GEOTECHNICAL INVESTIGATION

LORNE STREET SUBDIVISION
LORNE STREET
HARRISTON, ONTARIO

CMT Project 17-575.R01

Prepared For:

MEX Developments Inc.

October 22, 2020

CMT ENGINEERING INC.

CMT Engineering Inc.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario N0B 2M0
***Tel:* 519-699-5775**
***Fax:* 519-699-4664**
www.cmtinc.net

October 22, 2020

17-575.R01

MEX Developments Inc.
6297 Wellington Road 109
Harriston, Ontario
N0G 1Z0

Attention: Mr. Jerry Roubos

Dear Sir:

Re: Geotechnical Investigation
Lorne Street Subdivision
Lorne Street
Harriston, Ontario

As requested, CMT Engineering Inc. conducted a geotechnical investigation at the above-referenced site, and we are pleased to present the enclosed report.

We trust that this information meets your present requirements and we thank you for allowing us to undertake this project. Should you have any questions, please do not hesitate to contact our office.

Yours very truly,

Jake Feeney, B.Eng., EIT.

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1.0 INTRODUCTION

The services of CMT Engineering Inc. (CMT Inc.) were retained by Mr. Jerry Roubos of MEX Developments Inc. to conduct a geotechnical investigation for the proposed subdivision to be located off of Lorne Street in Harriston, Ontario. The location of site is shown on Drawing 1.

It is understood that the project will involve the construction of a new residential subdivision with associated roadways, underground utilities and stormwater management facilities (stormwater management pond).

The purpose of the geotechnical investigation was to assess the existing soil and groundwater conditions encountered in the test pits. Included in the assessment are the soil classification and groundwater observations, as well as comments and recommendations regarding the estimated geotechnical resistance (bearing capacity); estimated serviceability limit states (anticipated settlement); recommended founding elevations; site classification for seismic site response; dewatering considerations; recommendations for site grading, site servicing, excavations and backfilling; recommendations for slab-on-grade construction; pavement design/drainage; soil design properties; and a summary of the laboratory test results.

The recommendations in this report are solely based on the soil conditions encountered in the test pits advanced at the subject site.

2.0 EXISTING SITE CONDITIONS

The site currently comprises a recently graded area as well as an area which was observed to be agricultural land. CMT Inc. conducted compaction testing during the recently completed site grading operation. The site is bounded by Lorne Street and residential properties to the west, agricultural land to the south and east, and residential and commercial properties to the north. The location of the site is shown on Drawing 1.

3.0 FIELD AND LABORATORY PROCEDURES

The field investigation was conducted on October 14, 2020 and comprised the advancement of seven (7) test pits (referenced as Test Pit 1 to Test Pit 7), utilizing an excavator operated by the client. The test pits were advanced to depths ranging from approximately 1.7 m (5.6 ft) to 2.5 m (8.2 ft) below the existing ground surface elevations. Test Pits 1 to 4 and 6 to 7 were advanced in the undeveloped area of the proposed roadways and lots. Test Pit 5 was advanced near the proposed stormwater management pond. Soil sampling took place throughout the advancement of the test pits. Technical staff from CMT Inc. observed the test pit advancement and collected and logged the recovered soil samples. A small portion of each sample was placed in a sealed, marked jar for moisture content determinations.

Representative samples from the following test pits and depths were submitted to the CMT Inc. laboratory in St. Clements, Ontario for grain size analyses:

- Test Pit 2 – depth 1.5 m (4.9 ft)
- Test Pit 6 – depth 0.9 m (3.0 ft)

The test pit logs are provided in Appendix A and the grain size analyses are presented in Appendix B.

The client surveyed the ground surface elevations at the test pit locations. A brass plug (Benchmark #11) in the concrete sewage access on the west side of Lorne Street (CGVD 2013) was utilized as a benchmark with a reported geodetic elevation of 382.441 m. The ground surface elevations at the test pit locations ranged from about 381.30 m to 386.58 m. The locations of the test pits are shown on Drawing 2.

4.0 SUBSOIL CONDITIONS

The soils encountered in the test pits are described briefly below and a more detailed stratigraphic description is provided on the test pit logs in Appendix A. Descriptions of soil relative density and/or consistency have been estimated based on visual observations during the advancement of the test pits. The following paragraphs have been simplified into terms of major soil strata. Further, the subsurface conditions are anticipated to vary between and beyond the test pit locations.

4.1. Topsoil

Dark brown, silty, organic topsoil was encountered at the surface of Test Pits 2, 3, 6 and 7. The thickness of the topsoil was observed to range from approximately 300 mm to 900 mm (average 450 mm) at the test pit locations, however the thickness of the topsoil is anticipated to vary throughout the site. Materials noted as topsoil in this report were classified based on visual and textural evidence. Testing of organic content or for other nutrients was not carried out.

4.2. Sand

Compact, brown sand with trace silt was encountered underlying the sandy silt at Test Pits 2, 3 and 4. The sand was considered to be in a saturated state.

4.3. ***Sand and Gravel***

Compact, grey sand and gravel with trace silt was encountered underlying the sandy silt at Test Pit 6. The sand and gravel was considered to be in a saturated state.

4.4. ***Sandy Silt***

Loose to compact, brown to grey sandy silt with trace gravel to gravelly and trace to some clay was encountered at the surface of Test Pits 1, 4 and 5, underlying the topsoil at Test Pits 2, 3, 6 and 7, underlying the sand at Test Pits 2 and 3, and underlying the sand and gravel at Test Pit 6. The sandy silt was considered to be moist to wet, with moisture contents ranging from about 10.2% to 22.0% (average 13.2%).

4.5. ***Groundwater***

No accumulated groundwater or seepage was observed in the test pit locations upon completion of excavation; however, it should be noted that wet to saturated soil conditions were encountered at all seven (7) test pit locations. Caving of the test pit walls was observed throughout all seven test pits. It should also be noted that the fine-grained sandy silt soils are particularly low in permeability and have the potential to create perched water conditions. Groundwater conditions (particularly perched water) are generally dependent on the amount of precipitation, control of surface water, as well as the time of year, and can fluctuate significantly in elevation and volume. The groundwater levels (particularly perched water) and wet soil conditions encountered in some of the test pits could make some excavations difficult. It should be expected that caving or sloughing of the excavation walls will occur when advancing into wet to saturated zones.

Recommendations with respect to dewatering conditions are provided in Section 5.8 of this report.

5.0 ***DISCUSSION AND RECOMMENDATIONS***

This section of the report provides CMT Inc.'s interpretation of the factual geotechnical data obtained during the investigation and is intended for the guidance of the owner and design engineer. Where comments are made on construction, they are provided only to highlight those aspects which could affect the design of the project. Contractors bidding on or undertaking the work should make their own independent interpretation of the factual subsurface information provided as it affects their proposed construction means and methods, equipment selection, scheduling, pricing, and the like.

It is understood that the project will involve the construction of a new residential subdivision with associated roadways, underground utilities and stormwater management facilities (stormwater management pond).

Utilizing the information gathered during the geotechnical investigation and assuming that the test pit information is representative of the subsoil conditions throughout the site, the following comments and recommendations are provided.

5.1. Serviceability and Ultimate Limit Pressure

Based on the information obtained from the test pits, the following table provides a summary of the estimated geotechnical reaction at the Serviceability Limit State (SLS) and the factored geotechnical resistance at the Ultimate Limit State (ULS) at the various elevations, including soil types:

Test Pit No.	Ground Surface Elevation (m)	SLS kPa (psf)	ULS kPa (psf)	Estimated Highest Founding Elevation (m)	Depth Below Ground Surface for Highest Founding Elevation (m)	Soil Type
1	381.41	75 (1,500)	115 (2,300)	381.41 to 380.41	0.00	Sandy Silt
		150 (3,000)	225 (4,500)	380.41 to 379.31 (termination)	1.00	
2	381.85	75 (1,500)	115 (2,300)	381.55 to 380.75	0.30	Sandy Silt/Sand
		150 (3,000)	225 (4,500)	380.75 to 380.15 (termination)	1.10	
3	381.66	75 (1,500)	115 (2,300)	381.36 to 380.66	0.30	Sandy Silt/Sand
		150 (3,000)	225 (4,500)	380.66 to 379.66 (termination)	1.00	
4	381.30	150 (3,000)	225 (4,500)	381.30 to 379.20 (termination)	0.00	Sandy Silt/Sand

Test Pit No.	Ground Surface Elevation (m)	SLS kPa (psf)	ULS kPa (psf)	Estimated Highest Founding Elevation (m)	Depth Below Ground Surface for Highest Founding Elevation (m)	Soil Type
5	381.44	150 (3,000)	225 (4,500)	381.44 to 378.94 (termination)	0.00	Sandy Silt
6	381.49	150 (3,000)	225 (4,500)	381.19 to 379.29 (termination)	0.30	Sandy Silt/Sand and Gravel/ Gravelly Sandy Silt
7	386.58	150 (3,000)	225 (4,500)	385.68 to 384.18 (termination)	0.90	Sandy Silt

Based on the bearing capacities and elevations provided in the table above, suitable founding elevations for conventional foundations designed with a minimum bearing capacity of 75 kPa (1,500 psf) at SLS and 115 kPa (2,300 psf) at ULS range from elevations of approximately 381.55 m to 380.41 m in the area of the proposed houses and roads.

Based on the bearing capacities and elevations provided in the table above, suitable founding elevations for conventional foundations designed with a minimum bearing capacity of 150 kPa (3,000 psf) at SLS and 225 kPa (4,500 psf) at ULS range from elevations of approximately 385.68 m to 378.94 m in the area of the proposed houses and roads.

Soils capable of supporting foundations were generally encountered below the topsoil, and upper zone of loose native soils at the test pit locations. Therefore, the topsoil and relatively loose native soils must be subexcavated in the areas of the proposed structures. The founding soil must be assessed at the time of construction by qualified geotechnical personnel in order to confirm their founding suitability.

It is understood that the grades are proposed to be raised significantly throughout the majority of the site. As such, structural fill will be required in order to achieve the design grades for the proposed foundations. The serviceability limit pressure for good quality granular structural fill placed and compacted in accordance with Section 5.4.4 of this report and constructed on approved competent native soils is estimated to be at least 150 kPa (3,000 psf).

Footings may be placed at a higher elevation relative to another footing provided that the slope between the outside face of the footings is separated by a minimum slope of 10 horizontal to 7 vertical (10H:7V) with an imaginary line projected from the underside of the footings. This must be taken into account for any deep structures such as elevator pits, sump pits and/or pump chambers.

With respect to the Serviceability Limit State (SLS), the total and differential footing settlements are not expected to exceed the generally acceptable limits of 25 mm (1") and 19 mm (3/4") respectively.

All exterior footings must be provided with a minimum of 1.2 m of soil cover or equivalent thermal insulation (sufficient thermal insulation is required to protect all footings and slab-on-grades during construction until such a time that the structure is heated) in order to provide protection from frost action.

CMT Inc. would be pleased to review design drawings when they become available and provide further recommendations with respect to bearing and foundation elevations.

5.2. ***Seismic Site Classification***

The site classification for seismic response in Table 4.1.8.4 of the 2012 Ontario Building Code relates to the average properties of the upper 30 m of strata. The information obtained in the geotechnical field investigation was gathered from the upper 2.5 m of strata. Based on the information gathered in the geotechnical field investigation, the site classification for seismic site response would be considered Site Class D (stiff soils) for structures founded on the native soils at the recommended founding elevations provided in Section 5.1 of this report. The structural engineer responsible for the design of the structure should review the earthquake loads and effects.

5.3. ***Soil Design Parameters***

The following table provides the estimated soil design parameters for imported granular fill, as well as the existing native soils encountered on-site. It should be noted that earth pressure coefficients (Ka, Kp, Ko) provided are for flat ground surface conditions and will differ for areas with slopes or embankments.

The estimated soil design parameters can be utilized for the design of perimeter shoring, foundations and retaining walls, as required:

Soil Type	Soil Density (kg/m^3)	Friction Angle (Degree)	Coefficient of Active Pressure (K_a)	Coefficient of Passive Pressure (K_p)	Coefficient of At-Rest Pressure (K_o)	Coefficient of Friction (μ)
Imported Granular 'A'/ Granular 'B' (OPSS 1010)	2,100	34 °	0.28	3.54	0.44	0.45
Sandy Silt	1800	30 °	0.33	3.00	0.50	0.38
Sand	1,850	33 °	0.29	3.39	0.46	0.43
Sand and Gravel	1,950	34 °	0.28	3.54	0.44	0.45

5.4. *Site Preparation*

The site preparation for the proposed subdivision is anticipated to include topsoil stripping, vegetation grubbing, the removal or relocation of any existing services (field tiles), the subexcavation of all unsuitable native soils deemed not capable of supporting the design bearing capacity, followed by the placement of structural fill (as required) and site grading to achieve proposed grades.

5.4.1. *Topsoil Stripping and Vegetation Removal*

All topsoil, vegetation, and trees (including tree root structures as well as any loose soils that are typically associated with root structures) must be removed from within the proposed houses, roadways, and driveway envelopes to expose approved competent subgrade soils. The topsoil may be used in landscaped areas where some settlement can be tolerated; otherwise it should be properly disposed of off-site.

The volume of topsoil removed during the stripping process is also relative to the equipment utilized for the stripping process as well as the moisture conditions at the time of stripping. If an excavator with a smooth bucket is utilized for stripping, there would generally be less potential for topsoil to become intermixed with the underlying relatively loose subsoil and therefore less concern of over-excavation to remove all topsoil. If the topsoil is stripped with wheeled equipment or bulldozers, then there is an increased potential for the topsoil and subsoil to become intermixed, subsequently requiring additional excavation to remove all topsoil. This is further influenced by rutting which can occur during wet conditions.

5.4.2. Unsuitable Soil Removal

All organic, deleterious or loose soils would be considered unsuitable to support structural fill, footings, slab-on-grades (including expansive sidewalk areas), driveways and roadways. Therefore, it is recommended that this material be subexcavated from these areas. It would be prudent to have qualified geotechnical personnel on-site during the site grading process in order to confirm the suitability of the soils for reuse.

5.4.3. Removal/Relocation of Existing Services

Any existing/abandoned underground services (including field tiles) that may be located within the proposed building envelopes and/or roadway and driveway areas should be removed/relocated. It is understood that the existing field is tiled for agricultural use. As such, the field tiles should be removed from the construction area. If left in place, the location of existing services must be reviewed to ensure that they do not conflict with the proposed foundation locations. All terminated pipes must be completely sealed with watertight mechanical covers, concrete or grout at termination points to prevent the migration of soils into pipe voids which can result in potential settlement. All existing trench backfill material associated with any underground services must be subexcavated and the subsequent excavation should be backfilled with approved soils placed in accordance with Section 5.4.4 of this report.

All existing backfill and any disturbed soils associated with the removal of any potential existing septic systems and/or well components must be subexcavated and the subsequent excavation must be backfilled with approved soils placed in accordance with Section 5.4.4 of this report.

5.4.4. Site Grading

All topsoil and any native soils considered unsuitable for supporting structural fill or building foundations must be removed from the building envelopes. Following the removal of these soils, the exposed subgrade should be proof-rolled and any soft or unstable areas must be subexcavated and replaced with approved fill materials. Qualified geotechnical personnel should inspect and approve the prepared subgrade soils prior to beginning placement of the structural fill. It should be feasible to reuse any non-organic subexcavated soils as structural fill, provided that the materials are at a suitable moisture content for compaction. All materials that will be used as structural fill must be submitted for a standard Proctor test in order to determine the maximum dry density and optimum moisture content. All fill materials required should be placed according to the following procedures:

- Prior to placement of any structural fill, the subgrade for any proposed structures must be prepared large enough to accommodate a 1:1 slope commencing a distance of 1.0 m beyond the outside edge of the proposed foundations down to the competent native founding soils;

- Soils approved for use as structural fill must be placed in loose lifts not exceeding 0.2 m (8") in depth for silts and clays, 0.3 m (12") in depth for granular soils (recommended fill material) or the capacity of the compactor (whichever is less);

- Fine-grained silt and clay soils must be compacted utilizing adequate heavy padfoot vibratory compaction equipment;

- Granular fill materials can be compacted utilizing adequate heavy vibratory smooth drum or padfoot compaction equipment;

- Approved fill materials must be at suitable moisture contents to achieve the specified compaction;

- Approved structural fill materials that will support structures must be compacted to 100% standard Proctor maximum dry density (SPMDD);

- Approved bulk fill (foundation wall backfill, bulk fill under slab-on-grades that will not support footings or heavy point loading) must be compacted to a minimum 95% SPMDD.

It should be noted that some of the native soils encountered in the test pits were in a wet to saturated state and may require significant air-drying if these soils are to be used as structural fill. As such, it would be recommended that site grading activities be conducted during the typically drier summer months and/or drier imported materials may be required. It should be noted, however, that due to the nature of some of the soils, during hot dry weather, the addition of water might be required in order to achieve the specified compaction. Reuse of excavated soils on-site will be subject to approval from qualified geotechnical personnel.

5.5. Foundation Subgrade Preparation

The native sandy silt encountered in the test pits are sensitive to change in moisture content and can become loose/soft if the subjected to additional water or precipitation as well as severe drying conditions. The native subgrade soils could also be easily disturbed if traveled on during construction. Once they become disturbed, they are no longer considered adequate for the support of shallow foundations.

To ensure and protect the integrity of the founding soils during construction operations, the following is recommended:

- During construction, the subgrade should be sloped to a sump (as required) located outside the building footprint (if feasible) in the excavation to promote surface drainage of rainwater or seepage and the collected water should be pumped out of the excavation. It is critical that all water be controlled (not allowed to pond) and that the subgrade and foundation preparation commence in dry conditions;

- Construction equipment travel and foot traffic on the founding soils should be minimized;

- If construction is to be undertaken during subzero weather conditions, the founding native soils and any potential fill materials must be maintained above freezing;

- Prior to pouring concrete for the footings, the footing area must be cleaned of all disturbed or caved materials;

- The foundation formwork and concrete should be installed as soon as practical following the excavation, inspection and approval of the founding soils. The longer that the excavated soils remains open to weather conditions and groundwater seepage, the greater the potential for construction problems to occur;

- If it is expected that the founding soils will be left open to exposure for an extended period of time, it is recommended that a 75 mm concrete mud slab be placed in order to protect the structural integrity of the founding soils.

5.6. Slab-on-Grade/Modulus of Subgrade Reaction

Prior to the placement of the granular base for the slab-on-grade construction, the subgrade should be proof-rolled. Any soft or weak zones should be subexcavated and backfilled with approved fill materials (see Section 5.10 of this report).

The following table provides the estimated modulus of subgrade reaction (k) for the native soils encountered on-site:

Soil Type	Modulus of Subgrade Reaction (k)
Sandy Silt	40,700 kN/m^3 (150 lb/in^3)
Imported Sand and Gravel (OPSS 1010)	81,000 kN/m^3 (300 lb/in^3)

Floor slabs can be founded on a minimum thickness of 150 mm (6") of coarse, clean granular material containing not more than 10% of material that will pass a 4 mm sieve in accordance with the current OBC. The use of 19 mm clear crushed stone (OPSS 1004) assists in creating a moisture barrier by reducing/preventing capillary rise of moisture from the subgrade. Compactive effort is required to consolidate the clear stone. The 19 mm clear crushed stone should meet the physical property and gradation requirements of OPSS 1004.

It is recommended that areas of extensive exterior slab-on-grade (sidewalks, accessibility ramps and exterior stairs) be constructed with a Granular 'B' subbase (300 mm) and a Granular 'A' base (150 mm), as well as incorporating subdrains, to provide rapid drainage and reduce the effects of frost heaving. This is particularly critical at all barrier-free access points and areas with outswinging doors. Alternatively, a structural frost slab or thermal insulation could be designed and constructed at door entrances.

5.7. Excavations

All excavations must be carried out in accordance with Ontario Regulation 213/91 (Reg 213/91) of the Occupational Health and Safety Act and Regulations for Construction Projects.

Type 3 Soils - In general, the sandy silt, sand, and sand and gravel soils encountered in the test pits as well as any fill soils, in a drained state (not wet or saturated), would be classified as Type 3 soils under Reg 213/91. The Type 3 soils must be sloped from the bottom of the excavation at a minimum gradient of 1 horizontal to 1 vertical. All saturated soils encountered must be treated as Type 4 soils, as described below.

Type 4 Soils - In general, any wet to saturated soils would be classified as Type 4 soils under Reg 213/91. Type 4 soils must be sloped from the bottom of the excavation at a minimum gradient of 3 horizontal to 1 vertical.

If it is not practical to excavate according to the above requirements, then a trench support system (designed in accordance with the Ontario Health and Safety Act Regulations) may be utilized. When using a temporary trench support system consisting of trench boxes to reduce the lateral extent of the excavations, it should be noted that the support system is intended primarily to protect workers as opposed to controlling lateral soil movement. Any voids between the excavation walls and the support system should be immediately filled to reduce the potential for loss of ground and to provide support to existing adjacent utilities and structures, and it is recommended that the excavation be carried out in short sections, with the support system installed immediately upon excavation completion. If the excavation is not a trench, no worker should be required to be closer to a wall of the excavation than the height of the excavated wall.

The wet to saturated soil conditions encountered in the test pits as well as any groundwater, particularly perched water, encountered could make excavations difficult. It should be expected that caving or sloughing of the excavation walls will occur when advancing into wet to saturated soils.

5.8. ***Construction Dewatering Considerations***

Accumulated groundwater or seepage was not observed in any of the test pits; however, wet to saturated soils were encountered. It should be noted that groundwater conditions (particularly perched water) are generally dependent on the amount of precipitation, control of surface water, as well as the time of year, and can fluctuate significantly in elevation and volume. As such, provisions for site dewatering should be part of the site development and construction process.

Seepage control requirements during construction will depend upon the area of work on the site, the depth of the excavations, the time of year, the amount of precipitation and the control of surface water. As required, seepage should generally be adequately controlled using conventional construction dewatering techniques such as pumping from sump pits. However, if heavy seepage occurs, it may be necessary to increase the number of pumps during construction.

Dewatering should be performed in accordance with OPSS 517 and the control of water must be in accordance with OPSS 518. It is the responsibility of the contractor to propose a suitable dewatering system based on the groundwater elevation at the time of construction. Collected water should discharge a sufficient distance away from the excavation to prevent re-entry. Sediment control measures must be installed at the discharge point of the dewatering system to avoid any potential adverse impacts on the environment.

5.9. ***Service Pipe Bedding***

The native soils encountered in the geotechnical investigation are generally considered suitable for indirect support of the site service pipes. Should instability due to saturated soil conditions be encountered, it may be necessary to increase the thickness of the granular base and utilize 19 mm clear stone to create an adequate supporting base for the service pipes and/or manholes. Pipe embedment, cover and backfill for both flexible and rigid pipes should be in accordance with all current and applicable OPSD, OPSS and OBC standards and guidelines and as follows:

Flexible Pipes - The pipe bedding should be shaped to receive the bottom of the pipe. If necessary, pipe culvert frost treatment should be undertaken in accordance with OPSD-803.031. The trench excavations should be symmetrical with respect to the centreline of the pipe. The granular material placed under the haunches of the pipe must be compacted to 95% SPMDD prior to the continued placement and compaction of the embedment material. The homogeneous granular material used for embedment should be placed and compacted uniformly around the pipe. Should wet conditions be encountered at the base of the trench, then the pipe bedding should consist of 19 mm clear stone (meeting OPS Specifications) wrapped completely in a geotextile fabric such as Terrafix 270 or equivalent.

Rigid Pipes - In general, the pipe installation recommendations for rigid pipes are the same as those for flexible pipes, except that the minimum bedding depth below a rigid pipe should be $0.15D$ (where D is the pipe diameter). In no case should this dimension be less than 150 mm or greater than 300 mm.

Any service pipes that are not provided with sufficient frost coverage must be protected with the necessary equivalent thermal insulation. The general contractor is responsible to protect service piping from damage by heavy equipment.

5.10. Perimeter Building Drainage, Foundation Wall Backfill and Trench Backfill

In order to assist in maintaining a dry building with respect to surface water seepage, it is recommended that exterior grades around the buildings be sloped down and away at a 2% gradient or more, for a distance of at least 1.5 m to 2.0 m (depending on side yard setbacks). Any surface discharge rainwater leaders must be constructed with solid piping that discharges with positive drainage at least 1.5 m away from the building foundations and/or beyond sidewalks to a drainage swale or appropriate storm drainage system.

The founding elevations for the proposed structures were not available at the time of preparation of this report. CMT Inc. can provide further recommendations for building drainage once the design drawings are completed and the founding elevations have been confirmed.

It should be noted that based on information obtained from the test pits, there is potential for perched water conditions to be encountered. Foundation wall and slab-on-grade dampproofing and/or waterproofing must conform to current OBC regulations. If required, it would be recommended that a waterproofing supplier/specialist be consulted to recommend an appropriate product and installation requirements that would be suited to this site. It is recommended that a good quality sump pump be utilized, and that the system be equipped with a battery backup in the event of power failure, (keeping in mind that a battery backup system does not typically have a long run time).

If it is expected that the new residences will have basements and as such an exterior perimeter drainage system comprising perforated drainage pipe with a factory installed filter sock, bedded in 19 mm clear crushed stone (OPSS 1004) and wrapped in a geotextile filter fabric such as Terrafix 270R (or equivalent) must be installed at an elevation that is below the proposed slab-on-grade elevation and provided with positive drainage into a sump pit. The portion of the piping that connects the exterior drainage tile system into the sump pit must comprise solid piping to prevent exterior water from being introduced into the interior subslab stone. It may be prudent to install perforated drainage pipe on the interior as well to provide an outlet for any water that may collect in the subslab stone (particularly during the construction phase of the project). It is also recommended that a capped cleanout port(s) be extended up to the ground surface elevation to provide future access (if required). The rainwater leaders must not be connected to the perimeter drainage system.

Depending on the groundwater conditions at the design founding elevations, it may be necessary to install a granular drainage layer to provide a suitable base for the foundations. This will depend on the bearing capacity required for the founding strata. If required, the granular drainage layer must conform to the requirements listed in Section 9.14.4 of the OBC 2012.

In order to reduce the effects of surficial frost heave in areas that will be hard surfaced, it is recommended that the exterior foundation backfill consist of free-draining granular material such as approved on-site sand or sand and gravel or imported Granular 'B' Type I or Type III (OPSS 1010), with a maximum aggregate size not exceeding 100 mm, and that it extend a minimum lateral distance of 600 mm out from the foundation walls and/or beyond perimeter sidewalks and entranceway slabs. It is critical that particles greater than 100 mm in diameter are not in contact with the foundation wall to prevent point loading and overstressing. The backfill material used against the foundation walls must be placed so that the allowable lateral capacities of the foundation walls are not exceeded. Where only one side of a foundation wall will be backfilled, and the height of the wall is such that lateral support is required, or where the concrete strength has not been achieved, the wall must be braced or laterally supported prior to backfilling. In situations where both sides of the wall are backfilled, the backfill should be placed in equal lifts, not exceeding 200 mm differential on each side during backfill operations and the backfill should be compacted to a minimum of 100% SPMDD.

The native mineral soils, as well as approved fill materials (non-organic) are generally considered suitable for reuse as trench backfill and bulk fill in the driveways; however, any wet soils encountered may require air-drying in order to achieve the specified compaction. Air-drying cannot typically be achieved during winter construction; therefore, depending on the time of year that construction takes place, it may be more feasible to utilize an imported granular fill for this project.

Backfilling operations should be carried out with the following minimum requirements:

- Adequate heavy smooth drum or padfoot vibratory compaction equipment should be used for the compaction and to break down any large blocky pieces of soil;
- Loose lift thicknesses should not exceed 0.3 m (12") for granular soils or 0.2 m (8") for silt soils or the capacity of the compactor (whichever is less);
- The soils must be at suitable moisture contents to achieve compaction to a minimum 95% SPMDD in non-structural bulk fill areas. Service trenches excavated within the zone of influence of footings for structures must be compacted to a minimum of 100% SPMDD;
- It is recommended that inspection and testing be carried out during construction to confirm backfill quality, thickness and to ensure that compaction requirements are achieved;
- Service trench backfill materials may consist of approved excavated soils with no particles greater than 100 mm and no topsoil or other deleterious materials;
- If construction operations are undertaken in the winter, strict consideration should be given to the condition of the backfill material to make certain that frozen material is not used.

5.11. ***Pavement Design/Drainage***

All existing topsoil, vegetation (including tree root structures as well as any loose soils that are typically associated with root structures), fill, and any soils containing organics or other deleterious material, must be stripped/subexcavated from within the roads, driveways and parking areas. It is recommended to either subexcavate any existing loose subgrade materials or provide further consolidation with vibratory compaction equipment in order to prepare a proper, stable subgrade.. Review of the subgrade and potential changes to the design of the pavement structure, as required, will be addressed at the time of construction.

Prior to placement of the new granular base materials, the subgrade must be proof-rolled, and any soft or unstable areas should be subexcavated and replaced with suitable drier materials. The subgrade should be graded smooth (free of depressions) and properly crowned to ensure positive drainage, with a minimum grade of 3% toward the drainage outlet or curb line. When service pipes are installed, pipe bedding and backfilling should be undertaken as indicated in Sections 5.9 and 5.10 of this report.

Rapid drainage of the pavement structure is critical to ensure long-term performance and to help minimize frost heave. The requirement for subdrains will be dependent on the composition of the prepared roadway subgrade soils. Should the subgrade soils comprise fine-grained, frost-susceptible soils (such as the native sandy silt), then it is recommended to install subdrains, provided gravity drainage to a suitable outlet can be provided. It is recommended to install minimum 100 mm diameter perforated subdrains to collect and redirect water beneath the pavement surface. Subdrains should be designed and installed in accordance with OPSS 405 and OPSD 216.021. If Granular 'A' bedding (OPSS 1010) is utilized, the subdrains should be equipped with a factory installed filter sock. If 19 mm clear stone (OPSS 1004) is utilized as bedding for the subdrain, then the bedding must be wrapped completely with geotextile filter fabric such as Terrafix 270R (or equivalent) and a factory installed filter sock is not required. Installation of rigid subdrains allows for better grade control and less potential for damage during installation. Positive drainage through grade control of subdrains is critical, as improperly installed subdrains can turn drainage systems into reservoirs, which can fuel frost action. The subdrains will hasten the removal of water, thereby reducing the risk and effects of frost heaving and load transfer in saturated conditions. The subdrains should be installed in a 0.3 m (1.0 ft) by 0.3 m (1.0 ft) trench in the subgrade and bedded approximately 50 mm (2") above the bottom of the trench. The subgrade must be prepared with positive drainage to the subdrains and the subdrains must be installed with positive drainage into a catch basin structure or other suitable outlet.

Should the subgrade comprise free-draining granular soils (minimum 1.0 m thick with positive drainage at the interface with any less permeable soils), then the installation of subdrains may not be required.

The native subgrade soils are sensitive to change in moisture content and can become loose or soft if the soils are subject to inclement weather and seepage or severe drying. Furthermore, the subgrade soils could be easily disturbed if traveled on during construction. As such, where this material will be exposed, it is recommended that the granular subbase be placed immediately upon completion of the subgrade preparation to protect the integrity of the subgrade soils.

It is anticipated that the roadways will be subject to mostly light traffic (personal vehicles) as well as some heavy traffic (delivery trucks, maintenance and emergency vehicles). Based on the frost-susceptibility of the existing soils and the anticipated loading, the following pavement design is provided:

Material	**Recommended Thickness For New Pavement**
Asphaltic Concrete	HL3 - 40 mm (1.5") HL4 or HL8 - 50 mm (2.0")
Granular 'A' Base (OPSS 1010)	150 mm (6.0")
Granular 'B' Subbase (OPSS 1010)	450 mm (18.0")

Should wet to saturated conditions be encountered during construction, site assessments may be required at the time of construction to determine what options can be undertaken to construct a stable roadway base. These options may include subexcavation and increasing the thickness of the Granular 'B' subbase, the use of geotextile and/or geogrid, or a combination of all.

The granular base and subbase materials must conform to the physical property and gradation requirements of OPSS 1010 and must be compacted to 100% SPMDD. Asphaltic concrete should be supplied, placed and compacted to a minimum 92.0% Marshall maximum relative density, in accordance with OPSS 1150 and OPSS 310.

Construction joints in the surface asphalt must be offset a minimum of 150 mm to 300 mm (6" to 12") from construction joints in the binder asphalt so that longitudinal joints do not coincide.

Where new asphalt is joined into existing asphalt, it is recommended that the existing asphalt be sawcut in a straight line prior to being milled to a depth of 40 mm and a width of 150 mm as per OPSD 509.010. It is recommended that a tackcoat in conformance with OPSS 308 be applied to the edge and surface of all milled asphalt prior to placement of new asphalt.

The pavement should be designed to ensure that water will not pond on the pavement surface. If the surface asphalt is not placed within a reasonable time following placement of the binder asphalt, it is recommended that the catch basin lids are set at a lower elevation or apertures provided to allow surface water to drain into the catch basins and not accumulate around the catch basins.

It should be noted that, currently, asphalt mixes tend to be more flexible and, as such, there is a tendency for damage to occur from vehicles turning their steering wheels or applying excessive brake pressure. The damage can occur from both passenger vehicles as well as large vehicles. The condition is further intensified during hot weather. In high traffic/tight turning areas, it is recommended that rigid Portland cement pavement be considered.

It is understood that it is standard construction practice for residential developments to not place the surface course asphalt until the construction of the houses is completed, however this would not be recommended. Pavement structures are designed to act as a unit, and leaving out the surface course asphalt reduces the pavement structure capabilities at a time when the roadways typically see the highest loading they will ever see due to concrete trucks, tri-axle dump trucks and excavation equipment moving throughout the subdivision. It would be recommended to install the full pavement structure prior to construction of the houses or place a sacrificial surface course of asphalt.

5.12. Stormwater Management Pond

It is understood that a stormwater management pond is proposed for this site in order to manage the excess runoff that will result from the development of the land. The proposed bottom of the stormwater management pond is to have an elevation of about 381.40 m. Based on the test pit information from Test Pit 5 (located near the proposed pond), it should be expected that the soils at the proposed bottom elevation would be considered hydraulically secure and that minimal infiltration is to be expected. Moist to wet soils were observed below an approximate elevation of 379.64 m in Test Pit 5.

5.13. Excess Soil Management

5.13.1. Chemical Testing was NOT Undertaken

Generally, if surplus soils are to be exported off-site, it will be necessary to perform chemical analysis of the soils. Chemical analysis was not undertaken as part of this geotechnical investigation. Should chemical analysis tests be required, the required tests vary and will be dependent on the disposal site utilized by the general contractor.

Most commonly, the soils are tested for the following:

- F1-F4, VOC's, BTEX as per O. Reg. 153/04 as amended by R511
- SVOC as per O. Reg. 153/04 as amended by R511
- Metals/Inorganics as per O. Reg. 153/04 amended by R511

The chemical analysis results are then compared to Ontario Regulation 153/04 - as amended by O.Reg. 511 – April 15, 2011 Standards = [Suite] – ON-511-T1/T2-SOIL-RPI.

5.13.2. TCLP Requirement

If soils are transported to a landfill facility, additional chemical testing in accordance with Ontario Regulation 347, Schedule 4, as amended to Ontario Regulation 558/00, dated March 2001, Toxicity Characteristic Leaching Procedure (TCLP) will be required.

When transporting soils off-site, the following is recommended:

- All chemical analyses and environmental assessment reports must be fully disclosed to the receiving site owners/authorities, whom must agree to receive the material;

- An environmental consultant must confirm the land use at the receiving site is compatible to receive the material;
- An environmental consultant must monitor the transportation and placement of the materials to ensure that the material is placed appropriately at the pre-approved site;
- The excess materials may not be transported to a site that has previously had a Record of Site Condition (RSC) filed, unless the material meets the criteria outlined in the RSC.

It should be noted that landfill sites will generally only accept laboratory test results that have been completed within 30 days of exporting. Therefore, it is recommended that provisions for chemical analysis be included in the tender documents. It should also be noted that the laboratory testing generally takes five (5) working days to process with a regular turnaround time.

5.14. Radon

According to information provided by Health Canada, radon is a radioactive gas that is naturally formed through the breakdown of uranium in soil, rock and water. When radon escapes the earth in the outdoors, it mixes with fresh air, resulting in concentrations that are too low to be of concern. However, when radon enters an enclosed space, such as a building, high concentration of radon can accumulate and become a health concern. Health Canada indicates that most buildings and homes have some level of radon in them. Unfortunately, it is not possible to predict before construction whether or not a new building will have high radon levels as radon can only be detected by radon measurement devices, which would be installed in a building, post-construction. Section 9.13.4.1 Soil Gas Control of the current 2012 Ontario Building Code (OBC) states that *"Where methane or radon gases are known to be a problem, construction shall comply with the requirements for soil gas control in MMAH Supplementary Standard SB-9, Requirements for Soil Gas Control"*.

6.0 SITE INSPECTIONS

Qualified geotechnical personnel should supervise excavation inspections as well as compaction testing for structural filling, site grading and site servicing. This will ensure that footings are founded in the proper strata and that proper material and techniques are used and the specified compaction is achieved. CMT Engineering Inc. would be pleased to review the design drawings and provide an inspection and testing program for the construction of the proposed development.

7.0 LIMITATIONS OF THE INVESTIGATION

The recommendations made in this report are in accordance with our present understanding of the project. We request that we be permitted to review our recommendations when the drawings and specifications are complete, or if the proposed construction should differ from that mentioned in this report.

It is important to emphasize that a soil investigation is, in fact, a random sampling of a site and the comments are based on the results obtained at the test locations only. It is therefore assumed that these results are representative of the subsoil conditions across the site. Should any conditions at the site be encountered which differ from those found at the test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations.

It should be noted that this report specifically addresses geotechnical aspects of the project and does not include any investigations or assessments relating to potential subsurface contamination. As such, there should be no assumptions or conclusions derived from this report with respect to potential soil or water contamination. Soil or water contamination is generally caused by the presence of xenobiotic (human-made) chemicals or other alteration processes in the natural soil and groundwater environment. If necessary, the investigation, assessment and rehabilitation of soil and water contaminants should be undertaken by qualified environmental specialists.

The samples obtained during the geotechnical investigation will be stored for a period of three months, after which time they will be disposed of unless alternative arrangements are made.

This report is intended solely for the client named. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the reliability of such third parties. The factual data, interpretation, and recommendations in this report pertain to a specific project as described in this report and are not applicable to any other project or site location. If the project is modified in concept, location or elevation, deviates from the assumptions stated herein, CMT Inc. should be given an opportunity to confirm that the recommendations are still valid. The subject geotechnical exploration and this report address only the geotechnical aspects of the proposed project; potential environmental impacts or related issues are beyond the defined scope of this work and have not been addressed.

We trust that this report meets with your present requirements. Should you have any questions, please do not hesitate to contact our office.

Prepared by:

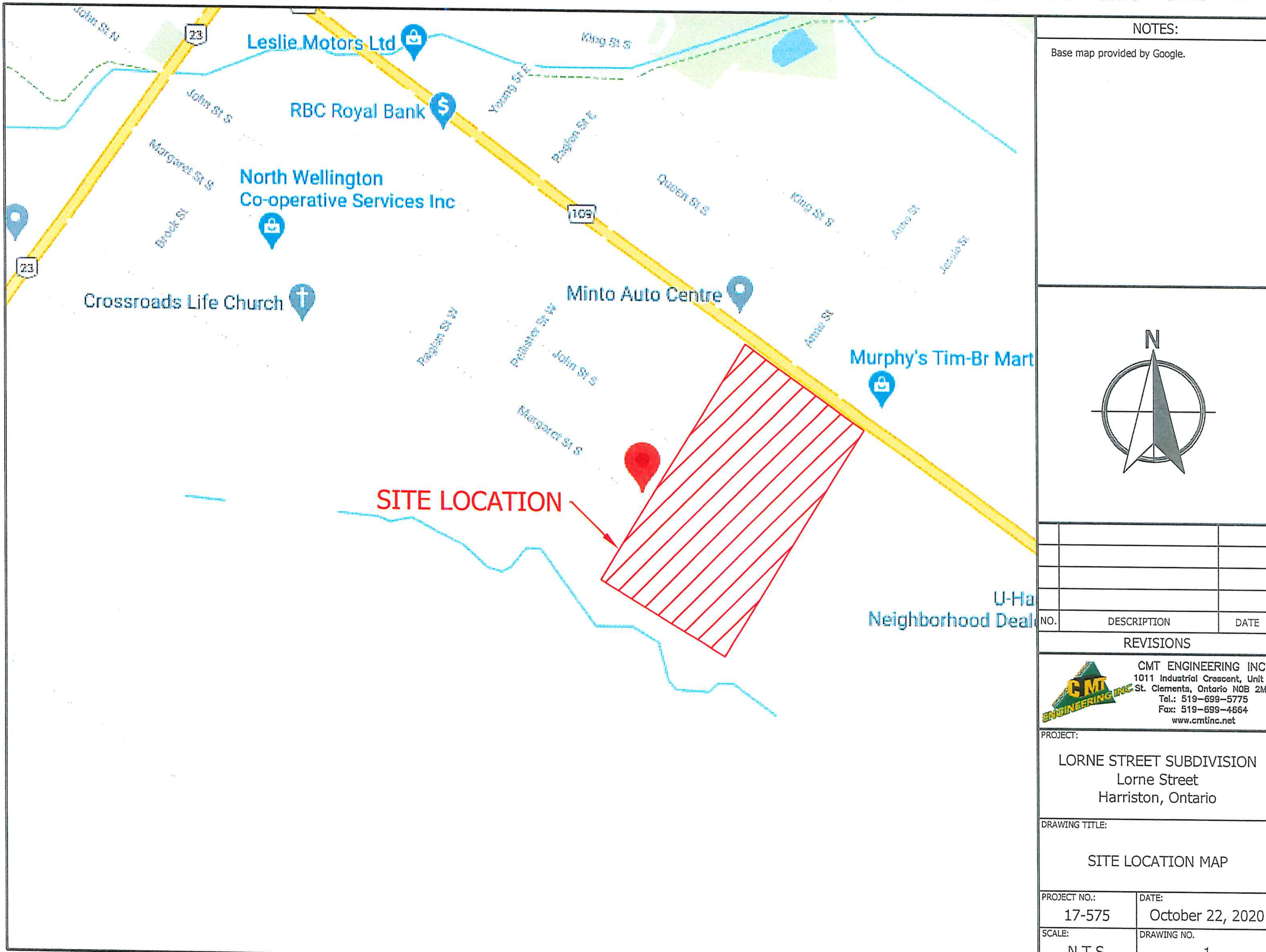
Jake Feeney, B.Eng., EIT

LICENSED PROFESSIONAL ENGINEER
2020/10/29
N. J. CHORTOS
100210851
PROVINCE OF ONTARIO

Reviewed by:

Nathan Chortos, P.Eng.
Senior Geotechnical Engineer

ks



NOTES:

Base map provided by Google.

NO.	DESCRIPTION	DATE

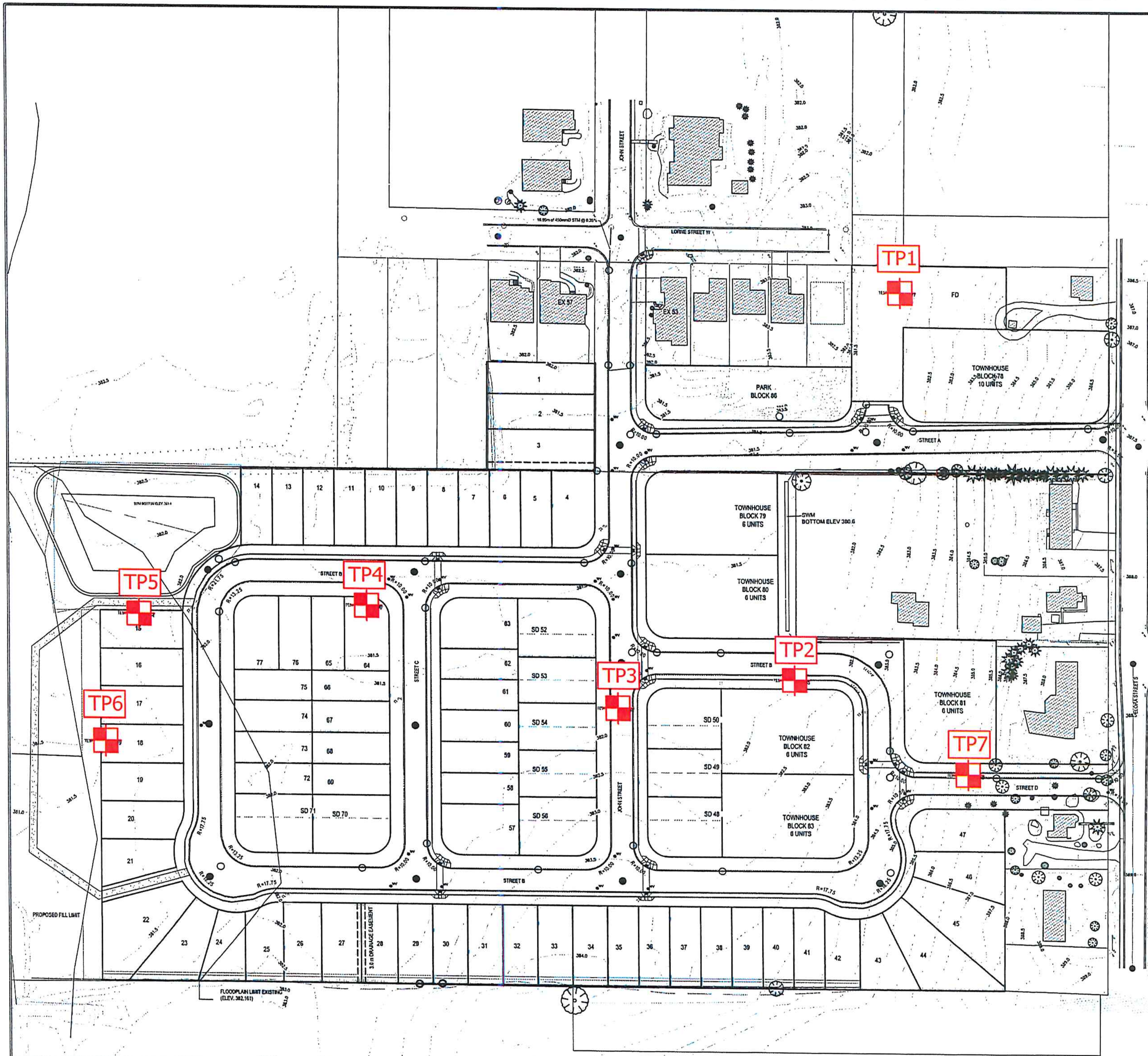
REVISIONS

CMT ENGINEERING INC.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario N0B 2M0
Tel.: 519-699-5775
Fax: 519-699-4664
www.cmtinc.net

PROJECT:
LORNE STREET SUBDIVISION
Lorne Street
Harriston, Ontario

DRAWING TITLE:
SITE LOCATION MAP

PROJECT NO.: 17-575
DATE: October 22, 2020
SCALE: N.T.S.
DRAWING NO. 1



NOTES:

Base map provided Moorefield Excavating

Legend

CMT Test Pit - 2020

NO.	DESCRIPTION	DATE
	REVISIONS	

CMT ENGINEERING INC.
1011 Industrial Crescent, Unit 1
St. Clements, Ontario N0B 2M0
Tel.: 519-699-5775
Fax: 519-699-4664
www.cmtinc.net

PROJECT:

LORNE STREET SUBDIVISION
Lorne Street
Harriston, Ontario

DRAWING TITLE:

AERIAL VIEW SHOWING TEST PIT LOCATIONS

PROJECT NO.:	DATE:
17-575	October 22, 2020
SCALE:	DRAWING NO.
N.T.S.	2

APPENDIX A

TEST PIT LOGS

CMT Engineering Inc.
1011 Industrial Crescent
St. Clements, Ontario, N0B 2M0
Telephone: 519-699-5775
Fax: 519-699-4664

TEST PIT NUMBER TP1

PROJECT: Lorne Street Subdivision
PROJECT ADDRESS: Lorne Street
PROJECT LOCATION: Harriston, Ontario
PROJECT NUMBER: 17-575
EXCAVATION DATE: 20-10-14
EXCAVATION CONTRACTOR: N/A
EXCAVATION EQUIPMENT: Excavator
GROUND ELEVATION: 381.41 m
LOGGED BY: J. Feeney
SAMPLING METHOD: GS

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	POCKET PENETROMETER (kPa) 90 180 270 360 / MOISTURE CONTENT (%) 12 24 36 48
		Sandy Silt: Loose, brown sandy silt, trace gravel and clay, wet	0.00, 381.41		
				GB 1	22
1		becoming compact	1.00, 380.41		
		becoming grey with some clay and gravel, moist	1.60, 379.81		
				GB 2	12.5
2					

Test pit walls caving throughout. No accumulated groundwater observed upon completion.
Bottom of test pit at 2.10 m, Elevation 379.31 m.

CMT Engineering Inc.
1011 Industrial Crescent
St. Clements, Ontario, N0B 2M0
Telephone: 519-699-5775
Fax: 519-699-4664

TEST PIT NUMBER TP2

PROJECT: Lorne Street Subdivision

PROJECT ADDRESS: Lorne Street

PROJECT LOCATION: Harriston, Ontario

PROJECT NUMBER: 17-575

EXCAVATION DATE: 20-10-14

EXCAVATION CONTRACTOR: N/A

EXCAVATION EQUIPMENT: Excavator

GROUND ELEVATION: 381.85 m

LOGGED BY: J. Feeney

SAMPLING METHOD: GS

DEPTH (m)	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	POCKET PENETROMETER (kPa) 90 / 180 / 270 / 360 — MOISTURE CONTENT (%) 12 / 24 / 36 / 48
	Topsoil: Loose, dark brown, silty, organic topsoil, moist (300 mm)	0.00, 381.85		
	Sandy Silt: Loose, brown sandy silt, trace gravel and clay, wet	0.30, 381.55	GB 1	17.4
1				
	Sand: Compact, brown sand, trace silt, saturated	1.10, 380.75		
	Sandy Gravelly Silt: Compact, brown sandy, gravelly silt, some clay, moist	1.40, 380.45	GB 2	12.8

Test pit walls caving throughout. No accumulated groundwater observed upon completion.

Bottom of test pit at 1.70 m, Elevation 380.15 m.

CMT Engineering Inc.
1011 Industrial Crescent
St. Clements, Ontario, N0B 2M0
Telephone: 519-699-5775
Fax: 519-699-4664

TEST PIT NUMBER TP3

PROJECT: Lorne Street Subdivision
PROJECT ADDRESS: Lorne Street
PROJECT LOCATION: Harriston, Ontario
PROJECT NUMBER: 17-575
EXCAVATION DATE: 20-10-14
EXCAVATION CONTRACTOR: N/A
EXCAVATION EQUIPMENT: Excavator
GROUND ELEVATION: 381.66 m
LOGGED BY: J. Feeney
SAMPLING METHOD: GS

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	POCKET PENETROMETER (kPa) 90 / 180 / 270 / 360; MOISTURE CONTENT (%) 12 / 24 / 36 / 48
		Topsoil: Loose, dark brown, silty, organic topsoil, moist (300 mm)	0.00, 381.66		
		Sandy Silt: Loose, mottled grey and brown sandy silt, trace gravel and clay, very moist	0.30, 381.36		
1		becoming compact	1.00, 380.66	GB 1	12.4
		Sand: Compact, brown sand, trace silt, saturated	1.60, 380.06		
2		**Sandy Silt:** Compact, grey sandy silt, some clay and gravel, moist	1.80, 379.86	GB 2	10.3

Test pit walls caving throughout. No accumulated groundwater observed upon completion.
Bottom of test pit at 2.00 m, Elevation 379.66 m.

CMT Engineering Inc.
1011 Industrial Crescent
St. Clements, Ontario, N0B 2M0
Telephone: 519-699-5775
Fax: 519-699-4664

TEST PIT NUMBER TP4

PROJECT: Lorne Street Subdivision
PROJECT ADDRESS: Lorne Street
PROJECT LOCATION: Harriston, Ontario
PROJECT NUMBER: 17-575
EXCAVATION DATE: 20-10-14
EXCAVATION CONTRACTOR: N/A
EXCAVATION EQUIPMENT: Excavator
GROUND ELEVATION: 381.30 m
LOGGED BY: J. Feeney
SAMPLING METHOD: GS

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)
		Sandy Silt: Compact, mottled brown and grey sandy silt, trace gravel and clay, moist to wet	0.00, 381.30	GB 1	12.2
1					
		Sand: Compact, brown sand, trace silt, saturated	1.50, 379.80		
		Sandy Silt: Compact, grey sandy silt, some clay, trace gravel, moist	1.80, 379.50	GB 2	11.8
2					

POCKET PENETROMETER (kPa): 90, 180, 270, 360
MOISTURE CONTENT (%): 12, 24, 36, 48

Test pit walls caving throughout. No accumulated groundwater observed upon completion.

Bottom of test pit at 2.10 m, Elevation 379.20 m.

CMT Engineering Inc.
1011 Industrial Crescent
St. Clements, Ontario, N0B 2M0
Telephone: 519-699-5775
Fax: 519-699-4664

TEST PIT NUMBER TP5

PROJECT: Lorne Street Subdivision
PROJECT ADDRESS: Lorne Street
PROJECT LOCATION: Harriston, Ontario
PROJECT NUMBER: 17-575
EXCAVATION DATE: 20-10-14
EXCAVATION CONTRACTOR: N/A
EXCAVATION EQUIPMENT: Excavator
GROUND ELEVATION: 381.44 m
LOGGED BY: J. Feeney
SAMPLING METHOD: GS

DEPTH (m)	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	MOISTURE CONTENT (%)
0	**Sandy Silt:** Compact, brown sandy silt, some clay, moist	0.00, 381.44		
1			GB 1	11.3
	becoming grey and gravelly, moist to wet	1.80, 379.64		
2			GB 2	10.2

POCKET PENETROMETER (kPa): 90, 180, 270, 360
MOISTURE CONTENT (%): 12, 24, 36, 48

Test pit walls caving throughout. No accumulated groundwater observed upon completion.
Bottom of test pit at 2.50 m, Elevation 378.94 m.

CMT Engineering Inc.
1011 Industrial Crescent
St. Clements, Ontario, N0B 2M0
Telephone: 519-699-5775
Fax: 519-699-4664

TEST PIT NUMBER TP6

PROJECT: Lorne Street Subdivision
PROJECT ADDRESS: Lorne Street
PROJECT LOCATION: Harriston, Ontario
PROJECT NUMBER: 17-575
EXCAVATION DATE: 20-10-14
EXCAVATION CONTRACTOR: N/A
EXCAVATION EQUIPMENT: Excavator
GROUND ELEVATION: 381.49 m
LOGGED BY: J. Feeney
SAMPLING METHOD: GS

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	POCKET PENETROMETER (kPa) 90 / 180 / 270 / 360; MOISTURE CONTENT (%) 12 / 24 / 36 / 48
		Topsoil: Loose, dark brown silty, organic topsoil, moist (300 mm)	0.00, 381.49		
		Sandy Silt: Compact, mottled brown sandy silt, some clay, wet	0.30, 381.19	GB 1	16.3
1					
		Sand and Gravel: Compact, grey sand and gravel, trace silt, saturated	1.20, 380.29		
		Gravelly Sandy Silt: Compact, grey gravelly sandy silt, some clay and gravel, moist to wet	1.70, 379.79		
2				GB 2	11.9

Test pit walls caving throughout. No accumulated groundwater observed upon completion.
Bottom of test pit at 2.20 m, Elevation 379.29 m.

TEST PIT NUMBER TP7

CMT Engineering Inc.
1011 Industrial Crescent
St. Clements, Ontario, N0B 2M0
Telephone: 519-699-5775
Fax: 519-699-4664

PROJECT: Lorne Street Subdivision

PROJECT ADDRESS: Lorne Street

PROJECT NUMBER: 17-575

PROJECT LOCATION: Harriston, Ontario

EXCAVATION DATE: 20-10-14

GROUND ELEVATION: 386.58 m

EXCAVATION CONTRACTOR: N/A

LOGGED BY: J. Feeney

EXCAVATION EQUIPMENT: Excavator

SAMPLING METHOD: GS

DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	Depth, Elevation (m)	SAMPLE TYPE NUMBER	POCKET PENETROMETER (kPa) 90 / 180 / 270 / 360; MOISTURE CONTENT (%) 12 / 24 / 36 / 48
		Topsoil: Loose, dark brown, silty, organic topsoil, moist (900 mm)	0.00, 386.58		
1		**Sandy Silt:** Compact, brown sandy silt, some clay and gravel, moist	0.90, 385.68		
				GB 1	10.7
2					

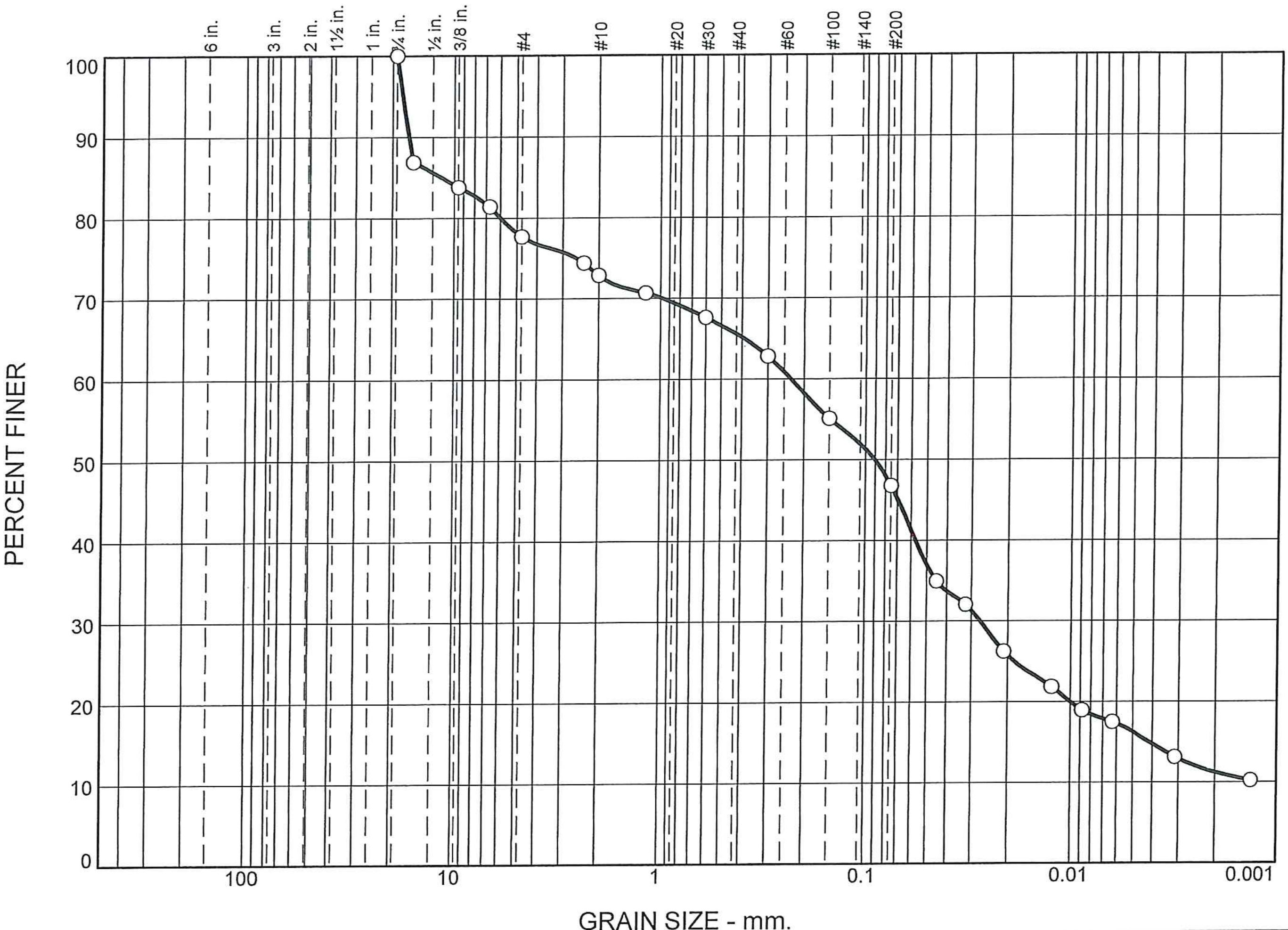
Test pit walls caving throughout. No accumulated groundwater observed upon completion.

Bottom of test pit at 2.40 m, Elevation 384.18 m.

APPENDIX B

GRAIN SIZE ANALYSES

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	22.3	4.8	7.3	18.8	35.6	11.2

SOIL DATA

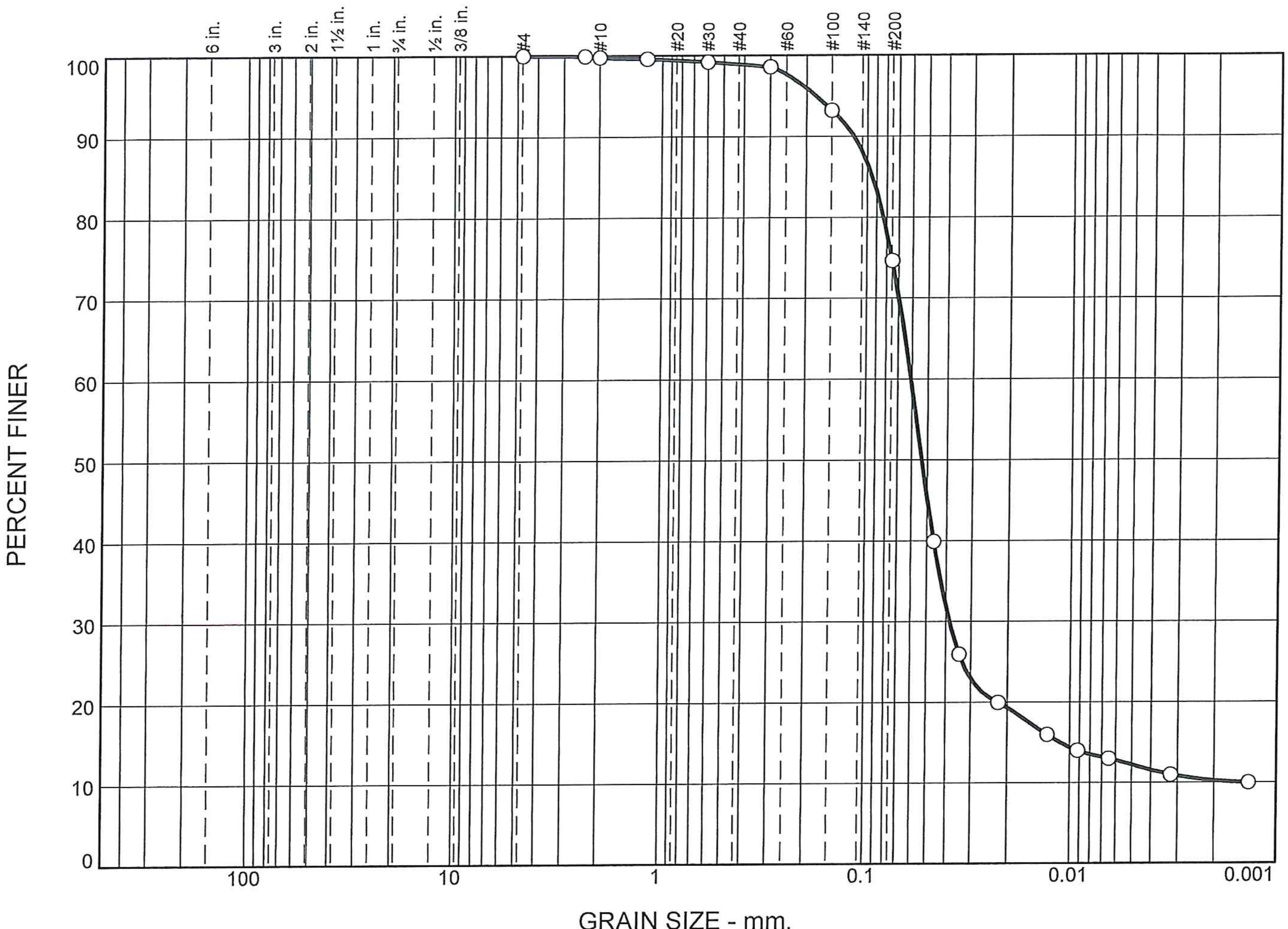
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	TP2	2	1.5m	sandy, gravelly silt, some clay	SM
				Sampled by JF of CMT Engineering Inc., October 14, 2020	
				Tested by MS of CMT Engineering Inc., October 15, 2020	

CMT Engineering Inc.

St. Clements, ON

Client: MEX Developments Inc.
Project: Lorne Street Subdivision
Harriston, Ontario
Project No.: 17-575 **Figure** 1

Particle Size Distribution Report



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.2	0.9	24.3	64.4	10.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	TP6	1	0.9m	sandy silt, some clay	ML
				Sampled by JF of CMT Engineering Inc., October 14, 2020	
				Tested by MS of CMT Engineering Inc., October 15, 2020	

CMT Engineering Inc.

St. Clements, ON

Client: MEX Developments Inc.
Project: Lorne Street Subdivision
Harriston, Ontario
Project No.: 17-575

Figure 2