE 1:50



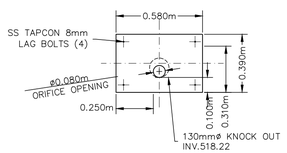
SWMF OUTLET STRUCTURE CROSS SECTION Y-Y
SCALE 1:50



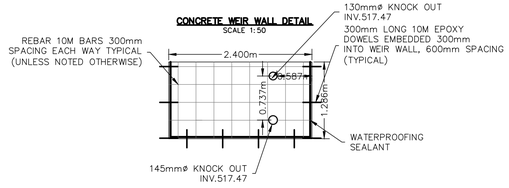
ORIFICE PLATE A
SCALE 1:20

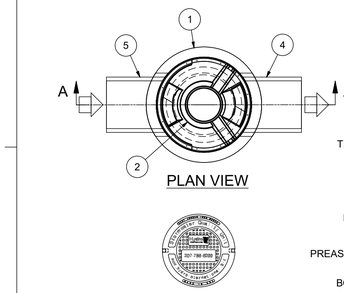


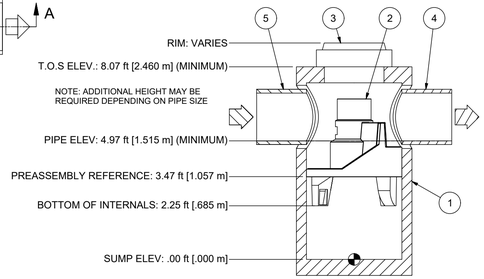
ORIFICE PLATE B
SCALE 1:20



CONCRETE WEIR WALL DETAIL
SCALE 1:50







1. MANHOLE WALL AND SLAB THICKNESSES ARE NOT TO SCALE.

2. CONTACT HYDRO INTERNATIONAL FOR A BOTTOM OF STRUCTURE ELEVATION PRIOR TO SETTING FIRST DEFENSE MANHOLE.

3. CONTRACTOR TO CONFIRM RIM, PIPE INVERTS, PIPE DIA. AND PIPE ORIENTATION PRIOR TO RELEASE OF UNIT TO FABRICATION.

PROJECTION

IF IN DOUBT ASK

DATE:	SCALE:
11/2/2021	1:30

DRAWN BY:	CHECKED BY:	APPROVED BY
ER	MRJ	

Title:
4-ft DIAMETER
FIRST DEFENSE

GENERAL ARRANGEMENT

Hydro International
hydro-int.com
HYDRO INTERNATIONAL

WEIGHT:	MATERIAL:

STOCK NUMBER:

DRAWING NO.:
FD GA-4

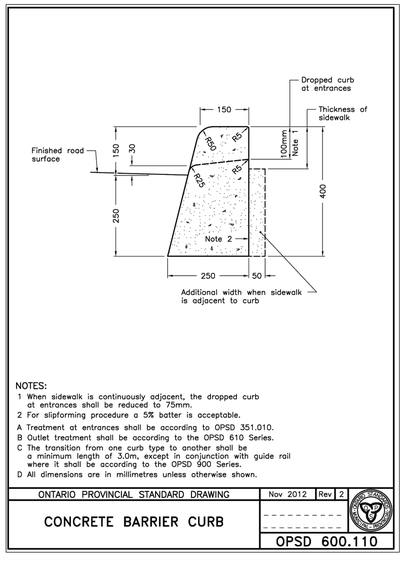
SHEET SIZE:	SHEET:	Rev:
B	1 OF 1	-

PRODUCT SPECIFICATION:

1. Peak Hydraulic Flow: 18.0 cfs (510 l/s)
2. Min Sediment Storage Capacity: 0.7 cu. yd. (0.5 cu. m.)
3. Maximum Inlet/Outlet Pipe Diameters: 24 in. (600 mm)
4. The Treatment System Shall Use An Induced Vortex To Separate Pollutants From Stormwater Runoff.
5. For More Product Information Including Regulatory Acceptances, Please Visit https://hydro-int.com/en/products/first-defense

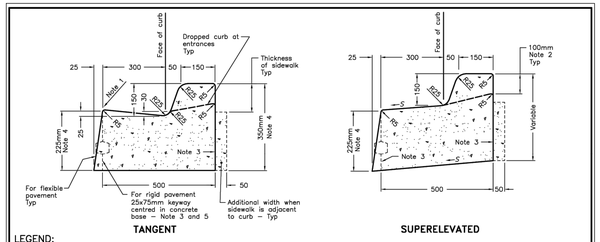
GENERAL NOTES:
1. General Arrangement drawings only. Contact Hydro International for site specific drawings.
2. The diameter of the inlet and outlet pipes may be no more than 24".
3. Multiple inlet pipes possible (refer to project plan).
4. Inlet/outlet pipe angle can vary to align with drainage network (refer to project plans).
5. Peak flow rate and minimum height limited by available cover and pipe diameter.
6. Larger sediment storage capacity may be provided with a deeper sump depth.

PARTS LIST				
ITEM	QTY	SIZE (in)	SIZE (mm)	DESCRIPTION
1	1	48	1200	I.D. PRECAST MANHOLE
2	1			INTERNAL COMPONENTS (PRE-INSTALLED)
3	1	30	750	FRAME AND COVER (ROUND)
4	1	24 (MAX)	600 (MAX)	OUTLET PIPE (BY OTHERS)
5	1	24 (MAX)	600 (MAX)	INLET PIPE (BY OTHERS)



NOTES:
1 When sidewalk is continuously adjacent, the dropped curb at entrances shall be reduced to 75mm.
2 For slipforming procedure a 5% batter is acceptable.
A Treatment at entrances shall be according to OPSD 351.010.
B Outlet treatment shall be according to the OPSD 610 Series.
C The transition from one curb type to another shall be a minimum length of 3.0m, except in conjunction with guide rail where it shall be according to the OPSD 900 Series.
D All dimensions are in millimetres unless otherwise shown.

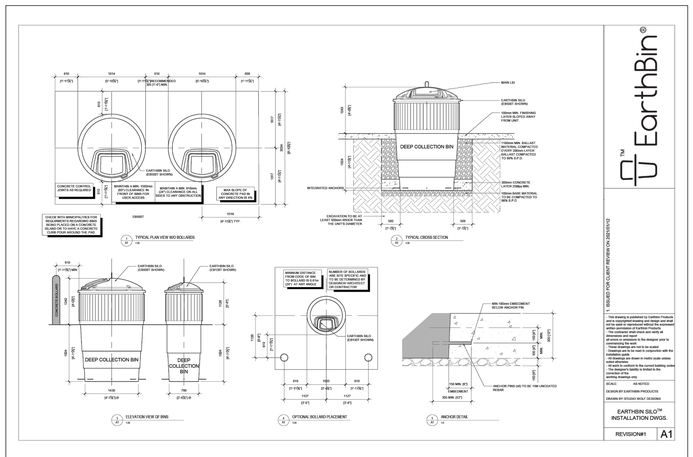
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2012	Rev 2
CONCRETE BARRIER CURB		OPSD 600.110



LEGEND:
S – Rate of pavement superelevation in percent, %.

NOTES:
1 Flexible and composite pavement shall be placed 5mm above the adjacent edge of gutter.
2 When sidewalk is continuously adjacent, the dropped curb at entrances shall be reduced to 75mm.
3 For slipforming procedure a 5% batter is acceptable.
4 For composite pavement the depth of concrete curb shall be adjusted to depth of concrete pavement.
5 When tie bars are specified, refer to OPSD 552.010 and 552.020 for details.
A Treatment at entrances shall be according to OPSD 351.010.
B Outlet treatment shall be according to the OPSD 610 Series.
C The transition from one curb type to another shall be a minimum length of 3.0m, except in conjunction with guide rail where it shall be according to the OPSD 900 Series.
D All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2012	Rev 2
CONCRETE BARRIER CURB WITH STANDARD GUTTER		OPSD 600.040



1. THIS DRAWING IS THE EXCLUSIVE PROPERTY OF C.F. CROZIER & ASSOCIATES INC. AND THE MODIFICATION AND/OR REPRODUCTION OF ANY PART OF THIS DRAWING IS STRICTLY PROHIBITED WITHOUT WRITTEN AUTHORIZATION FROM THIS OFFICE.
2. THE DIGITAL FILES CONTAIN INTELLECTUAL AND DIGITAL DATA PROPERTY THAT IS THE EXCLUSIVE PROPERTY OF C.F. CROZIER & ASSOCIATES INC.
3. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, LEVELS, AND DATUMS ON SITE AND REPORT ANY DISCREPANCIES OR OMISSIONS TO C.F. CROZIER & ASSOCIATES INC. PRIOR TO CONSTRUCTION.
4. THIS DRAWING IS TO BE READ AND UNDERSTOOD IN CONJUNCTION WITH ALL OTHER PLANS AND DOCUMENTS APPLICABLE TO THIS PROJECT.
5. ALL EXISTING UNDERGROUND UTILITIES TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO CONSTRUCTION.
6. DO NOT SCALE DRAWINGS.

Town: Township of Southgate

No.	ISSUE	DATE: YYYY/MM/DD
0	ISSUED FOR 1ST SUBMISSION SPA	2024/04/26

Engineer

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Engineer

Project: 271 MAIN STREET EAST DUNDALK
TOWNSHIP OF SOUTHGATE

Drawing: CONSTRUCTION NOTES & DETAILS
(2 OF 2)

CROZIER CONSULTING ENGINEERS

Drawn By	R.D.M.	Design By	J.L.A./A.M.	Project	2514-6796
Check By	J.L'A.	Check By	N.C.O.	Drawing	C108