Terraprobe
an **Englobe** Company
Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

HYDROGEOLOGICAL INVESTIGATION
GARITO BARBUTO TOR RESIDENTIAL SUBDIVISION
WEST OF FOURTH LINE AND SOUTH OF LOUIS ST LAURENT AVENUE
MILTON, ONTARIO

Prepared for:

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1.0 INTRODUCTION

Terraprobe Inc. (Terraprobe) was retained by Mattamy (Brownridge) Limited (Mattamy) c/o David Schaeffer Engineering Ltd. (DSEL) to conduct a hydrogeological investigation for a proposed development consisting of a residential subdivision located immediately south of Louis St Laurent Avenue and immediately west of Forth Line in the Town of Milton as indicated on the attached **Figure 1**. The site consists of an irregular shaped parcel of land covering an area of approximately 51.9 hectares (128.2 acres).

Currently the site consists of agricultural fields. Surrounding properties generally consist of agricultural fields and municipally serviced residential subdivisions. It is expected that privately serviced rural residential dwellings have either been connected to municipal servicing or have been demolished with development of the area with municipally serviced residential subdivisions. It is proposed to develop the site for use as a residential subdivision with detached residential lots, townhouses and medium density residential blocks, creek and woodlot bocks, storm water management and internal public roadways.

The purpose of the hydrogeological investigation was to assess shallow groundwater levels and groundwater quality in relation to the proposed underground servicing to provide for the estimation of groundwater dewatering rates and dewatering discharge locations required for short term construction dewatering. Dewatering requirements for the installation of a series of storm water management ponds were also assessed to facilitate the installation and compaction of the liner for the storm water management ponds. An assessment was completed to evaluate the potential for impacts to surrounding groundwater uses and natural features, and to provide recommendations regarding groundwater monitoring, mitigation, and contingency plans over the duration of active dewatering for the proposed construction at the site.

2.0 SCOPE OF WORK

The scope of work for the hydrogeologic investigation consisted of the following:

- Review of available background information. A review of available geotechnical and hydrogeologic information for the site was conducted including topographic mapping, geologic mapping, and results of the previous investigations competed Terraprobe and others for the site and surrounding vicinity.

- Completion of rising head permeability analyses. Rising head tests were completed within accessible representative monitoring wells installed at the site. Selected monitoring wells were completed within overburden deposits consisting of silty clay to clayey silt till to silty sand to sandy silt till. The results of hydraulic conductivity testing were used to assess the groundwater control requirements for the project.

- Completion of groundwater sampling. Groundwater sampling was completed at the site. Groundwater was sampled for general inorganics and metals to characterize groundwater quality and assess potential constraints on dewatering discharge locations.

- Assessment of groundwater control requirements. An assessment of the groundwater inflow rates and discharge volumes for underground servicing and storm water management ponds was completed. The information obtained from water level monitoring and the results of rising head tests was utilized to provide an assessment of the potential groundwater control requirements and the calculated radius of influence of dewatering works during construction. Recommendations and requirements with regards to permitting, and monitoring and mitigation plans were provided.

3.0 DESCRIPTION OF SITE CONDITIONS

3.1 Site Location and Description

The site is located within the Town of Milton, immediately west of Fourth Line and immediately south Louis St. Laurent Avenue. Current land use at the site consists of agricultural fields, woodlots, and a tributary to Omagh Creek crossing the central portion of the site. The site consists of an irregular parcel of land covering approximately 51.9 hectares (128.2 acres).

Land uses in the vicinity of the site consists of agricultural fields and properties either developed as, or proposed to be developed with, municipally serviced residential subdivisions. It is proposed to develop the site for a municipally serviced residential subdivision including detached residential lots, townhouses, and medium density residential, including creek and woodlot blocks, storm water management ponds and internal public roadways. The current proposed site development plan is provided in **Appendix D**.

3.2 Site Topography and Drainage

Topographical relief at the site slopes to the tributary of Omagh Creek centrally located across the site, with the Omagh Creek tributary sloping to the east toward Fourth Line. Based on topographic mapping, it is expected that a total grade change across the site is approximately 3.8 m. The local topographic high is present to the northern property limits of the site at an elevation of approximately 196.4 m (BH101), and the topographic low lies at an elevation of approximately 192.6 m to the central eastern property limit (BH110). Drainage is predominantly overland and will be directed to the tributary of Omagh Creek flowing east toward Sixteen Mile Creek, approximately 4.2 kilometers southeast of the site.

3.3 Site Geology and Hydrogeology

The site is situated in the physiographic region identified as the Peel Plain. Locally the area is overlain by glacial till soils consisting of sandy silt to clayey silt glacial till (Halton Till). The distribution of till across the area is regionally extensive extending from the Niagara Escarpment approximately 10 kilometers west of the site to areas north of Toronto. Underlying bedrock consists of shale bedrock of the Queenston Formation with the uppermost bedrock consisting of highly weathered shale. Drift thickness at the site ranges from approximately 5.5 to 9.0 m across the northern portion of the site.

Groundwater at the subject site will be influenced by topography and generally flows to the tributary of Omagh Creek. Groundwater levels within surficial glacial till across the site were observed to generally be within 0.3 to 1.8 m below the existing ground surface. Surficial layers of till locally act to limit lateral groundwater movement and infiltration to the underlying shale bedrock. The shale bedrock also generally provides low quantities of groundwater which is often mineralized (i.e., high iron, manganese, hardness, chloride).

3.4 Previous Subsurface Investigation

The results of the previous supplemental geotechnical investigation completed by Shad and Associates, dated June 17, 2022) have been reviewed as background information for the hydrogeologic investigation. This investigation involved completion of a series of 11 monitoring wells across the project area. Soil stratigraphy was observed to be uniform across the site.

Subsurface information used herein was obtained from the subsurface investigation completed as part of the above noted supplementary geotechnical investigation.

Geotechnical investigations at the site involved advancing a total of 14 boreholes (BH101 – BH114) which were completed to depths between 6.2 to 12.3 m (between elevations of 187.9 to 180.3 m) into weathered shale. Monitoring wells were installed at selected boreholes screened within overburden deposits at depths of approximately 6.1 m.

The subsurface conditions encountered at the site generally consisted of silty clay till overlying silty sand till followed by weathered shale. In areas soils directly overlying shale were described as the till-shale complex representing a transition from till to weathered shale. Borehole logs are attached in **Appendix A**. Borehole locations are indicated on the attached **Figure 2**. The following is a general description of the major stratigraphic units and groundwater conditions observed in the boreholes completed at the Site.

3.4.1 Topsoil

A topsoil layer was encountered at the ground surface at each borehole location.

3.4.2 Silty Clay to Clayey Silt Till

Underlying topsoil soils consisted of silty clay to clayey silt till. A disturbed layer of till was present immediately underlying topsoil which was disturbed due to the ongoing agricultural practices at the site. The thickness of the silty clay till layer varied across the site with thicknesses between 2.1 to 7.0 m below existing grades (elevations ranging from 191.0 to 187.6 m).

Standard Penetration Test results (N-values) obtained from the silty clay to clayey silt till ranged from 28 to 50 blows per 100 mm of penetration, indicating a very stiff to hard relative density.

3.4.3 Silty Sand to Sandy Silt Till

Silty sand to sandy silt till was encountered underlying silty clay to clayey silt till deposits or within deposits of silty clay to clayey silt till (boreholes BH102 and BH105) at all completed boreholes except for borehole BH114 which was completed within clayey silt to silty clay till. Silty sand to sandy silt till was encountered to depths ranging from 5.5 to 9.1 m below the existing ground surface (elevations between 189.9 and 182.5 masl). The thickness of silty sand to sandy silt till varied across the site from 1.2 to 6.8 m in thickness. The relative density of the silty sand to sandy silt till layer was observed to be very dense.

3.4.4 Till Shale Matrix to Weathered Shale

A till shale matrix to highly weathered shale was encountered underlying till within boreholes BH102, BH104, BH106 and BH110. The weathered shale elevation across the site varied from elevations of 189.9 m in the northwest of the site (BH104) to elevations of 182.7 m to the eastern extents of the site (BH 110). Weathered shale was encountered to the depth of completion for deeper boreholes, up to a depth of 12.3 m below grade (elevation of 180.3 m).

3.4.5 Groundwater Conditions

A series of monitoring wells were installed at the site by Shad and Associates within selected boreholes upon completion of drilling. Monitoring wells were constructed of PVC pipe with an interior diameter of 50 mm with a slotted well screen approximately 1.5 to 3.1 m in length generally screened within clayey silt to silty clay till and silty sand to sandy silt till. Monitoring wells were not screened within shale bedrock, or within the till-shale complex where encountered.

Groundwater measurements were obtained by Shad and Associates in June 2022, with additional groundwater elevations obtained by Terraprobe on February 16, 2023. In general, shallow groundwater was encountered between 0.3 m above grade to 1.8 m below the existing ground surface. Based on completed groundwater monitoring it is expected that seasonal variation in groundwater at the site will range from between 0.3 m to 1.8 m below the existing ground surface. A summary of measured water levels is provided in the following table:

Summary of Groundwater Measurements

Well Location	Ground Surface Elevation (masl)	Well Depth		Groundwater Measurements					
				03-Jun-22		10-Jun-22		16-Feb-23	
		mbgl	masl	mbgl	masl	mbgl	masl	mbgl	Masl
BH 101	196.4	7.7	188.7	2.7	193.7	3.0	193.4	1.8	194.6
BH 102	194.1	7.0	187.1	1.6	192.5	1.6	192.5	+0.3	194.4
BH 104	195.4	7.0	188.4	2.6	192.8	2.6	192.8	Not Found	
BH 106	193.8 193.9	7.7	186.2	1.5	192.4	1.6	192.3	0.4	193.5
BH 107	193.0	6.9	186.1	0.9	192.1	1.0	192.0	0.4	192.6
BH 108	194.9	9.3	185.6	2.0	192.9	2.1	192.8	Not Found	
BH 110	192.6	12.3	180.3	1.8	190.8	1.9	190.7	0.9	191.7
BH 111	194.6	10.0	184.6	1.9	192.7	2.0	192.6	Not Found	
BH 112	195.1	9.2	185.9	1.9	193.2	2.2	192.9	1.0	194.1
BH 113	194.9	9.4	185.5	1.9	193.0	2.1	192.8	Not Found	
BH 114	193.9	7.7	186.2	1.7	192.2	1.9	192.0	Not Found	

Groundwater elevations were plotted for measured water levels obtained on June 10, 2022, with elevations also noted from February 16, 2023. The groundwater flow direction at the site is expected towards the tributary of Omagh Creek to the central eastern property limit. Groundwater flow direction is indicated on the attached **Figure 3**. It is expected that the seasonal high groundwater elevation will be near surface as measured on February 16, 2023.

3.5 Aquifer Performance Tests

In-situ hydraulic conductivity testing was completed on February 16, 2023, for monitoring well installations BH102 and BH106. Both monitoring wells were screened within deposits of silty sand to sandy silt till. The testing involved the removal of water from the well (i.e., bail test) and the recovery of groundwater was observed over time. Water level data obtained from the in-situ testing was interpreted using the Brouwer and Rice analysis method. Methodology of the analysis of in-situ hydraulic conductivity is provided in the attached **Appendix B**.

The rates of hydraulic conductivity were estimated based on the relative density of soil strata, and the soil classification, or the results of in-situ hydraulic conductivity testing. Rates of hydraulic conductivity for the various soil types encountered at the site are summarized as follows:

- Silty Clay to Clayey Silt Till 1.0 x 10^{-8} m/s
- Silty Sand to Sandy Silt Till 2.6 x 10^{-7} m/s
- Weathered Shale 5.0 x 10^{-7} m/s

These values are considered representative of the soils encountered given the corresponding relative densities of these strata as discussed in Section 3.4 above.

Given that the site is underlain by silty clay to clayey silt till the site would be considered low permeability with slow rates of groundwater movement. Soils present across the site will limit the flow of groundwater both laterally and horizontally. Significant upwelling of groundwater is not expected due to extensive shallow deposits of silty clay to clayey silt till. The primary hydrogeological function of the site is to provide for limited groundwater recharge to the underlying bedrock. Areas of enhanced groundwater recharge were not noted at the site (i.e., depressions, ponded surface water).

3.6 Groundwater Quality

Groundwater quality samples were obtained from well BH106 and sampled for total metals, microbiology, and general inorganics. Groundwater was sampled following the completion of hydraulic conductivity testing using HDPE tubing with a Waterra foot valve. Groundwater samples were not filtered and were collected in laboratory supplied bottles appropriate for the completed analysis. All samples were stored on ice for transport to Agat Laboratories in Mississauga for analysis.

Water quality analysis results were compared with the Provincial Water Quality Objectives (PWQO) as discharge is likely to be directed overland for infiltration. Water quality sampling was completed to assess the background water quality conditions at the site prior to construction. Laboratory Certificates of Analysis are provided in **Appendix C**.

In summary exceedance above the PWQO were noted for total metals including boron, cobalt, , and vanadium. The above noted water quality exceedances are considered naturally occurring and are due to high sediment loads within the collected sample. Concentrations of total suspended solids (TSS) and turbidity were observed elevated within the collected sample. Metals will adhere to sediment particles resulting in high metals concentrations that would not be representative of groundwater quality.

It is expected that with proper sediment control, consisting of filter sacs on dewatering discharge, temporary sedimentation ponds, and filtered sump pits and discharge erosion control measures including silt fences and hay bales or rock check dams to prevent channelization of discharge would limit sediment loads within discharge groundwater, thereby reducing total metals within discharged groundwater.

4.0 DISCUSSION AND ANALYSIS

4.1 Summary of Hydrogeological Conditions

The results of the investigation completed by Terraprobe indicate the following hydrogeological characteristic and function for the Site:

1. The subsurface conditions encountered at the site generally consisted of silty clay till overlying silty sand till followed by weathered shale. In areas soils overlying shale were described as till-shale complex representing a transition from till to weathered shale.

2. Shallow groundwater was encountered between 0.3 m above ground surface to 1.8 m below ground surface. Based on completed groundwater monitoring it is expected that seasonal variation in groundwater at the site will range from between 1.0 to 2.0 m below grade.

3. Groundwater elevations were plotted for measured water levels obtained on June 3, 2022, and February 16, 2023. The groundwater flow direction at the site is expected toward the tributary of Omagh Creek centrally located across the site flowing to the eastern property limit.

4. Rising head tests were completed at BH102 and BH106, screened within silty sand to sandy silt till. Hydraulic conductivity was calculated at 2.6×10^{-7} m/s for sandy silt to silty sand till. The hydraulic conductivity of silty clay to clayey silt soils was estimated at 1.0×10^{-8} m/s.

5. Given that shallow soils across the site were observed to consist of silty clay to clayey silt till, it is expected that low permeable soils will limit the movement of infiltration and groundwater. It is expected that the site will provide for limited infiltration to the underlying shale bedrock. Areas of enhanced groundwater recharge were not noted at the site (i.e., depressions, ponded surface water).

6. Background groundwater quality samples were obtained from the site. Groundwater quality was compared to the PWQO, and exceedances were noted for total metals including boron, cobalt, iron, and vanadium. High metals concentrations in collected groundwater samples is due to high sediment loads within the collected sample. Groundwater analysis indicated elevated levels for total suspended solids and turbidity. It is expected that with sediment and erosion control measures in place groundwater would be suitable for discharge overland.

7. The site is proposed to be serviced with municipal sewer and water servicing. Private water supply wells are not expected within a 500 m radius of the site with surrounding lands consisting of municipally serviced residential subdivisions of lands proposed to be developed for residential subdivisions. Rural residential homes have either been connected to municipal supplies or have been demolished.

4.2 Proposed Development Plan

The proposed development plan is to develop the site for use as a residential subdivision consisting of detached residential dwellings, townhouse units, and medium density residential blocks, creek and woodlot blocks with associated buffers, storm water management ponds, and internal roadways. The site will be serviced with municipal water, storm, and sanitary servicing. It is anticipated that the deepest excavations at the site will be required for the installation of underground servicing. Servicing is proposed to be installed using open cut excavations utilizing trench boxes to maintain the stability of excavation walls where required.

Groundwater control is expected to be required for site servicing and installation of storm water management ponds. Given the low permeability soils present at the site groundwater control from a series of filtered sumps along the base of open excavations is anticipated. Sand seams within glacial till deposits have the potential to laterally convey groundwater. Sand seams were noted within till deposits but were not observed to be continuous across the site and are not expected to yield significant quantities of water given the dense relative density of till soils at depth.

Excavations for detached residential and townhouse blocks will be limited in extent and will be open for a short duration. Localized dewatering will be required for building foundations however, the volume of localized dewatering is not expected to require permitting (i.e., volumes not exceeding 50,000 L/day). Plans for the medium density residential blocks were not available at the time of reporting. It is recommended that architectural plans for medium density residential development at the site be reviewed to assess potential short term construction dewatering and long-term footing drainage volumes when available.

Excavations for the installation of storm water management ponds were also assessed for temporary construction dewatering. It is expected that the base of storm water management ponds will be completed below the shallow groundwater table. The base of storm water management ponds is expected to be compacted; native soils are expected to be of low permeability such that groundwater interaction from the base of these features will be limited.

4.3 Groundwater Control Requirements

4.3.1 Site Servicing

Servicing profiles along proposed roadways within the development were reviewed with respect to soil and groundwater profiles in comparison to the various servicing depths for proposed sanitary and storm sewers, including the proposed trunk sanitary sewer alignment along proposed Sreet B (Whitlock Avenue).

Dewatering estimates for site servicing were estimated using a trench dewatering model as illustrated within Powers et.al (2007). The dewatering calculations assumed the following parameters:

- The hydraulic conductivity of soils encountered within excavations required for servicing installation were assumed at the highest expected hydraulic conductivity expected to be encountered based on the proposed depth of servicing. Based on completed in-situ hydraulic conductivity testing the rate was calculated at 2.6×10^{-7} m/s.

- Soil conditions and unit thicknesses for each encountered soil formation was assumed from the completed geotechnical borehole in closest proximity to the proposed servicing excavation.

- Groundwater levels were based on the highest observed water levels measured within the monitoring well located in proximity to the proposed servicing alignment. Excavation depths were determined based on the deepest proposed servicing along each street profile and dewatering targets were set at approximately 1.0 m below the excavation depth.

- Construction staging for servicing installation was not known and will ultimately be determined by the contractor retained for servicing installation. For the purposes of estimating volumes of groundwater control for open excavations it was assumed that excavations would be completed in 100 m lengths. It should be noted that multiple sections could be open at a given time during construction.

- All servicing excavations are proposed to be completed as open cut excavations. The excavation area was assumed based on the proposed diameter of servicing to be installed including 1.0 m clearance from servicing to the excavation walls. It is assumed that open cut excavations will be utilized where feasible for excavations (i.e., trench boxes may be required in areas of localized sand seams).

A table showing assumed excavation details (depths and extents), soil and groundwater conditions and servicing details is provided in the attached **Appendix E** along with detailed dewatering calculations for servicing installation. Servicing profiles for the proposed development are provided in **Appendix D**.

Based on the above assumptions, groundwater control volumes for proposed servicing alignments are estimated upwards of 20,010 L/day (0.23 L/sec). It is expected that the highest construction dewatering volumes will be required for the installation of the sanitary sewer line along Street B (Whitlock Avenue) at approximately 6 to 9 m below existing grades).

Excavations are expected to be open for limited duration and have a limited area and as such runoff of precipitation to open excavations was not expected to significantly contribute to total dewatering volumes and was not considered in the completed servicing dewatering calculations.

4.3.2 Storm Water Management Ponds

A total of two storm water management ponds are proposed for the residential development. These ponds can be summarized as follows:

- *Pond S5b-3* –located to the southeast corner of the site, with the permanent pool covering an estimated area of approximately 11,623 m^2 and a base elevation of 188.9 m, and the forebay structure covering an area of approximately 4,960 m^2 with a base elevation of 190.4 m.

- *Pond S5b-4* - located immediately west of Fourth Line south of Craig Kielburger Secondary School. The permanent pool is proposed to cover an area of 8,120 m^2 with a base elevation of 189.7 m; and the forebay structure is proposed with an area of 1,800 m^2 with a base elevation of 191.2 m.

The anticipated construction and dewatering considerations and assumptions for each of the proposed storm water management ponds are summarized in the following table:

Summary of Dewatering Conditions – Storm Water Management Ponds

Pond ID	Area of Pond (m^2)	Perimeter of Pond (m)	Dewatering Target (mbgl)	Groundwater Level (mbgl)	Hydraulic Conductivity (m/s)
Pond S5b-3	18,380	981	4.3	0.8	1.0 x 10^{-8} (silty clay)
Forebay S5b-3	5,424	443	2.8	0.8	1.0 x 10^{-8} (silty clay)
Pond S5b-4	9,800	551	6.0	0	2.6 x 10^{-7} (silty sand)
Forebay S5b-4	2,426	200	4.5	0	2.6 x 10^{-7} (silty sand)

The estimated area and perimeter of storm water management ponds were determined from pond profiles included in **Appendix D**. The dewatering target was set at a level approximately 1.0 m below the proposed pond invert elevation, and rates of hydraulic conductivity were assumed at the rates determined in Section 3.5 above for soil types expected at the base of excavations for the various storm water ponds.

Based on the above assumptions the following rates of groundwater control are expected for the excavation and lining of the proposed storm water management ponds:

Pond S5b-3 (Permanent Pool)	2,800 L/day (0.03 L/sec)
Pond S5b-3 (Forebay)	800 L/day (0.01 L/sec)
Pond S5b-4 (Permanent Pool)	44,200 L/day (0.51 L/sec)
Pond S5b-4 (Forebay)	11,200 L/day (0.13 L/sec)

It should be noted that discharge of accumulated precipitation within storm water pond excavations should be discharged to overland flow or directed to storm water retention ponds installed in the beginning phases of the development. Discharge of accumulated precipitation runoff should not be discharged directly to surface water features including the tributary to Omagh Creek.

It is anticipated that short term dewatering for groundwater control, where required for storm water management ponds will be up to 44,200 L/day (0.51 L/sec). It should be noted that the dewatering assessment was completed utilizing seasonal high groundwater conditions from monitoring wells screened within overburden below the pond invert elevations. Actual dewatering for storm water management ponds is expected to be below the above conservative estimates.

It is anticipated that dewatering for storm water management ponds will not require permitting from the MECP. Dewatering is expected to be required for pond excavation and compaction of the base of ponds only and will be required for a limited duration. The transfer of accumulated precipitation runoff is not expected to impact underlying shallow groundwater. Any pumped precipitation runoff should be retained on site where possible to minimize potential storm surges to down-gradient water courses. A summary of dewatering calculations for the storm water management ponds is provided in the attached **Appendix E**.

4.3.3 Discharge of Pumped Groundwater

It is proposed that flows from the dewatering systems will be directed overland to temporary structures including, but not limited to diversion swales, infiltration ponds, overland flow through rock check dams to slow discharge flows and promote sheet flow for infiltration to the shallow subsurface. Sediment and erosion control measures will be required to be implemented by the contractor to ensure discharged groundwater is visually clear and free of sediment, sheen, and foam. Direct discharge to both the municipal sewer system and/or surface water (tributary of Omagh Creek) is not proposed.

The construction dewatering system must be appropriately filtered to prevent the pumping of fines and loss of ground during the dewatering activities. The groundwater quality sample collected indicated that groundwater from within overburden will have elevated total metals in the event sediment is transported with discharged groundwater as detailed in Section 3.6 above.

If dewatering discharge is directed overland to the tributary of Omagh Creek as opposed to storm water management ponds, temporary retention ponds or other methodology to allow for sediment retention in conjunction with groundwater quality analysis should be taken at the point of discharge would be required to confirm adequate quality for discharge to surface water. Groundwater quality monitoring would be compared to the Provincial Water Quality Objectives (PWQO).

Notwithstanding, visual monitoring of the dewatering discharge should be conducted daily. Adjustments to the dewatering system should be made if an increase in turbidity or sediment is noted. The dewatering system design is the responsibility of the contractor.

4.3.4 Zone of Influence

The potential zone of influence arising from groundwater taking activities was calculated based on the anticipated drawdown and hydraulic conductivity determined for the site. The calculated zone of influence will extend to an anticipated maximum distance of 14 m surrounding the proposed excavation areas. A summary of the calculated zones of influence for dewatering for both servicing excavations and installation of storm water management ponds are provided with the detailed dewatering calculation provided in the attached **Appendix E**.

4.3.5 Geotechnical Considerations

Lowering of groundwater levels during construction activities has the potential to create ground subsidence or settlement. Potential settlement is expected to be limited to the zone of influence of dewatering work. Structures and municipal servicing are not expected within the anticipated zone of influence of dewatering work, and as such potential geotechnical impacts due to dewatering at the site is not expected. Dewatering discharge should be inspected frequently to ensure discharge is clear and free of sediment to prevent possible ground loss with active dewatering.

4.3.6 Contamination Sources

The Site and immediate surrounding areas currently consist of municipally serviced residential subdivisions agricultural land. Potential sources of groundwater contamination were not noted, and it is understood that a detailed environmental site assessment was not required for this site. The results of groundwater quality sampling did not indicate issues with regards to groundwater quality at the site.

4.4 Construction Constraints

The results of the subsurface investigation indicate that there is limited transmission of groundwater at the site. Based on the completed subsurface investigation soils at the site primarily consist of silts and clayey silts which are not anticipated to transmit significant amounts of groundwater.

Dewatering discharge is to be discharged to diffuse overland flow or to installed storm water management ponds. Dewatering discharge should be inspected daily to confirm discharge is diffuse in nature and erosion down-gradient is not occurring. Measures such as temporary holding ponds, hay bales, rock check dams and filter strips can be implemented to prevent channelization of discharge flows. Discharge should be monitored to ensure any discharge entering surface water features (i.e., tributary to Omagh Creek) is visually clear and free of visible solids, sheens, or foams.

The excavation of underground services across sand layers may interrupt groundwater flow. Trench backfilling operations should be carried out with materials with similar hydraulic conductivity to the materials that have been excavated where practically feasible. If sand zones are encountered during excavation, the contractor shall make best efforts to not backfill the trench using lower permeability material (such as the silt till identified across the balance of the site) where practically feasible. The continuity of sand zones can be ensured by backfilling with native sandy material as excavated. Based on soil conditions observed during completed subsurface investigations significant sand layers are not expected at the site.

Installation of trench plugs for servicing excavations at manhole locations are also recommended such that lateral groundwater flow pathways are not formed within the granular backfill around underground servicing with long sections of below grade servicing. It is expected that granular fill required around servicing, if below the shallow groundwater table may alter local groundwater flow pathways. Trench plugs are recommended at a maximum of 100 m intervals along servicing alignments to limit preferential flow pathways.

It is recommended that site grading maintain overland pathways to surface water features where possible. It is anticipated that the grading plan will reduce overall slopes at the site so that surface water runoff is reduced and groundwater infiltration at the site is promoted.

5.0 SUMMARY AND CONCLUSIONS

Based on the studies conducted at the site the following conclusions can be made regarding the hydrogeologic function of the subject property:

1. The subsurface conditions encountered at the site generally consisted of silty clay till overlying silty sand till followed by weathered shale. In areas soils overlying shale were described as till-shale complex representing a transition from till to weathered shale.

2. Shallow groundwater was encountered between 0.3 m above ground surface to 1.8 m below ground surface. Based on completed groundwater monitoring it is expected that seasonal variation in groundwater at the site will range from between 0.9 and 2.0 m below grade.

3. Groundwater elevations were plotted for measured water levels obtained on June 3, 2022, and February 16, 2023. The groundwater flow direction at the site is expected to the central east property limit toward the tributary of Omagh Creek.

4. Significant groundwater is not expected within shallow deposits of silty clay to clayey silt till present across the site. This shallow soil layer will restrict infiltration to deeper soil strata and underlying bedrock. The primary hydrogeological function of the site is to provide for limited groundwater recharge, and runoff to surface water features. Areas of enhanced groundwater recharge were not noted at the site (i.e., depressions, ponded surface water).

5. Based on a review of the data collected from the rising head tests performed at the site the hydraulic conductivity was assessed for each of the various soil types encountered. The hydraulic conductivity of silty clay to clayey silt soils was estimated at 1.0×10^{-8} m/s, and the hydraulic conductivity of silty sand to sandy silt till deposits was calculated at 2.6×10^{-7} m/s.

6. Background groundwater quality samples were obtained from the site. Groundwater quality was compared to the Provincial Water Quality Objectives and exceedances were noted for total boron, total cobalt, total iron, and total vanadium. Total metals concentrations we due to high sediment yields within the collected groundwater sample (high total suspended solids and turbidity). Metals particles will bind with sediment resulting in elevated total metals concentrations in groundwater. With implementation of sediment and erosion control it is expected that groundwater will meet the quality guidelines of the Provincial Water Quality Objectives for discharge overland.

7. The site is proposed to be serviced with municipal sewer and water servicing. Private water supply wells are not located within 500 m of the site. Private rural residential properties have either been demolished for development of residential subdivisions or been connected to

municipal water supplies. Private wells are expected to have been decommissioned within the vicinity of the site.

Based on the above conclusions of the hydrogeologic assessment the following recommendations are made:

1. It is anticipated that short term dewatering for servicing installation will be upwards of 20,010 L/day (0.23 L/sec). It is expected that the highest construction dewatering volumes will be required for the installation of the trunk sanitary sewer along proposed Street B (Whitlock Avenue) at depths of approximately 6.0 m to 9.0 m installed within silty sand to sandy silt till.

2. Dewatering is anticipated to be required for the two proposed storm water management ponds. It is anticipated that dewatering will be required to control precipitation falling within the pond areas in addition to groundwater inflow. Groundwater control is expected upwards of 44,200 L/day (0.51 L/sec). It should be noted that the dewatering assessment was completed utilizing seasonal high groundwater conditions from monitoring wells screened within overburden below the pond invert elevations. Actual dewatering for storm water management ponds is expected to be below the above conservative estimates.

3. It is expected that dewatering requirements for storm water management ponds and servicing installation at the site will not require permitting from the Ministry of the Environment Conservation and Parks (MECP). Consideration should be given to post dewatering activities to the Environmental Activity and Sector Registry (EASR) if multiple servicing excavations are open at a given time. An EASR would be required for dewatering above 50,000 L/day without exceeding 400,000 L/day.

4. It is anticipated that flows from the dewatering systems could be directed via overland flow towards to the tributary of Omagh Creek and/or storm water ponds (once completed). The construction dewatering system must be appropriately filtered to prevent the pumping of fines and loss of soil during dewatering activities.

5. The potential zone of influence arising from groundwater taking activities was calculated based on the anticipated drawdown and hydraulic conductivity determined for the site. The calculated zone of influence will extend to an anticipated maximum distance of 14 m surrounding the proposed excavation areas.

6. Lowering of groundwater levels during construction activities has the potential to create ground subsidence or settlement. Potential settlement is expected to be limited to the zone of influence of dewatering work. Structures and municipal servicing are not expected within the anticipated zone of influence of dewatering work, and as such potential geotechnical impacts due to dewatering at the site is not expected.

7. Dewatering discharge is to be discharged to diffuse overland flow or to installed storm water management ponds. Dewatering discharge should be inspected daily to confirm discharge is diffuse in nature and erosion down-gradient is not occurring. Measures such as temporary holding ponds, hay bales, rock check dams and filter strips can be implemented to prevent channelization of discharge flows. Discharge should be monitored to ensure any discharge entering surface water features is visually clear and free of visible solids, sheens, or foams.
8. Upon the completion of hydrogeologic investigations at the site it is recommended that all monitoring well installations at the site be decommissioned by a licenced well driller following O. Reg. 903.

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

Yours truly,

Terraprobe Inc.

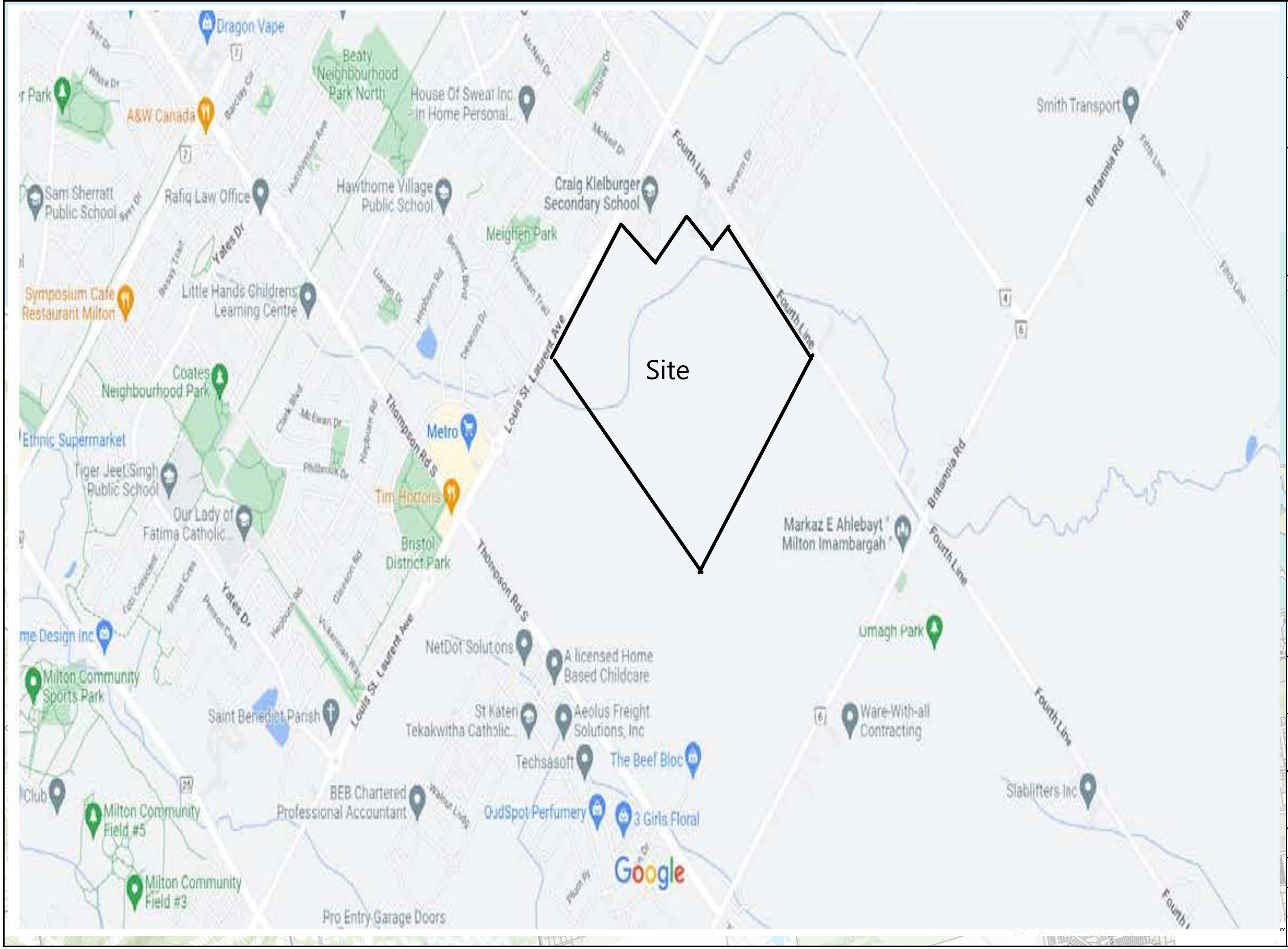
P. L. RAEPPLE
2242

Paul L. Raepple, P.Geo.
Hydrogeologist

R. Baker Wohayeb, M.A.Sc., P.Eng, QP_{RA}
Principal

FIGURES

Terraprobe Inc.



Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

Reference:

Notes:

Legend:

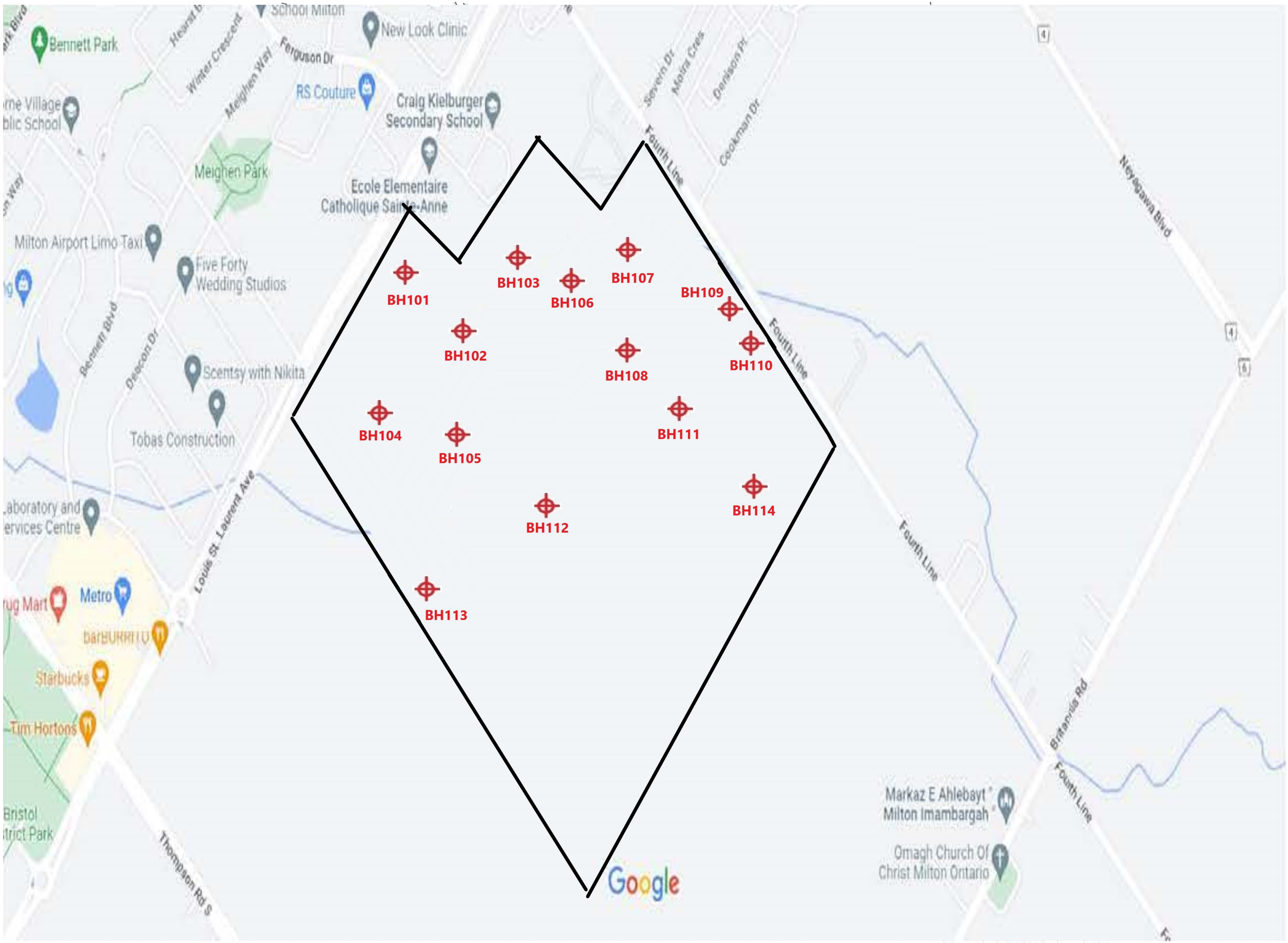
-·-·-·-	Site Boundary

Project Title:
Hydrogeological Assessment

Site Location:
Garito Barbuto Tor Property,
Milton ON

Figure Title:
Site Location Plan

Designed By: SA	*File No.:* 02300931.000
Drawn By: SSK	*Scale:* N.T.S.
Reviewed By: BW	
Date: February 2023	*Figure No.:* 1



Terraprobe Inc.

Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

Reference:

Notes:

Legend:

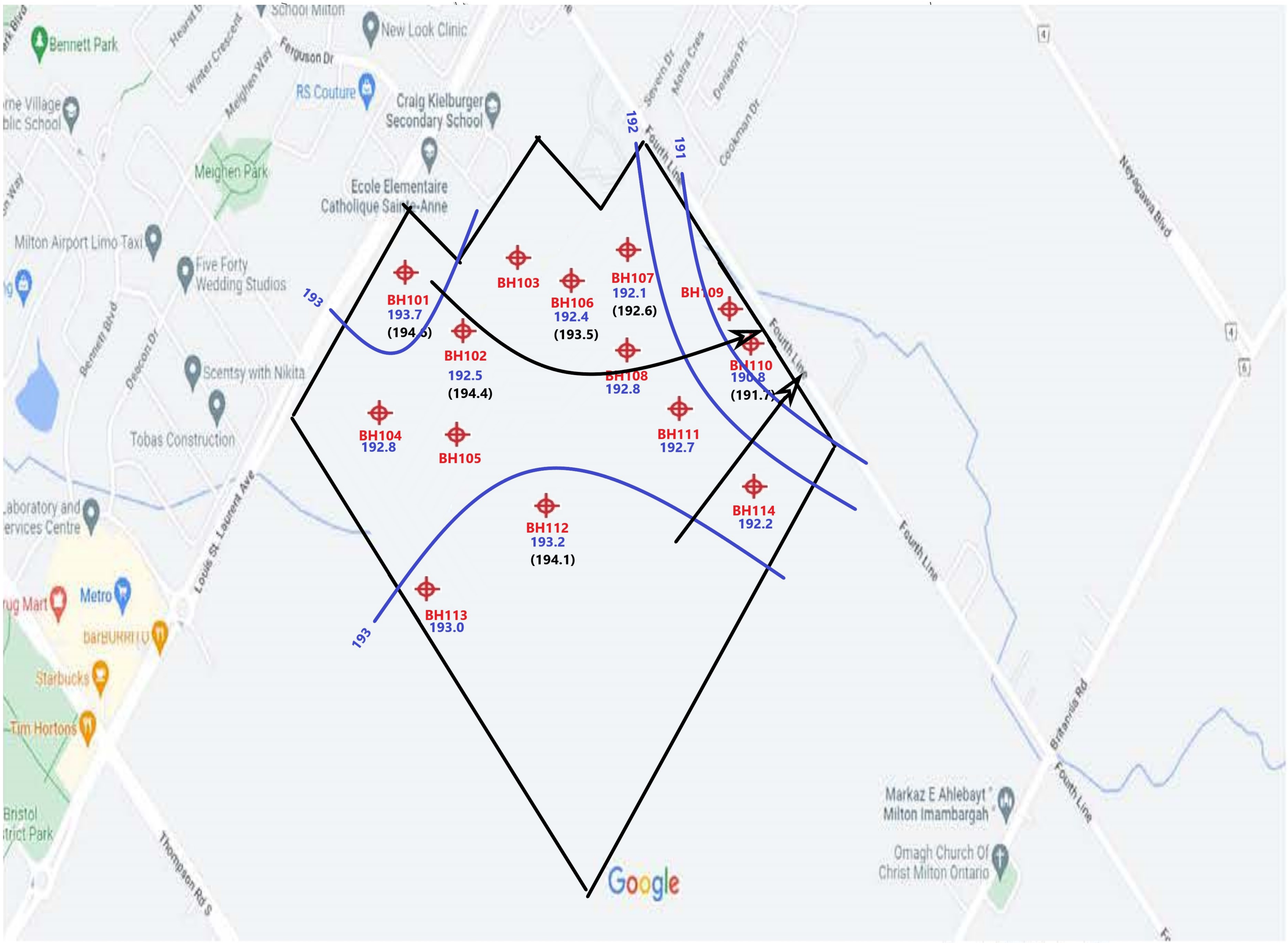
-··-··-	Site Boundary
⌖	Borehole (Shad Associates, June 2022)

Project Title:
Hydrogeological Assessment

Site Location:
Garito Barbuto Tor Property,
Milton ON

Figure Title:
Borehole Location Plan

Designed By: SA	*File No.:* 02300931.000
Drawn By: SSK	*Scale:* N.T.S
Reviewed By: BW	*Figure No.:* 2
Date: February 2023	



Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

N

Reference:

Notes:

Legend:

-·-·-·-	Site Boundary
190.8	Groundwater Level (June 3, 2022)
(191.7)	Groundwater Level (Feb 16, 2023
⌒	Groundwater Contour (1.0 m interval)
➤	Groundwater Flow Direction

Project Title:
Hydrogeological Assessment

Site Location:
Garito Barbuto Tor Property,
Milton ON

Figure Title:
Groundwater Flow Direction

Designed By: SA	*File No.:* 02300931.000
Drawn By: SSK	*Scale:* N.T.S.
Reviewed By: BW	*Figure No.:* 3
Date: February 2023	

Borehole Logs

APPENDIX A

Terraprobe Inc.

RECORD OF BOREHOLE 101

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.

DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.

DATUM: Geodetic
BOREHOLE TYPE: Solid Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE

ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION
~196.4	0	Ground Surface
196.3		**Topsoil**
196.0		brown **Ploughed Silty Clay/Clayey Silt Fill** occ. topsoil, some rootlets, damp
		mottled brown, damp, stiff
	1	mottled brown, occ. grey **Silty Clay/Clayey Silt Till** trace sand damp to moist, very stiff
194.9		brown **Clayey Silt Till** some sand, occ. oxidized fissures damp, very stiff
	2	brown, occ. greyish brown occ. clayey sandy silt till interbeddings damp to moist, hard
	3	brown, silty sand/sandy silt interbedding
		greyish brown
192.8	4	very dense
	5	grey **sand** occ. gravel moist to wet, dense
	6	very dense
190.0		reddish brown **Till-Shale** occ. cobbles/boulder hard
189.3	7	reddish brown **Till-Shale to Highly Weathered Shale**

SAMPLES

SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	WATER CONTENT (%)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
1	SS	46	9	17 22 13	Borehole was moved ~5m west of stake, and ~ 0.3m lower in elevation due to slope.
2	SS	46	22	15	
3	SS	41	21	12	
4	SS	20	50/10cm	13	possible cobbles/boulder
5	SS	46	72	9	
6	SS	46	55	12	
7	SS	36	48	13	Gradation Analysis, S(7): 3 92 5
8	SS	30	68/23cm	17 8	

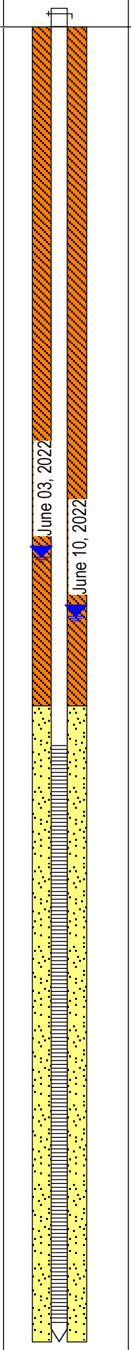
GROUND WATER CONDITIONS: May 25, 2022

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: 20 40 60 80 100

WATER CONTENT (%): 5 15 25 35

MONITORING WELL



RECORD OF BOREHOLE 101

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.

DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.

DATUM: Geodetic
BOREHOLE TYPE: Solid Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE				SAMPLES					DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ▲ 20 40 60 80 100 ▲	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS				
188.8				8	SS	5	50/5cm			12		
	8 9 10 11 12 13 14	**End of Borehole** Practical Auger Refusal at 7.6m. Cave-in Depth on Completion: 7.3m Groundwater Depth on Completion: 3.4m Measured Groundwater Level in Installed Monitoring Well on: June 03, 2022: 2.7m June 10, 2022: 3.0m										

RECORD OF BOREHOLE 102

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.
DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Solid Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE

ELEVATION (metres)	DESCRIPTION
194.1	Ground Surface
193.8	**Topsoil**
193.7	Mottled brown **Ploughed Silty Clay/Clayey Silt Fill** some rootlets, damp to moist
	brown, occ. grey **Silty Clay/Clayey Silt Till** some sand, some oxidized fissures damp, very stiff
192.0	brown
	reddish grey **Silty Sand/Sandy Silt Till** damp, very dense
189.5	damp to moist occ. clayey zones
	reddish grey
	grey **Clayey Silt** some sand seams interbeddings damp to moist, hard
187.5	occ. cobbles/boulder occ. till-shale zones
187.1	reddish grey **Till-Shale** hard
	End of Borehole

SAMPLES

SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	WATER CONTENT (%)
1	SS	46	7	22 22
2	SS	46	25	11
3	SS	46	25	10
4	SS	46	71	8
5	SS	46	82	15
6	SS	46	36	15
7	SS	10	50/13cm	7
8	SS	10	50/13cm	10

DEPTH SCALE (metres): 0, 1, 2, 3, 4, 5, 6, 7

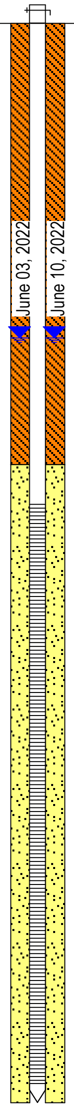
GROUND WATER CONDITIONS: May 25, 2022

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: 20 40 60 80 100

WATER CONTENT (%): 5 15 25 35

MONITORING WELL



REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

RECORD OF BOREHOLE 102

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.

DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.

DATUM: Geodetic
BOREHOLE TYPE: Solid Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ▲ 20 40 60 80 100 ▲	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
		Cave-in Depth on Completion: None Groundwater Depth on Completion: 5.2m Measured Groundwater Level in Installed Monitoring Well on: June 03, 2022: 1.6m June 10, 2022: 1.6m										
	8											
	9											
	10											
	11											
	12											
	13											
	14											

RECORD OF BOREHOLE 103

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.
DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Solid Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE			SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
194.9		Ground Surface									
194.7	0	**Topsoil**							22		
194.4		mottled brown **Ploughed Silty Clay/Clayey Silt Fill** some rootlets, some gravel, damp	1	SS	46	16			22 5		
194.2		light brown **Sand & Gravel (Possible Fill)** damp									
	1	brown, occ. grey **Silty Clay/Clayey Silt Till** some oxidized fissures damp, very stiff	2	SS	46	21			18		
192.0	2	brown some sand, occ. gravel/cobble hard	3 4	SS SS	46 46	47 31			11 12		
	3	grey	5	SS	20	50/10cm			6		
190.8		reddish grey **Clayey Sandy Silt Till** damp, hard									
	4 5	grey **Silty Sand/Sandy Silt Till** damp, very dense	6	SS	25	50/13cm	May 25, 2022 ▼		6		
	6	occ. gravel moist	7	SS	10	50/13cm			8		
187.7	7	occ. cobbles/boulder occ. sandy silt interbeddings moist to wet	8	SS	15	50/13cm			11		
		End of Borehole									

RECORD OF BOREHOLE 103

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.

DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.

DATUM: Geodetic
BOREHOLE TYPE: Solid Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE				SAMPLES									
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ▲ 20 40 60 80 100 ▲	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	8 9 10 11 12 13 14 15	Cave-in Depth on Completion: None Groundwater Depth on Completion: 4.6m										

RECORD OF BOREHOLE 104

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.
DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Solid Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

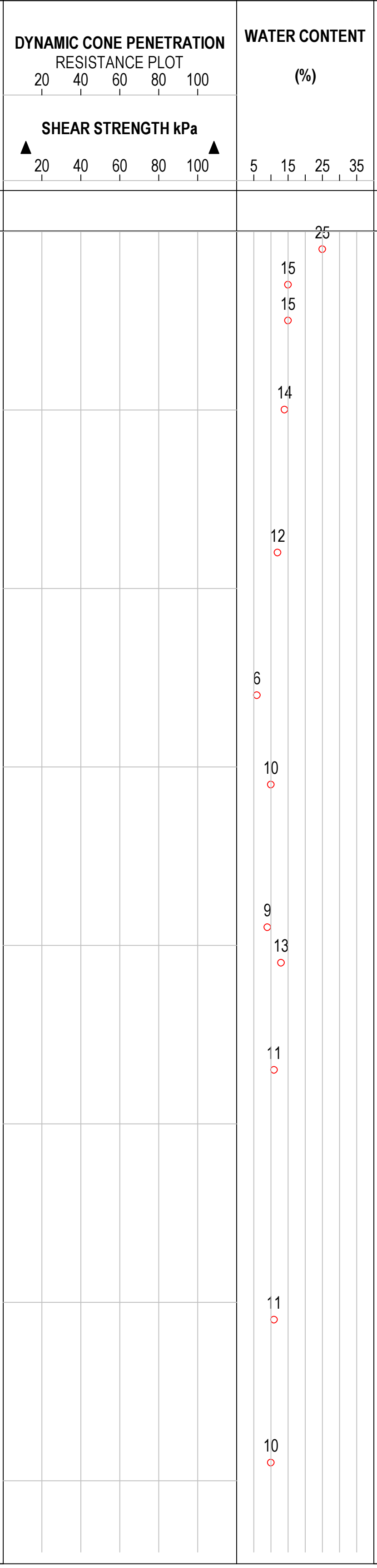
SOIL PROFILE

ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION
195.4		Ground Surface
195.2	0	**Topsoil**
194.9		brown **Ploughed Silty Clay/Clayey Silt Fill** some rootlets, damp
	1	mottled brown grey **Silty Clay/Clayey Silt Till** damp, very stiff brown, occ. grey some sand, some oxidized fissures brown
193.3	2	brown **Silty Sand Till** damp to moist, very dense some cobbles/boulder moist grey reddish brown reddish grey some clay, some shale fragments
189.9	3, 4, 5	reddish grey **Highly Weathered Shale**
188.4	6, 7	**End of Borehole**

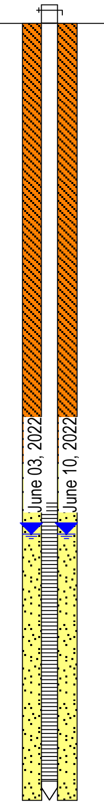
SAMPLES

SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES
1	SS	46	8
2	SS	46	22
3	SS	46	27
4	SS	46	78
5	SS	10	50/13cm
6	SS	30	89/25cm
7	SS	10	50/13cm
8	SS	5	50/8cm
9	SS	5	50/10cm

GROUND WATER CONDITIONS: May 25, 2022



MONITORING WELL



REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Proposed lowest Sanitary Sewer Invert @ ~ El. 190.5m.

RECORD OF BOREHOLE 104

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.

DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.

DATUM: Geodetic
BOREHOLE TYPE: Solid Stem
CHECKED BY: H.S.

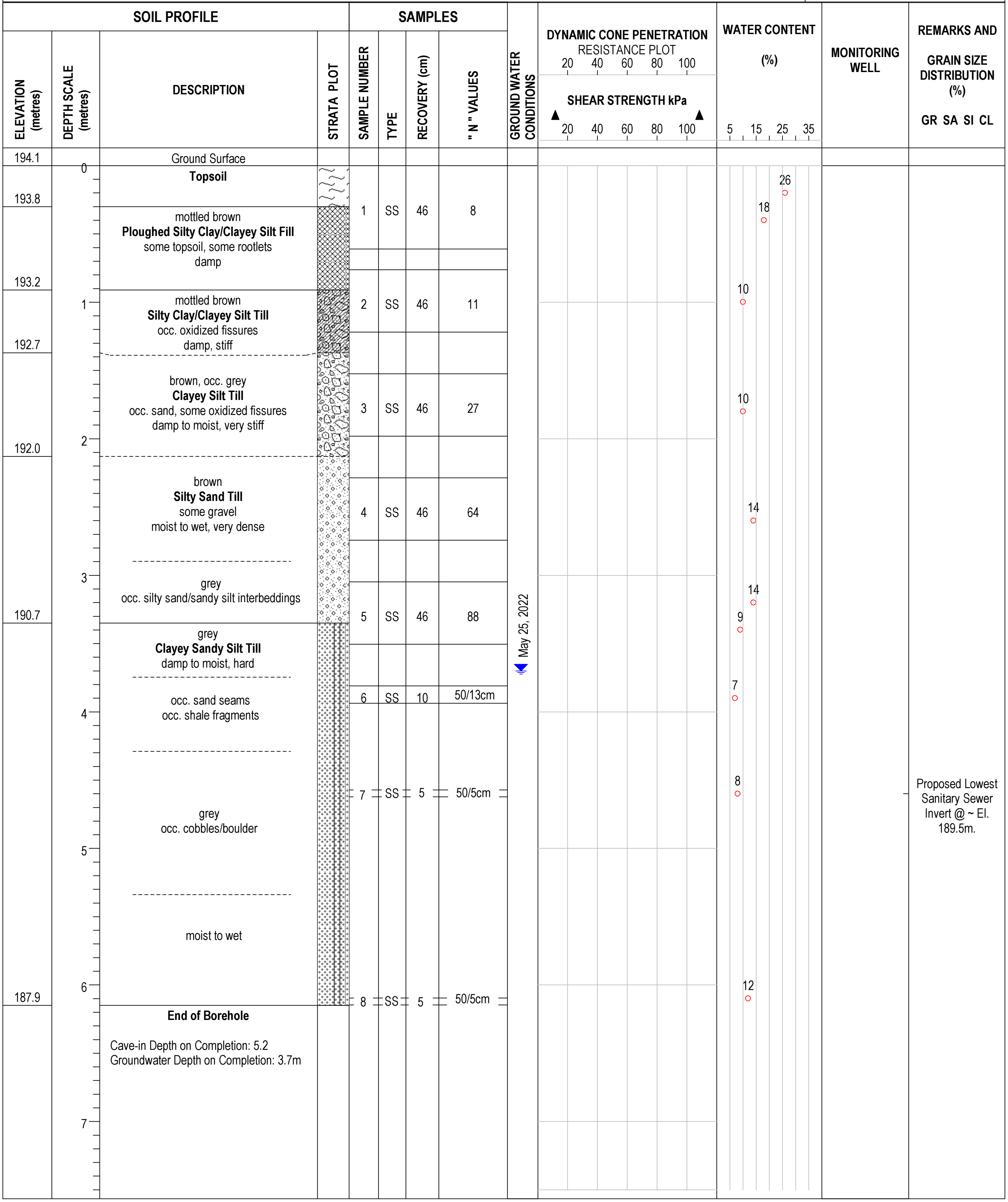
SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ▲ 20 40 60 80 100 ▲	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
		Cave-in Depth on Completion: 6.4m Groundwater Depth on Completion: 3.0m Measured Groundwater Level in Installed Monitoring Well on: June 03, 2022: 2.6m June 10, 2022: 2.6m										
	8											
	9											
	10											
	11											
	12											
	13											
	14											

RECORD OF BOREHOLE 105

Project No.:	T22885	**CLIENT:**	Mattamy Development Corporation	**ORIGINATED BY:**	R.H.
DATE:	May 24-27, 2022	**LOCATION:**	Milton, Ontario	**COMPILED BY:**	R.H.
DATUM:	Geodetic	**BOREHOLE TYPE:**	Solid Stem	**CHECKED BY:**	H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7



ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	WATER CONTENT (%)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
194.1	0	Ground Surface							
		Topsoil						26	
193.8		mottled brown **Ploughed Silty Clay/Clayey Silt Fill** some topsoil, some rootlets damp	1	SS	46	8		18	
193.2	1	mottled brown **Silty Clay/Clayey Silt Till** occ. oxidized fissures damp, stiff	2	SS	46	11		10	
192.7		brown, occ. grey **Clayey Silt Till** occ. sand, some oxidized fissures damp to moist, very stiff	3	SS	46	27		10	
192.0	2	brown **Silty Sand Till** some gravel moist to wet, very dense	4	SS	46	64		14	
	3	grey occ. silty sand/sandy silt interbeddings	5	SS	46	88		14 9	
190.7		grey **Clayey Sandy Silt Till** damp to moist, hard					May 25, 2022		
	4	occ. sand seams occ. shale fragments	6	SS	10	50/13cm		7	
	5	grey occ. cobbles/boulder	7	SS	5	50/5cm		8	Proposed Lowest Sanitary Sewer Invert @ ~ El. 189.5m.
	6	moist to wet	8	SS	5	50/5cm		12	
187.9		**End of Borehole**							
	7								

Cave-in Depth on Completion: 5.2
Groundwater Depth on Completion: 3.7m

RECORD OF BOREHOLE 106

Project No.:	T22885	CLIENT:	Mattamy Development Corporation	ORIGINATED BY:	R.H.
DATE:	May 24-27, 2022	LOCATION:	Milton, Ontario	COMPILED BY:	R.H.
DATUM:	Geodetic	BOREHOLE TYPE:	Solid Stem	CHECKED BY:	H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE

ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION
193.9		Ground Surface
193.7	0	**Topsoil**
193.4		brown **Ploughed Silty Clay/Clayey Silt Fill** some rootlets, damp to moist
		mottled brown, stiff
	1	reddish brown **Silty Clay/Clayey Silt Till** some oxidized fissures damp, very stiff
191.8	2	brown, hard
191.0		greyish brown **Clayey Sandy Silt Till** damp, hard
189.9	3	brown **Silty Sand Till** occ. sand seams/pockets occ. cobbles moist, very dense
	4	greyish brown **Sandy Silt** some clay damp to moist, very dense
		brown, silty sand interbedding, moist
188.4	5	brown, occ. reddish grey
186.9	6	reddish grey **Silty Sand Till** occ. shale fragments moist, very dense
	7	reddish brown **Till Shale to Highly Weathered Shale**

SAMPLES

SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES
1	SS	46	10
2	SS	46	23
3	SS	46	41
4	SS	46	56
5	SS	46	61
6	SS	36	93/28cm
7	SS	10	50/13cm

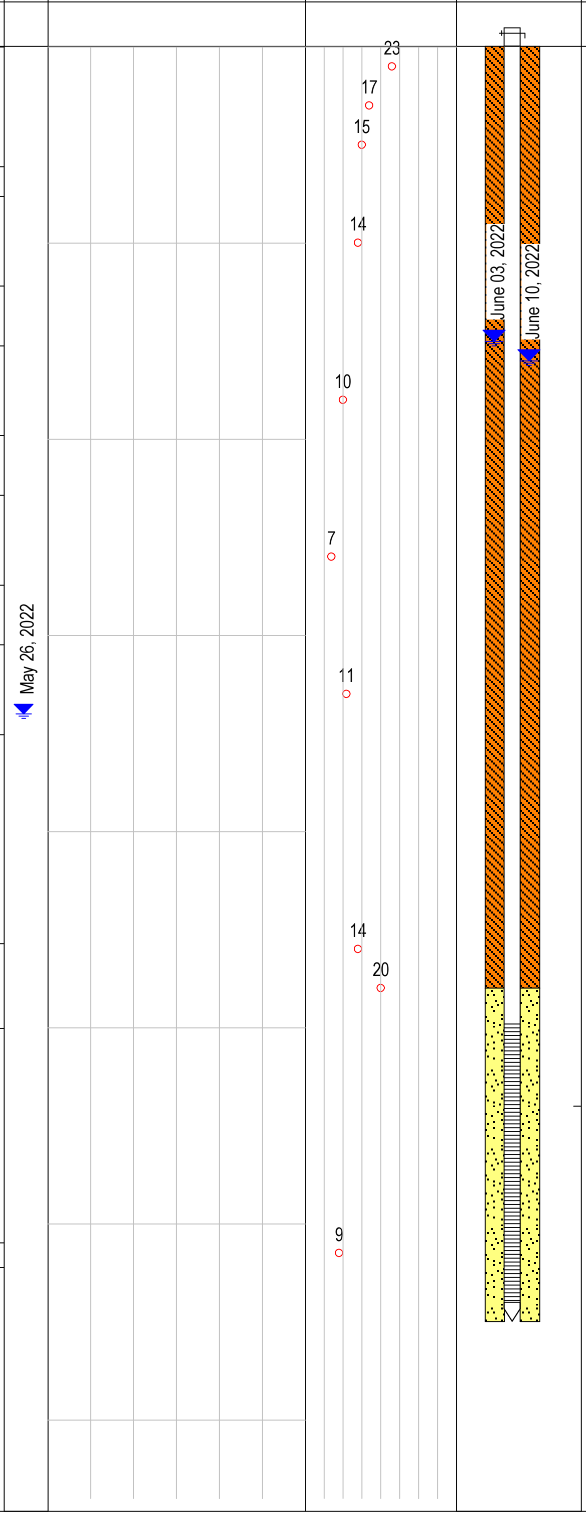
GROUND WATER CONDITIONS

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa 20 40 60 80 100

WATER CONTENT (%) 5 15 25 35

MONITORING WELL



REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

Proposed Deepest Sanitary Sewer @ ~ El. 188.5m.

RECORD OF BOREHOLE 106

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.
DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Solid Stem
CHECKED BY: H.S.

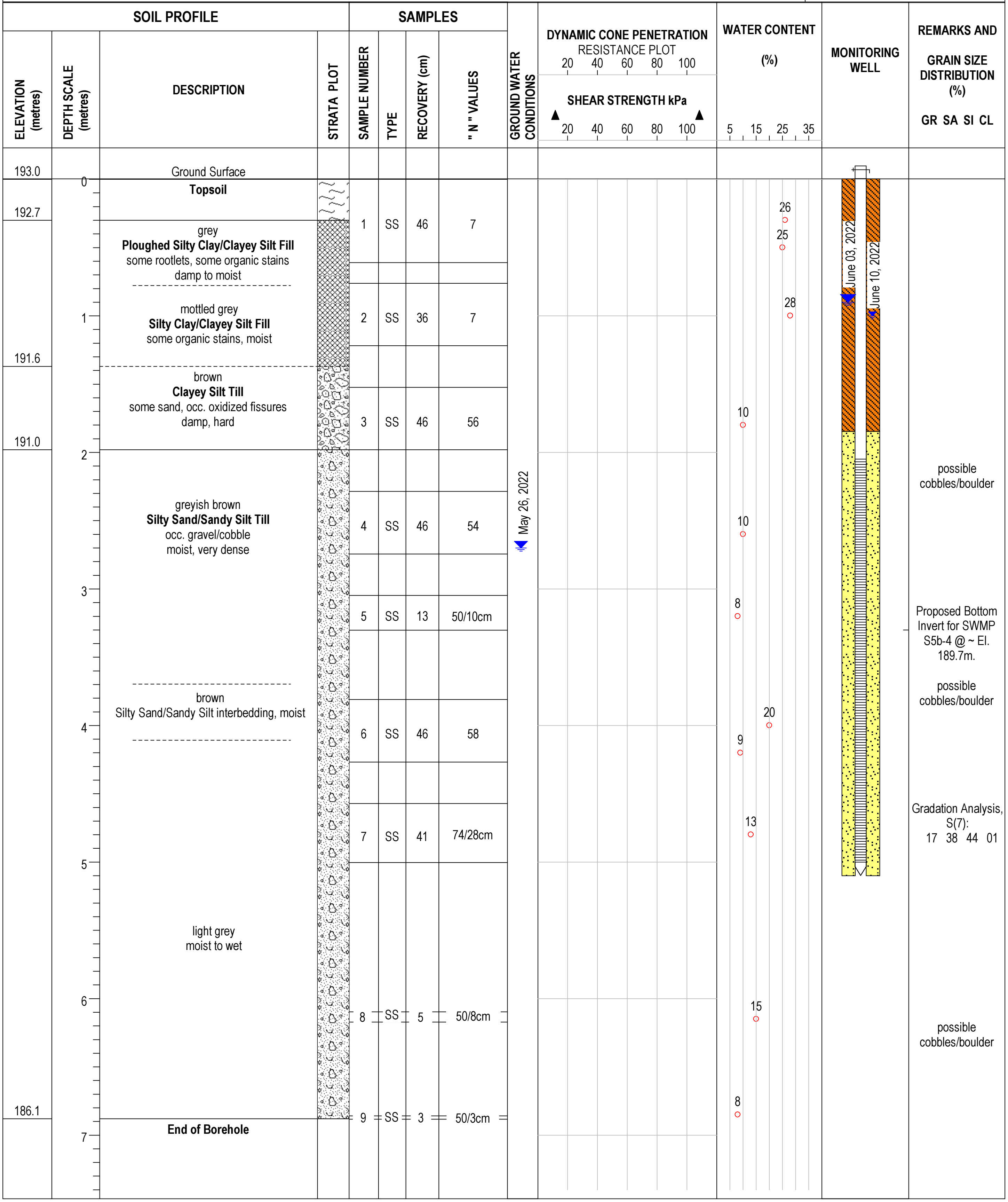
SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
186.2				8	SS	5	50/5cm			8		
	8 9 10 11 12 13 14	**End of Borehole** Cave-in Depth on Completion: 7.3m Groundwater Depth on Completion: 3.4m Measured Groundwater Level in Installed Monitoring Well on: June 03, 2022: 1.5m June 10, 2022:1.6m										

RECORD OF BOREHOLE 107

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.
DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Solid Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7



SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
193.0		Ground Surface										
	0	**Topsoil**										
192.7		grey **Ploughed Silty Clay/Clayey Silt Fill** some rootlets, some organic stains damp to moist		1	SS	46	7			26 25	June 03, 2022	
	1	mottled grey **Silty Clay/Clayey Silt Fill** some organic stains, moist		2	SS	36	7			28	June 10, 2022	
191.6		brown **Clayey Silt Till** some sand, occ. oxidized fissures damp, hard		3	SS	46	56			10		
191.0	2	greyish brown **Silty Sand/Sandy Silt Till** occ. gravel/cobble moist, very dense		4	SS	46	54	May 26, 2022		10		possible cobbles/boulder
	3			5	SS	13	50/10cm			8		Proposed Bottom Invert for SWMP S5b-4 @ ~ El. 189.7m.
	4	brown Silty Sand/Sandy Silt interbedding, moist		6	SS	46	58			20 9		possible cobbles/boulder
				7	SS	41	74/28cm			13		Gradation Analysis, S(7): 17 38 44 01
	5	light grey moist to wet										
	6			8	SS	5	50/8cm			15		possible cobbles/boulder
186.1				9	SS	3	50/3cm			8		
	7	**End of Borehole**										

RECORD OF BOREHOLE 107

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.

DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.

DATUM: Geodetic
BOREHOLE TYPE: Solid Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ▲ 20 40 60 80 100 ▲	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	8	Cave-in Depth on Completion: 6.1m Groundwater Depth on Completion: 2.7m Measured Groundwater Level in Installed Monitoring Well on: June 03, 2022: 0.9m June 10, 2022: 1.0m										
	9											
	10											
	11											
	12											
	13											
	14											

RECORD OF BOREHOLE 108

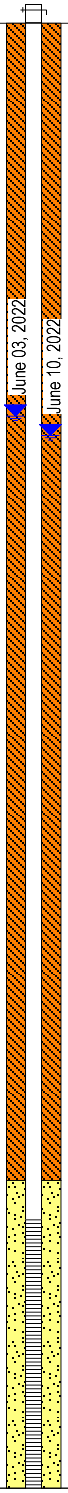
Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.

DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.

DATUM: Geodetic
BOREHOLE TYPE: Solid Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE			SAMPLES				GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES					
194.9		Ground Surface									
194.8	0	**Topsoil**							21		
194.4		brown **Ploughed Silty Clay/Clayey Silt Fill** some rootlets, damp to moist	1	SS	46	8			17 12		
		mottled brown, occ. shale fragments, stiff									
	1	brown, occ. grey **Silty Clay/Clayey Silt Till** occ. gravel, some oxidized fissures damp, very stiff	2	SS	46	22			12		
		hard	3	SS	46	40			12		
	2		4	SS	46	38			12		Proposed Channel Invert @ ~ El. 192.7m. possible cobbles/boulder
	3	brown, occ. greyish brown occ. fine sand seams/pockets very stiff	5	SS	46	27			14		Proposed Culvert Invert on Sheet A @ ~ El. 192.049m.
	4	reddish grey hard	6	SS	46	36			9		
189.4	5										
	6	reddish grey, occ. grey **Silty Sand/Sandy Silt Till** trace to some clay damp, very dense	7	SS	36	82/25cm			12		
	7										Deepest Sanitary Sewer @ ~ El. 187.9m.



RECORD OF BOREHOLE 108

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.
DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Solid Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ▲ 20 40 60 80 100 ▲	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	8	reddish grey		8	SS	25	50/13cm			6		
	9	damp to moist						May 27, 2022 ▼				
185.6				9	SS	13	50/13cm			6		
	10	**End of Borehole** Cave-in Depth on Completion: None Groundwater Depth on Completion: 9.1m Measured Groundwater Level in Installed Monitoring Well on: June 03, 2022: 2.0m June 10, 2022: 2.1m										
	11											
	12											
	13											
	14											

RECORD OF BOREHOLE 109

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.
DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Hollow Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE			SAMPLES				GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES					
192.6		Ground Surface									
192.3	0	**Topsoil**							22		
191.9		mottled brown **Ploughed Silty Clay/Clayey Silt Fill** some topsoil, some rootlets some organic stains, damp to moist	1	SS	46	8			21		Proposed Channel Bottom Invert @ ~ El. 192.24 m.
	1	brown, occ. grey **Silty Clay/Clayey Silt Till** some oxidized fissures damp, stiff	2	SS	46	14			13		
	2	brown, occ. reddish brown very stiff	3	SS	46	22			12		
		greyish brown hard	4	SS	46	36			9		
189.2	3	occ. silt interbeddings some gravel	5	SS	46	45			8 8		
188.5	4	grey **Silty Sand/Sandy Silt Till** damp, dense									possible cobbles/boulder
	5	greyish brown **Silty Sand Till** occ. gravel/cobbles damp, very dense	6	SS	10	50/13cm			5		
	6	occ. fine sand seams	7	SS	10	50/10cm			6		
185.6	7	grey **Sandy Silt** damp, very dense									

RECORD OF BOREHOLE 109

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.
DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Hollow Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE			SAMPLES									
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ▲ 20 40 60 80 100 ▲	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
			8	SS	10	50/13cm			9		
	8										
184.1		greyish brown **Silty Sand/Sandy Silt** trace to some clay damp, very dense									
	9		9	SS	10	50/10cm			6		
182.5	10	reddish brown **Till-Shale** moist, hard					May 24, 2022				
			10	SS	25	50/13cm			12		
	11										
		reddish brown, occ. grey									
	12		11	SS	5	50/5cm			9		
180.3		**End of Borehole** Cave-in Depth on Completion: None Groundwater Depth on Completion: 10.1 m									
	13										
	14										
	15										

RECORD OF BOREHOLE 110

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.
DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Hollow Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE

ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION
192.6	0	Ground Surface
192.3		**Topsoil**
191.9		mottled brown **Ploughed Silty Clay/Clayey Silt Fill** some topsoil, some rootlets some organic stains, damp
189.7	1–2	brown, occ. greyish brown **Silty Clay/Clayey Silt Till** occ. oxidized fissures damp, very stiff some oxidized fissures greyish brown grey some sand seams
188.9	3	reddish grey **Clayey Silt Till** some silty sand/sandy silt interbeddings moist, very stiff
187.1	4–5	reddish grey **Silty Sand/Sandy Silt Till** occ. gravel damp to moist, very dense some gravel
185.5	6	light grey **Clayey Silt** damp, hard
	7	reddish grey **Clayey Sandy Silt Till** some gravel, moist, hard

SAMPLES

SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	WATER CONTENT (%)
1	SS	46	8	19 19
2	SS	46	15	13
3	SS	46	23	12
4	SS	46	30	12
5	SS	41	21	14
6	SS	46	80	7
7	SS	25	50/10cm	7
8	SS	46	67	13

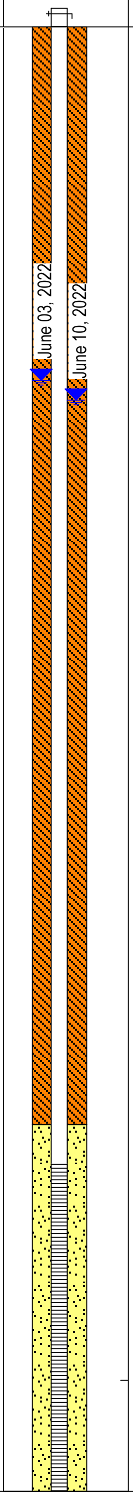
GROUND WATER CONDITIONS

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: 20 40 60 80 100

WATER CONTENT (%): 5 15 25 35

MONITORING WELL



REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

possible cobbles/boulder

Deepest Sanitary Sewer @ ~ El. 185.7 m.

RECORD OF BOREHOLE 110

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.
DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Hollow Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE			SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	8		9	SS	46	80			8		
184.0	9	greyish borwn **Clayey Silt** some shale fragments damp, hard	10	SS	10	50/13cm			8		
182.7	10	reddish brown **Highly Weathered to Weathered Shale**	11	SS	10	50/13cm			5		
	11	grey					May 24, 2022				
	12		12	SS	10	50/10cm			8		
180.3	13 14	**End of Borehole** Cave-in Depth on Completion: None Groundwater Depth on Completion: 11.6m Measured Groundwater Level in Installed Monitoring Well on: June 03, 2022: 1.8m June 10, 2022: 1.9m									

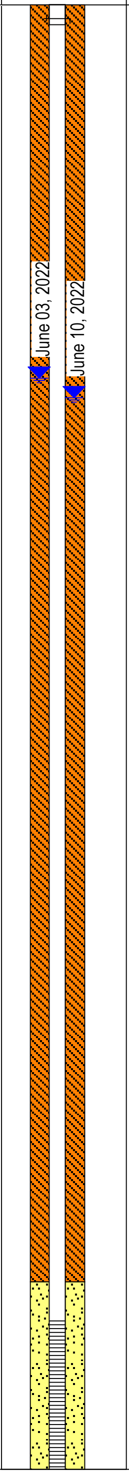
RECORD OF BOREHOLE 111

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.
DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Solid Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE			SAMPLES				GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES				
194.6		Ground Surface								
194.4	0	**Topsoil**							23	
194.1		brown **Ploughed Silty Clay/Clayey Silt Fill** some rootlets, moist	1	SS	46	8			14 14	
		stiff								
	1	brown to reddish brown **Silty Clay/Clayey Silt Till** some oxidized fissures damp, very stiff	2	SS	46	24			12	
			3	SS	46	27			11	
	2	reddish brown, occ. brown hard	4	SS	46	39			10	
	3	occ. sand pockets	5	SS	46	43			11	Gradation Analysis & Atterberg Limits, S(5): 7 18 46 29 LL: 27% PL: 18% PI: 9%
190.6	4	reddish grey **Clayey Sandy Silt Till** some sand seams, occ. shale fragments damp to moist, hard	6	SS	46	30			10	
189.1	5									
	6	reddish grey, occ. grey **Silty Clay/Clayey Silt Till** trace sand damp, hard	7	SS	46	38			9	
187.6	7									

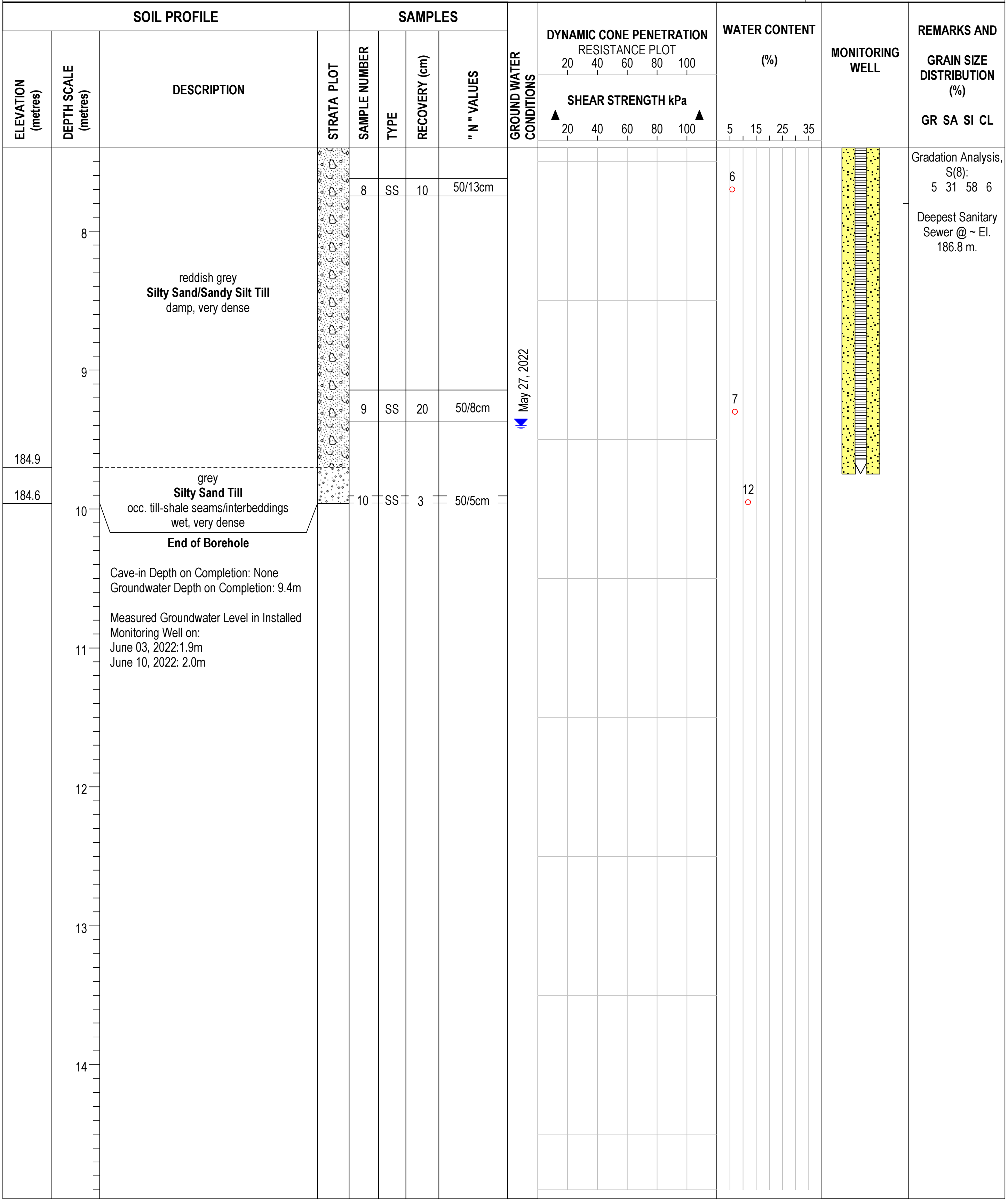
MONITORING WELL



RECORD OF BOREHOLE 111

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.
DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Solid Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7



ELEVATION (metres)	DESCRIPTION
	reddish grey **Silty Sand/Sandy Silt Till** damp, very dense
184.9	grey **Silty Sand Till** occ. till-shale seams/interbeddings wet, very dense
184.6	**End of Borehole**

Cave-in Depth on Completion: None
Groundwater Depth on Completion: 9.4m

Measured Groundwater Level in Installed Monitoring Well on:
June 03, 2022:1.9m
June 10, 2022: 2.0m

SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	WATER CONTENT (%)
8	SS	10	50/13cm	6
9	SS	20	50/8cm	7
10	SS	3	50/5cm	12

Gradation Analysis, S(8):
5 31 58 6

Deepest Sanitary Sewer @ ~ El. 186.8 m.

RECORD OF BOREHOLE 112

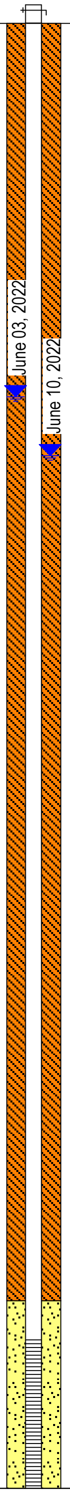
Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.

DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.

DATUM: Geodetic
BOREHOLE TYPE: Solid Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE			SAMPLES				GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES					
195.1		Ground Surface									
194.9	0	**Topsoil**							21		
194.4		mottled brown **Ploughed Silty Clay/Clayey Silt Fill** occ. topsoil, some rootlets some organic stains, damp	1	SS	46	7			18		
	1	greyish brown **Silty Clay/Clayey Silt Till** damp, very stiff	2	SS	46	24			16		
	2	some oxidized fissures	3	SS	46	23			15		
		brown hard	4	SS	46	33			10		
	3		5	SS	46	30			11		Gradation Analysis & Atterberg Limits, S(5): 6 17 46 31 LL: 26% PL: 19% PI: 7%
190.5	4	some gravel									
189.6	5	brown **Clayey Sandy Silt Till** damp, hard	6	SS	46	42			9		
	6	grey **Silty Clay/Clayey Silt Till** damp, hard	7	SS	41	52			6		
188.1	7	some silty sand/sandy silt till interbeddings, moist									



RECORD OF BOREHOLE 112

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.
DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Solid Stem
CHECKED BY: H.S.

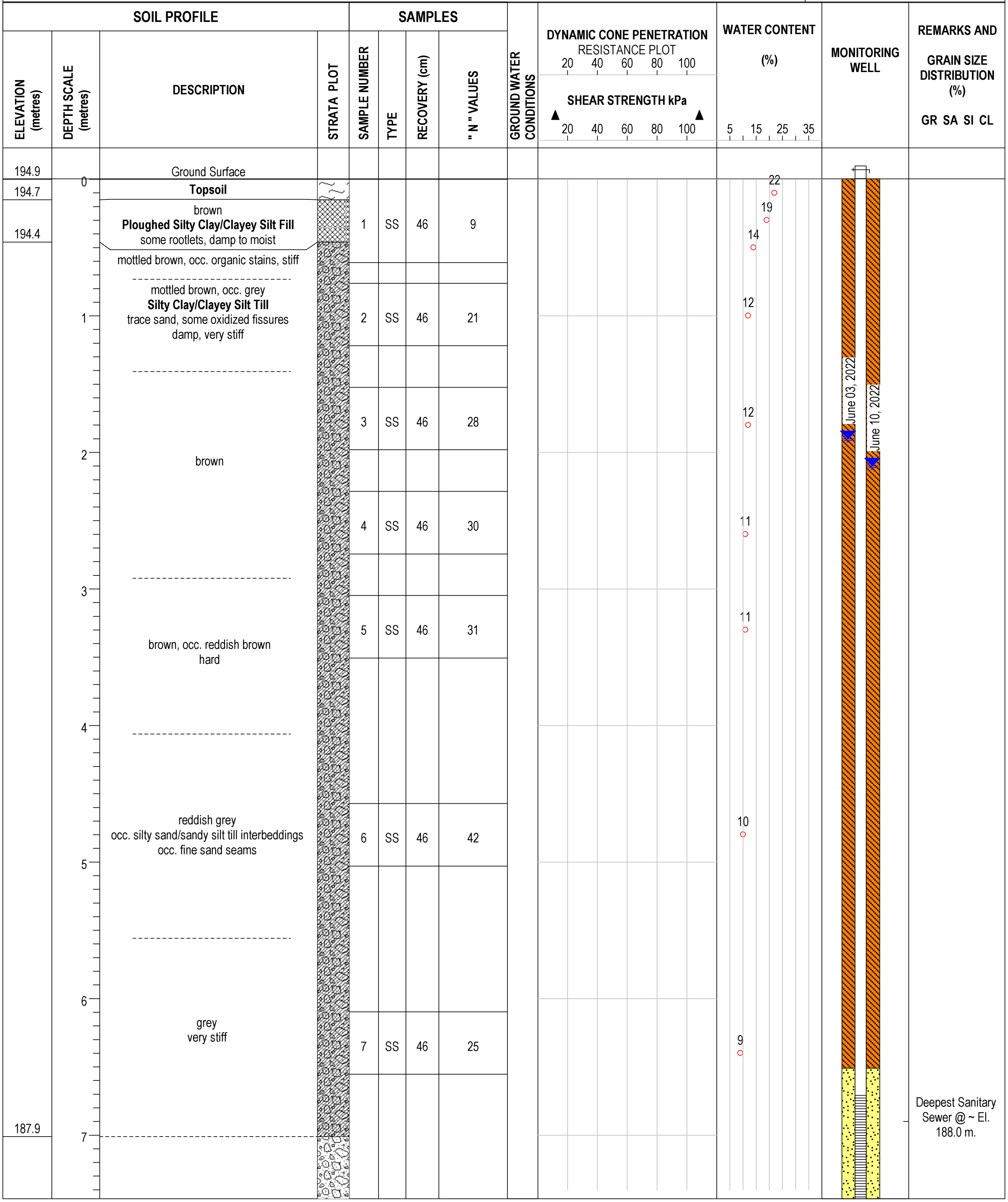
SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa 20 40 60 80 100	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	8	reddish grey **Silty Sand/Sandy Silt Till** some gravel damp, very dense		8	SS	41	75			7		Deepest Sanitary Sewer @ ~ El. 187.5 m.
												possible cobbles/boulder
	9			9	SS	0	50/3cm					
185.9		**End of Borehole** Cave-in Depth on Completion: None Groundwater Depth on Completion: Dry Measured Groundwater Level in Installed Monitoring Well on: June 03, 2022: 1.9m June 10, 2022: 2.2m										
	10											
	11											
	12											
	13											
	14											

RECORD OF BOREHOLE 113

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.
DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Solid Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7



SOIL PROFILE

ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION
194.9		Ground Surface
194.7	0	**Topsoil**
194.4		brown **Ploughed Silty Clay/Clayey Silt Fill** some rootlets, damp to moist
		mottled brown, occ. organic stains, stiff
	1	mottled brown, occ. grey **Silty Clay/Clayey Silt Till** trace sand, some oxidized fissures damp, very stiff
	2	brown
	3	brown, occ. reddish brown hard
	4–5	reddish grey occ. silty sand/sandy silt till interbeddings occ. fine sand seams
	6	grey very stiff
187.9	7	

SAMPLES

SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES
1	SS	46	9
2	SS	46	21
3	SS	46	28
4	SS	46	30
5	SS	46	31
6	SS	46	42
7	SS	46	25

GROUND WATER CONDITIONS

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Deepest Sanitary Sewer @ ~ El. 188.0 m.

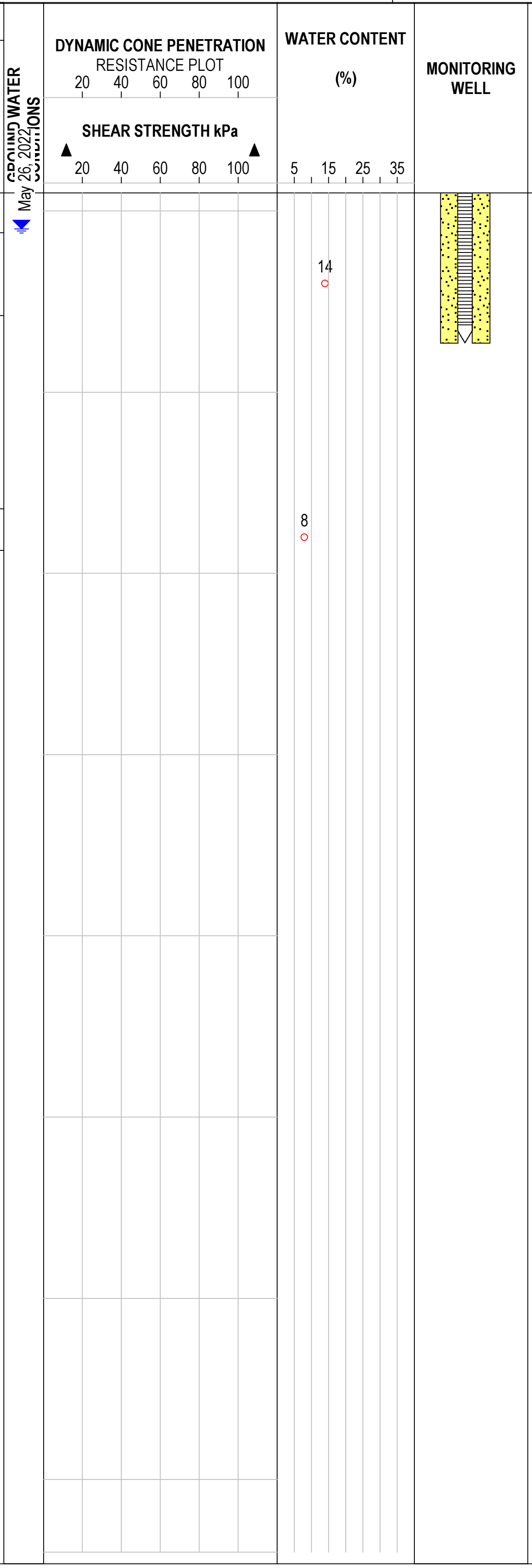
RECORD OF BOREHOLE 113

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.
DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Solid Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	WATER CONTENT (%)
	8	grey **Clayey Silt Till** occ. sand seams, occ. gravel damp to moist, hard	8	SS	46	34	14
186.3	9	reddish grey **Silty Sand/Sandy Silt Till** occ. cobbbles/boulder moist, very dense	9	SS	15	50/8cm	8
185.5	10	**End of Borehole** Cave-in Depth on Completion: None Groundwater Depth on Completion: 7.6m Measured Groundwater Level in Installed Monitoring Well on: June 03, 2022: 1.9m June 10, 2022: 2.1m					

GROUND WATER CONDITIONS: May 26, 2022



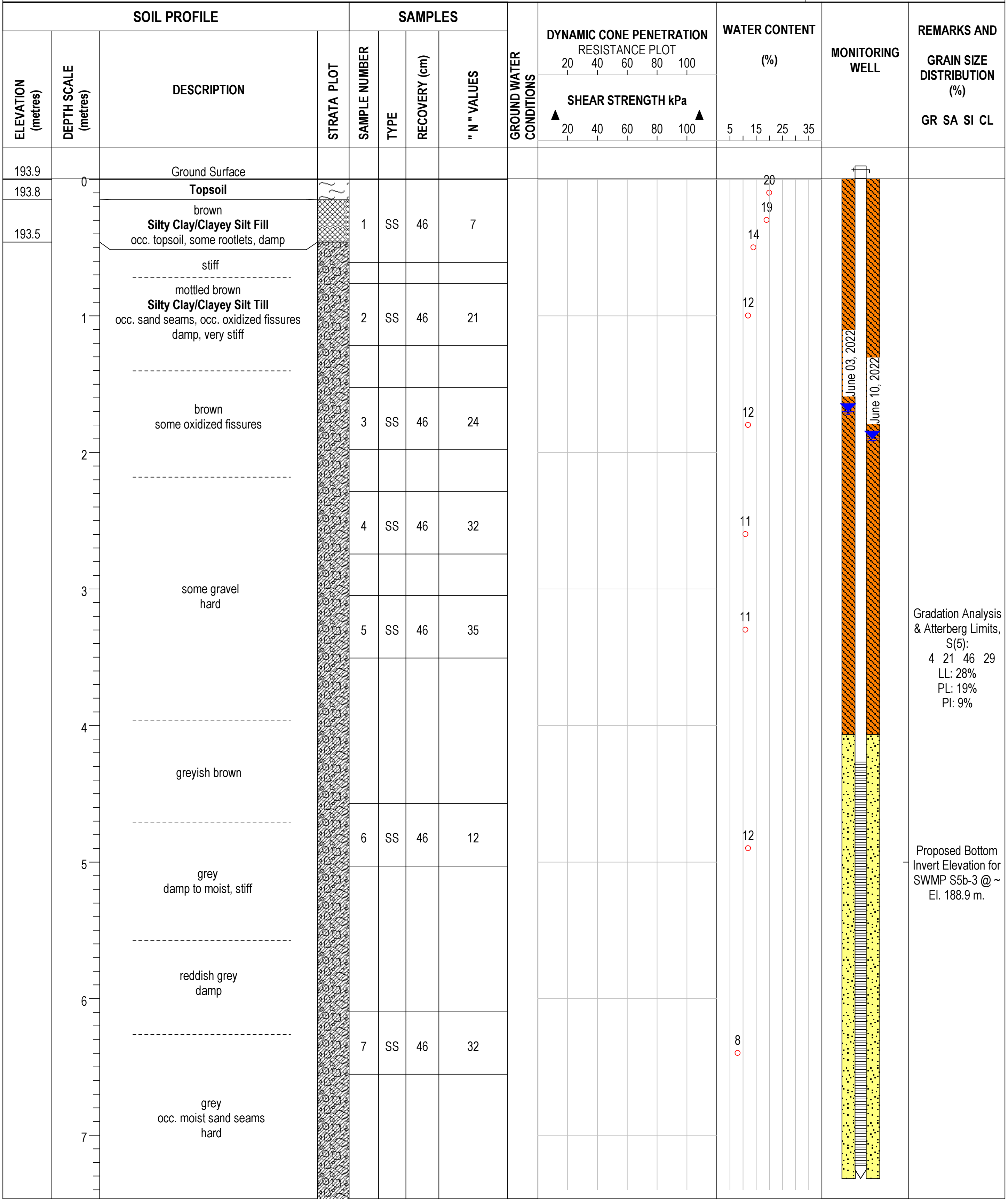
REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Depth scale: 8, 9, 10, 11, 12, 13, 14

RECORD OF BOREHOLE 114

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.
DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Solid Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7



ELEVATION (metres)	DESCRIPTION
193.9	Ground Surface
193.8	**Topsoil**
193.5	brown **Silty Clay/Clayey Silt Fill** occ. topsoil, some rootlets, damp
	stiff
	mottled brown **Silty Clay/Clayey Silt Till** occ. sand seams, occ. oxidized fissures damp, very stiff
	brown some oxidized fissures
	some gravel hard
	greyish brown
	grey damp to moist, stiff
	reddish grey damp
	grey occ. moist sand seams hard

SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	WATER CONTENT (%)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
				20	
1	SS	46	7	19	
				14	
2	SS	46	21	12	
3	SS	46	24	12	
4	SS	46	32	11	
5	SS	46	35	11	Gradation Analysis & Atterberg Limits, S(5): 4 21 46 29 LL: 28% PL: 19% PI: 9%
6	SS	46	12	12	Proposed Bottom Invert Elevation for SWMP S5b-3 @ ~ El. 188.9 m.
7	SS	46	32	8	

RECORD OF BOREHOLE 114

Project No.: T22885
CLIENT: Mattamy Development Corporation
ORIGINATED BY: R.H.
DATE: May 24-27, 2022
LOCATION: Milton, Ontario
COMPILED BY: R.H.
DATUM: Geodetic
BOREHOLE TYPE: Solid Stem
CHECKED BY: H.S.

SHAD & ASSOCIATES INC.
250 Sheilds Court, Unit 27
Markham, Ontario, L3R 9W7

SOIL PROFILE				SAMPLES								
ELEVATION (metres)	DEPTH SCALE (metres)	DESCRIPTION	STRATA PLOT	SAMPLE NUMBER	TYPE	RECOVERY (cm)	" N " VALUES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ▲ 20 40 60 80 100 ▲	WATER CONTENT (%) 5 15 25 35	MONITORING WELL	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
186.3			▨	8	SS	0	50/3cm					
	8	**End of Borehole** Cave-in Depth on Completion: None Groundwater Depth on Completion: Dry Measured Groundwater Level in Installed Monitoring Well on: June 03, 2022: 1.7m June 10, 2022: 1.9m										
	9											
	10											
	11											
	12											
	13											
	14											

EXPLANATION OF BOREHOLE LOG

This form describes some of the information provided on the borehole logs, which is based primarily on examination of the recovered samples, and the results of the field and laboratory tests. It should be noted that materials, boundaries and conditions have been established only at the borehole locations at the time of investigation and are not necessarily representative of subsurface conditions elsewhere across the site. Additional description of the soil/rock encountered is given in the accompanying geotechnical report.

GENERAL INFORMATION

Project details, borehole number, location coordinates and type of drilling equipment used are given at the top of the borehole log.

SOIL LITHOLOGY

Elevation and depth

This column gives the elevation and depth of inferred geologic layers. The elevation is referred to the datum shown in the Description column.

Lithology Plot

This column presents a graphic depiction of the soil and rock stratigraphy encountered within the borehole.

Description

This column gives a description of the soil stratums, based on visual and tactile examination of the samples augmented with field and laboratory test results. Each stratum is described according to the following classification and terminology (Ref. Unified Soil Classification System):

The compactness condition of cohesionless soils (SPT) and the consistency of cohesive soils (undrained shear strength) are defined as follows (Ref. Canadian Foundation Engineering Manual):

Compactness of Cohesionless Soils	SPT N-Value
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	> 50

Consistency of Cohesive Soils	SPT N-Value	Undrained Shear Strength	
		kPa	psf
Very soft	0 to 2	0 to 12	0 to 250
Soft	2 to 4	12 to 25	250 to 500
Firm	4 to 8	25 to 50	500 to 1000
Stiff	8 to 15	50 to 100	1000 to 2000
Very stiff	15 to 30	100 to 200	2000 to 4000
Hard	> 30	Over 200	Over 4000

Soil Sampling

Sample types are abbreviated as follows:

SS	Split Spoon	TW	Thin Wall Open (Pushed)	RC	Rock Core
AS	Auger Sample	TP	Thin Wall Piston (Pushed)	WS	Washed Sample

Additional information provided in this section includes sample numbering, sample recovery and numerical testing results.

Field and Laboratory Testing

Results of field testing (e.g., SPT, pocket penetrometer, and vane testing) and laboratory testing (e.g., natural moisture content, and limits) executed on the recovered samples are plotted in this section.

Instrumentation Installation

Instrumentation installations (monitoring wells, piezometers, inclinometers, etc.) are plotted in this section. Water levels, if measured during fieldwork, are also plotted. These water levels may or may not be representative of the static groundwater level depending on the nature of soil stratum where the piezometer tips are located, the time elapsed from installation to reading and other applicable factors.

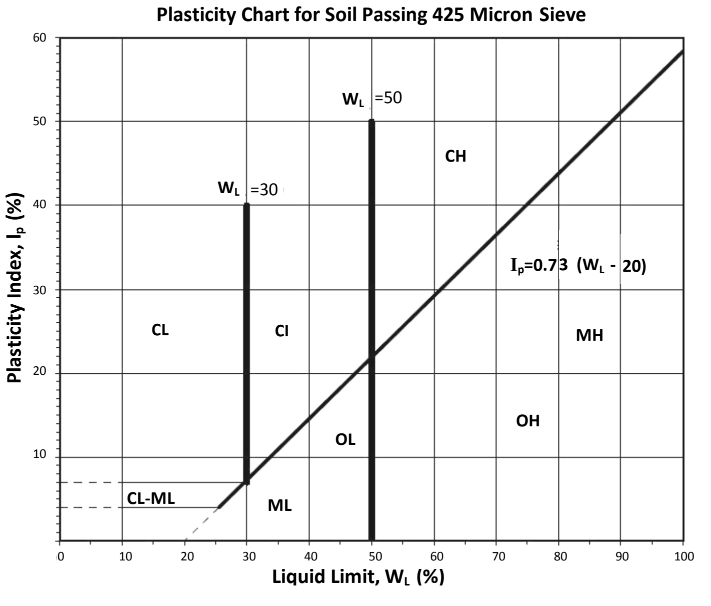
Comments

This column is used to describe non-standard situations or notes of interest.

MODIFIED * UNIFIED CLASSIFICATION SYSTEM FOR SOILS
*The soil of each stratum is described using the Unified Soil Classification System (Technical Memorandum 36-357
prepared by Waterways Experiment Station, Vicksburg, Mississippi, Corps of Engineers, U.S Army. Vol. 1
March 1953.) modified slightly so that an inorganic clay of "medium plasticity" is recognized.

MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75µm)	GRAVELS MORE THAN HALF THE COARSE FRACTION LARGER THAN 4.75mm	CLEAN GRAVELS (TRACE OR NO FINES)	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 4;\ C_C = \frac{(D_{30})^2}{D_{10}\ x\ D_{60}} = 1 \text{ to } 3$
			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTYGRAVELS (WITH SOME OR MORE FINES)	GM	SILTY GRAVELS, GRAVEL-SAND- SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I. MORE THAN 4
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I. MORE THAN 7
	SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75mm	CLEAN SANDS (TRACE OR NO FINES)	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 6;\ C_C = \frac{(D_{30})^2}{D_{10}\ x\ D_{60}} = 1 \text{ to } 3$
			SP	POORLY GRADED GRAVELS, GRAVEL- SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
		DIRTY SANDS (WITH SOME OR MORE FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 4
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I MORE THAN 7
FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75µm)	SILTS BELOW "A" LINE NEGLIGIBLE ORGANIC CONTENT	$W_L < 50\%$	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)
		$W_L < 50\%$	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS	
	CLAY ABOVE "A" LINE NEGLIGIBLE ORGANIC CONTENT	$W_L < 30\%$	CL	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY OR SILTY CLAYS, LEAN CLAYS	
		$30\% < W_L < 50\%$	CI	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS	
		$W_L < 50\%$	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	ORGANIC SILTS & CLAYS BELOW "A" LINE	$W_L < 50\%$	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	WHENEVER THE NATURE OF THE FINES CONTENT HAS NOT BEEN DETERMINED, IT IS DESIGNATED BY THE LETTER "F", E.G SF IS A MIXTURE OF SAND WITH SILT OR CLAY
		$W_L < 50\%$	OH	ORGANIC CLAYS OF HIGH PLASTICITY	
HIGH ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR, AND OFTEN FIBROUS TEXTURE

SOIL COMPONENTS					
FRACTION	U.S STANDARD SIEVE SIZE		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS		
GRAVEL	COARSE	PASSING	RETAINED	PERCENT	DESCRIPTOR
		76 mm	19 mm	35-50 20-35	AND Y/EY
	FINE	19 mm	4.75 mm	10-20	SOME
SAND	COARSE	4.75 mm	2.00 mm	1-10	TRACE
	MEDIUM	2.00 mm	425 µm		
	FINE	425 µm	75 µm		
FINES (SILT OR CLAY BASED ON PLASTICITY)		75 µm			
OVERSIZED MATERIAL					
ROUNDED OR SUBROUNDED: COBBLES 76 mm TO 200 mm BOULDERS > 200 mm				NOT ROUNDED: ROCK FRAGMENTS > 76 mm ROCKS> 0.76 CUBIC METRE IN VOLUME	



Note 1: Soils are classified and described according to their engineering properties and behavior.
Note 2: The modifying adjectives used to define the actual or estimated percentage range by weight of minor components are consistent with the Canadian Foundation Engineering Manual (3rd Edition, Canadian Geotechnical Society, 1992)

Results of In-Situ Hydraulic Conductivity Testing

APPENDIX B

Terraprobe Inc.

WELL ID: BH102

Local ID:

Date: 2023-02-16

Time: 0:00

INPUT

Construction:

Casing dia. (d_c) 0.05 Meter

Annulus dia. (d_w) 0.20955 Meter

Screen Length (L) 3.1 Meter

Depths to:

water level (DTW) 0.36 Meter

top of screen (TOS) 3 Meter

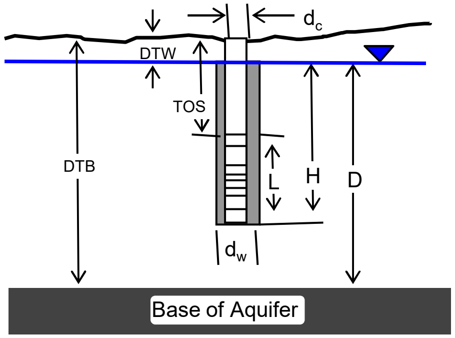
Base of Aquifer (DTB) 8 Meter

Annular Fill:

across screen -- Coarse Sand

above screen -- Bentonite

Aquifer Material -- Till



COMPUTED

L_{wetted} 3.1 Meter

D = 7.64 Meter

H = 5.74 Meter

L/r_w = 29.59

$y_{0\text{-DISPLACEMENT}}$ = 0.93 Meter

$y_{0\text{-SLUG}}$ = 1.02 Meter

From look-up table using L/r_w

Partial penetrate A = 2.499

B = 0.412

ln(Re/rw) = 2.503

Re = 4.20 Meter

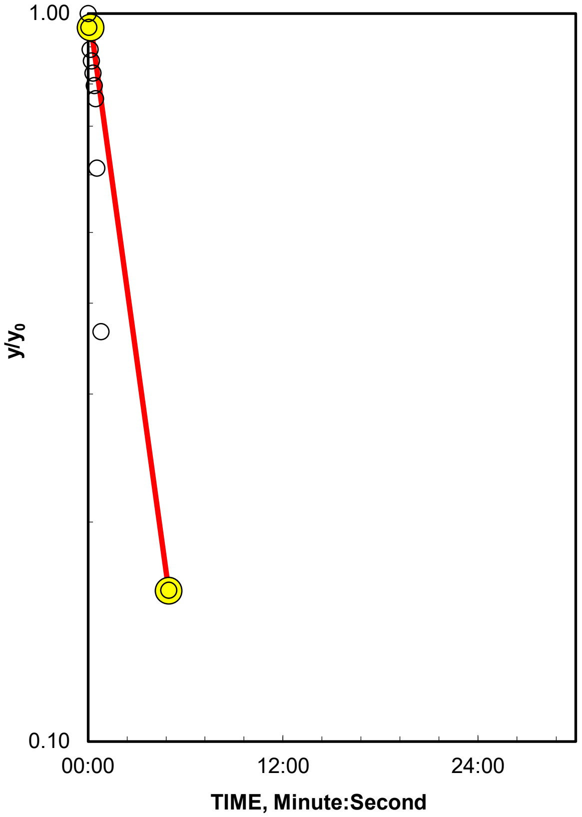
Slope = 0.000448 $\log_{10}$/sec

$t_{90\%}$ recovery = 2230 sec

Input is consistent.

K = 2.6E-07 Meter/Second

Adjust slope of line to estimate K



Reduced Data

Entry	Time, Hr:Min:Sec	Water Level
1	0:00:15.0	5.04
2	0:00:30.0	5.00
3	0:01:00.0	4.94
4	0:01:30.0	4.91
5	0:02:00.0	4.88
6	0:02:30.0	4.85
7	0:03:00.0	4.82
8	0:03:30.0	4.68
9	0:05:00.0	4.45
10	0:10:00.0	4.18
11	0:15:00.0	4.01
12	0:20:00.0	3.57
13	0:30:00.0	4.26
14	0:45:00.0	2.83
15	1:00:00.0	2.40
16	1:15:00.0	1.93
17	1:30:00.0	1.61
18	1:45:00.0	1.25
19	2:00:00.0	1.10
20	2:15:00.0	0.84

WELL ID: BH106

Local ID:
Date: 2023-02-16
Time: 0:00

INPUT

Construction:	
Casing dia. (d_c)	0.05 Meter
Annulus dia. (d_w)	0.20955 Meter
Screen Length (L)	3.1 Meter
Depths to:	
water level (DTW)	0.41 Meter
top of screen (TOS)	3 Meter
Base of Aquifer (DTB)	8 Meter
Annular Fill:	
across screen --	Coarse Sand
above screen --	Bentonite
Aquifer Material --	Till

COMPUTED

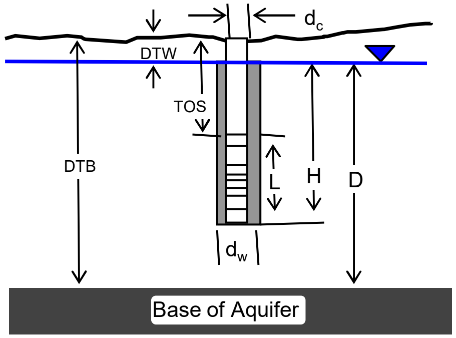
L_{wetted}	3.1 Meter
D =	7.59 Meter
H =	5.69 Meter
L/r_w =	29.59
$y_{0\text{-DISPLACEMENT}}$ =	2.06 Meter
$y_{0\text{-SLUG}}$ =	2.05 Meter

From look-up table using L/r_w

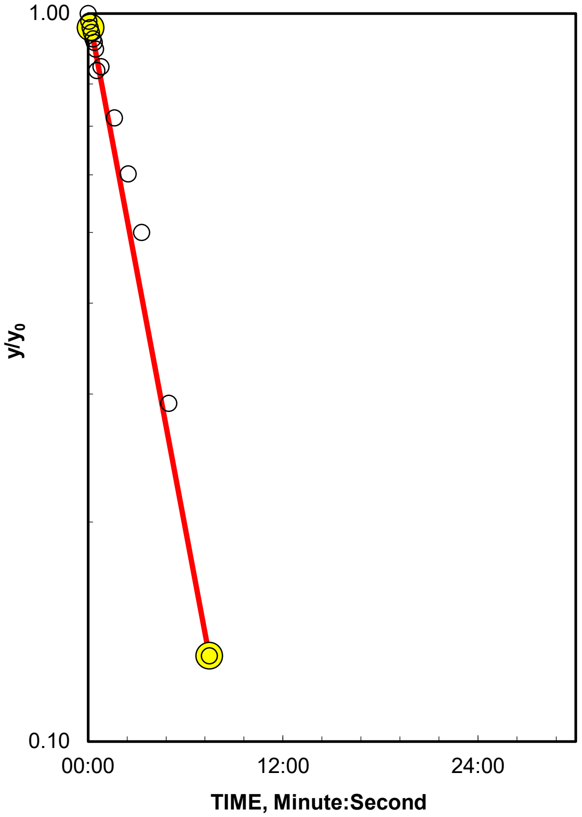
Partial penetrate A =	2.499
B =	0.412
ln(Re/rw) =	2.499
Re =	4.19 Meter
Slope =	0.000329 $\log_{10}$/sec
$t_{90\%}$ recovery =	3041 sec

Input is consistent.

K = 1.9E-07 Meter/Second



Adjust slope of line to estimate K



Reduced Data

Entry	Time, Hr:Min:Sec	Water Level
1	0:00:15.0	6.17
2	0:00:30.0	6.12
3	0:01:00.0	6.08
4	0:01:30.0	6.05
5	0:02:00.0	6.01
6	0:02:30.0	5.99
7	0:03:00.0	5.95
8	0:03:30.0	5.83
9	0:05:00.0	5.85
10	0:10:00.0	5.59
11	0:15:00.0	5.35
12	0:20:00.0	5.14
13	0:30:00.0	4.71
14	0:45:00.0	4.38
15	1:00:00.0	3.97
16	1:15:00.0	3.53

Laboratory Certificates of Analysis

APPENDIX C

Terraprobe Inc.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: **TERRAPROBE INC**
903 Barton Street
Stoney Creek, ON L8E5P5
(905) 643-7560
ATTENTION TO: **Paul Raepple**
PROJECT:
AGAT WORK ORDER: **23H998705**
MICROBIOLOGY ANALYSIS REVIEWED BY: **Nivine Basily, Inorganics Report Writer**
WATER ANALYSIS REVIEWED BY: **Yris Verastegui, Report Reviewer**
DATE REPORTED: **Feb 24, 2023**
PAGES (INCLUDING COVER): **13**
VERSION*: **1**

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.*
- *AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.*
- *This Certificate shall not be reproduced except in full, without the written approval of the laboratory.*
- *The test results reported herewith relate only to the samples as received by the laboratory.*
- *Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.*
- *All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.*

Member of: Association of Professional Engineers and Geoscientists of Alberta (APEGA)
Western Enviro-Agricultural Laboratory Association (WEALA)
Environmental Services Association of Alberta (ESAA)

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation. Measurement Uncertainty is not taken into consideration when stating conformity with a specified requirement.

Certificate of Analysis

AGAT WORK ORDER: 23H998705
PROJECT:

CLIENT NAME: TERRAPROBE INC
ATTENTION TO: Paul Raepple
SAMPLING SITE:
SAMPLED BY:ABC

Total Coliforms & E. Coli (MI-Agar)

DATE RECEIVED: 2023-02-17
DATE REPORTED: 2023-02-24

			SAMPLE DESCRIPTION:	SA1
			SAMPLE TYPE:	Water
			DATE SAMPLED:	2023-02-16 15:00
Parameter	**Unit**	**G / S**	**RDL**	**4786137**
Escherichia coli	CFU/100mL	100		0
Total Coliforms	CFU/100mL			24

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to PWQO * Variable - refer to guideline reference document
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4786137 Escherichia coli, Total Coliforms RDL = 2 CFU/100mL.
RDL > 1 indicates dilutions of the sample.

Presence of sediments was observed upon receipt.

Analysis performed at AGAT Toronto (unless marked by *)

NIVINE BASILY

Certified By:

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 23H998705

PROJECT:

CLIENT NAME: TERRAPROBE INC

ATTENTION TO: Paul Raepple

SAMPLING SITE:

SAMPLED BY:ABC

Water Quality Assessment - PWQO (mg/L)

DATE RECEIVED: 2023-02-17

DATE REPORTED: 2023-02-24

			SAMPLE DESCRIPTION:	SA1
			SAMPLE TYPE:	Water
			DATE SAMPLED:	2023-02-16 15:00
Parameter	**Unit**	**G / S**	**RDL**	**4786137**
Electrical Conductivity	µS/cm		2	1240
pH	pH Units	6.5-8.5	NA	7.85
Saturation pH (Calculated)				6.52
Langelier Index (Calculated)				1.33
Hardness (as CaCO3) (Calculated)	mg/L		0.5	600
Total Dissolved Solids	mg/L		10	764
Alkalinity (as CaCO3)	mg/L		5	394
Bicarbonate (as CaCO3)	mg/L		5	394
Carbonate (as CaCO3)	mg/L		5	<5
Hydroxide (as CaCO3)	mg/L		5	<5
Fluoride	mg/L		0.05	<0.05
Chloride	mg/L		0.12	77.4
Nitrate as N	mg/L		0.05	<0.05
Nitrite as N	mg/L		0.05	<0.05
Bromide	mg/L		0.05	<0.05
Sulphate	mg/L		0.10	208
Ortho Phosphate as P	mg/L		0.10	<0.10
Ammonia as N	mg/L		0.02	0.43
Ammonia-Un-ionized (Calculated)	mg/L	0.02	0.000002	0.0166
Total Phosphorus	mg/L	*	0.02	0.36
Total Organic Carbon	mg/L		0.5	2.1
True Colour	TCU		2.50	<2.50
Turbidity	NTU		0.5	733
Total Calcium	mg/L		0.20	97.4
Total Magnesium	mg/L		0.10	86.7
Total Potassium	mg/L		0.50	21.8
Total Sodium	mg/L		0.10	88.5
Aluminum-dissolved	mg/L	*	0.004	<0.004
Total Antimony	mg/L	0.020	0.001	<0.001

Certified By: Iris Verástegui

Certificate of Analysis

AGAT WORK ORDER: 23H998705
PROJECT:

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: TERRAPROBE INC
SAMPLING SITE:

ATTENTION TO: Paul Raepple
SAMPLED BY:ABC

Water Quality Assessment - PWQO (mg/L)

DATE RECEIVED: 2023-02-17

DATE REPORTED: 2023-02-24

			SAMPLE DESCRIPTION:	SA1
			SAMPLE TYPE:	Water
			DATE SAMPLED:	2023-02-16 15:00
Parameter	**Unit**	**G / S**	**RDL**	**4786137**
Total Arsenic	mg/L	0.1	0.003	0.004
Total Barium	mg/L		0.002	0.046
Total Beryllium	mg/L	*	0.001	<0.001
Total Boron	mg/L	0.2	0.010	**0.918**
Total Cadmium	mg/L	0.0002	0.0001	<0.0001
Total Chromium	mg/L		0.003	0.005
Total Cobalt	mg/L	0.0009	0.0005	**0.0025**
Total Copper	mg/L	0.005	0.001	0.005
Total Iron	mg/L	0.3	0.010	**3.61**
Total Lead	mg/L	*	0.001	0.002
Total Manganese	mg/L		0.002	0.157
Dissolved Mercury	mg/L	0.0002	0.0001	<0.0001
Total Molybdenum	mg/L	0.040	0.002	0.009
Total Nickel	mg/L	0.025	0.003	0.005
Total Selenium	mg/L	0.1	0.002	<0.002
Total Silver	mg/L	0.0001	0.0001	<0.0001
Total Strontium	mg/L		0.010	10.6
Total Thallium	mg/L	0.0003	0.0003	<0.0003
Total Tin	mg/L		0.002	<0.002
Total Titanium	mg/L		0.010	0.120
Total Tungsten	mg/L	0.030	0.010	<0.010
Total Uranium	mg/L	0.005	0.002	<0.002
Total Vanadium	mg/L	0.006	0.002	**0.007**
Total Zinc	mg/L	0.030	0.020	<0.020
Total Zirconium	mg/L	0.004	0.004	<0.004

Certified By: Iris Verástegui

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: TERRAPROBE INC **ATTENTION TO: Paul Raepple**

SAMPLING SITE: **SAMPLED BY:ABC**

Water Quality Assessment - PWQO (mg/L)

DATE RECEIVED: 2023-02-17 **DATE REPORTED: 2023-02-24**

Comments:	RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to PWQO * Variable - refer to guideline reference document Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.
4786137	Dilution required, RDL has been increased accordingly. Un-ionized Ammonia detection limit is a calculated RDL. The calculation of Un-ionized Ammonia is based on lab measured parameters (ammonia as N, pH and temperature).Values are reported as calculated.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: Iris Verástegui

Exceedance Summary

AGAT WORK ORDER: 23H998705

PROJECT:

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: TERRAPROBE INC

ATTENTION TO: Paul Raepple

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
4786137	SA1	ON PWQO	Water Quality Assessment - PWQO (mg/L)	Total Boron	mg/L	0.2	0.918
4786137	SA1	ON PWQO	Water Quality Assessment - PWQO (mg/L)	Total Cobalt	mg/L	0.0009	0.0025
4786137	SA1	ON PWQO	Water Quality Assessment - PWQO (mg/L)	Total Iron	mg/L	0.3	3.61
4786137	SA1	ON PWQO	Water Quality Assessment - PWQO (mg/L)	Total Vanadium	mg/L	0.006	0.007

Quality Assurance

CLIENT NAME: TERRAPROBE INC
PROJECT:
SAMPLING SITE:

AGAT WORK ORDER: 23H998705
ATTENTION TO: Paul Raepple
SAMPLED BY:ABC

Microbiology Analysis

RPT Date: Feb 24, 2023			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Total Coliforms & E. Coli (MI-Agar)															
Escherichia coli	4786137	4786137	0	0	NA										
Total Coliforms	4786137	4786137	24	22	8.7%										

Comments: NA - % RPD Not Applicable.

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
NIVINE BASILY
CHEMIST

Certified By: Nivine Basily

Quality Assurance

CLIENT NAME: TERRAPROBE INC
PROJECT:
SAMPLING SITE:

AGAT WORK ORDER: 23H998705
ATTENTION TO: Paul Raepple
SAMPLED BY:ABC

Water Analysis

RPT Date: Feb 24, 2023			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Water Quality Assessment - PWQO (mg/L)															
Electrical Conductivity	4786137	4786137	1240	1240	0.0%	< 2	104%	90%	110%						
pH	4786137	4786137	7.85	7.94	1.1%	NA	99%	90%	110%						
Total Dissolved Solids	4786137	4786137	764	780	2.1%	< 10	96%	80%	120%						
Alkalinity (as CaCO3)	4786137	4786137	394	406	3.0%	< 5	98%	80%	120%						
Bicarbonate (as CaCO3)	4786137	4786137	394	406	3.0%	< 5	NA								
Carbonate (as CaCO3)	4786137	4786137	<5	<5	NA	< 5	NA								
Hydroxide (as CaCO3)	4786137	4786137	<5	<5	NA	< 5	NA								
Fluoride	4785602		<0.05	<0.05	NA	< 0.05	101%	70%	130%	101%	80%	120%	93%	70%	130%
Chloride	4785602		81.2	85.2	4.8%	< 0.10	96%	70%	130%	101%	80%	120%	109%	70%	130%
Nitrate as N	4785602		<0.05	<0.05	NA	< 0.05	99%	70%	130%	100%	80%	120%	99%	70%	130%
Nitrite as N	4785602		<0.05	<0.05	NA	< 0.05	101%	70%	130%	108%	80%	120%	111%	70%	130%
Bromide	4785602		<0.05	<0.05	NA	< 0.05	107%	70%	130%	95%	80%	120%	93%	70%	130%
Sulphate	4785602		126	125	0.8%	< 0.10	96%	70%	130%	104%	80%	120%	NA	70%	130%
Ortho Phosphate as P	4785602		<0.10	<0.10	NA	< 0.10	99%	70%	130%	94%	80%	120%	92%	70%	130%
Ammonia as N	4790587		<0.02	<0.02	NA	< 0.02	101%	70%	130%	102%	80%	120%	94%	70%	130%
Total Phosphorus	4786137	4786137	0.36	0.39	8.0%	< 0.02	96%	70%	130%	107%	80%	120%	NA	70%	130%
Total Organic Carbon	4786137	4786137	2.1	2.1	NA	< 0.5	103%	90%	110%	99%	90%	110%	88%	80%	120%
True Colour	4774044		4.96	4.62	NA	< 2.5	103%	90%	110%						
Turbidity	4786137	4786137	733	749	2.2%	< 0.5	112%	80%	120%						
Total Calcium	4787432		248	244	1.6%	< 0.20	102%	70%	130%	108%	80%	120%	95%	70%	130%
Total Magnesium	4787432		16.5	16.2	1.8%	< 0.10	110%	70%	130%	116%	80%	120%	123%	70%	130%
Total Potassium	4787432		28.4	29.4	3.5%	< 0.50	106%	70%	130%	116%	80%	120%	115%	70%	130%
Total Sodium	4787432		102	100	2.0%	< 0.10	109%	70%	130%	111%	80%	120%	NA	70%	130%
Aluminum-dissolved	4795078		<0.004	<0.004	NA	< 0.004	96%	70%	130%	105%	80%	120%	102%	70%	130%
Total Antimony	4787432		<0.001	<0.001	NA	< 0.001	104%	70%	130%	107%	80%	120%	122%	70%	130%
Total Arsenic	4787432		<0.003	<0.003	NA	< 0.003	95%	70%	130%	99%	80%	120%	113%	70%	130%
Total Barium	4787432		0.020	0.021	4.9%	< 0.002	106%	70%	130%	111%	80%	120%	121%	70%	130%
Total Beryllium	4787432		<0.001	<0.001	NA	< 0.001	105%	70%	130%	111%	80%	120%	117%	70%	130%
Total Boron	4787432		<0.010	<0.010	NA	< 0.010	104%	70%	130%	115%	80%	120%	120%	70%	130%
Total Cadmium	4787432		<0.0001	<0.0001	NA	< 0.0001	102%	70%	130%	106%	80%	120%	121%	70%	130%
Total Chromium	4787432		<0.003	<0.003	NA	< 0.003	98%	70%	130%	100%	80%	120%	114%	70%	130%
Total Cobalt	4787432		<0.0005	<0.0005	NA	< 0.0005	101%	70%	130%	105%	80%	120%	115%	70%	130%
Total Copper	4787432		<0.001	<0.001	NA	< 0.001	99%	70%	130%	99%	80%	120%	108%	70%	130%
Total Iron	4787432		0.014	<0.010	NA	< 0.010	100%	70%	130%	105%	80%	120%	115%	70%	130%
Total Lead	4787432		<0.001	<0.001	NA	< 0.001	95%	70%	130%	94%	80%	120%	102%	70%	130%
Total Manganese	4787432		0.071	0.063	11.9%	< 0.002	101%	70%	130%	105%	80%	120%	118%	70%	130%
Dissolved Mercury	4786137	4786137	<0.0001	<0.0001	NA	< 0.0001	103%	70%	130%	102%	80%	120%	97%	70%	130%
Total Molybdenum	4787432		0.003	0.002	NA	< 0.002	102%	70%	130%	107%	80%	120%	121%	70%	130%
Total Nickel	4787432		0.005	<0.003	NA	< 0.003	101%	70%	130%	104%	80%	120%	110%	70%	130%

Quality Assurance

CLIENT NAME: TERRAPROBE INC
PROJECT:
SAMPLING SITE:

AGAT WORK ORDER: 23H998705
ATTENTION TO: Paul Raepple
SAMPLED BY:ABC

Water Analysis (Continued)

RPT Date: Feb 24, 2023			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Total Selenium	4787432		0.007	0.005	NA	< 0.002	99%	70%	130%	95%	80%	120%	112%	70%	130%
Total Silver	4787432		<0.0001	<0.0001	NA	< 0.0001	103%	70%	130%	106%	80%	120%	108%	70%	130%
Total Strontium	4787432		2.54	2.48	2.4%	< 0.005	99%	70%	130%	103%	80%	120%	NA	70%	130%
Total Thallium	4787432		<0.0003	<0.0003	NA	< 0.0003	95%	70%	130%	102%	80%	120%	110%	70%	130%
Total Tin	4787432		<0.002	<0.002	NA	< 0.002	108%	70%	130%	104%	80%	120%	116%	70%	130%
Total Titanium	4787432		<0.010	<0.010	NA	< 0.010	99%	70%	130%	103%	80%	120%	124%	70%	130%
Total Tungsten	4787432		<0.010	<0.010	NA	< 0.010	99%	70%	130%	101%	80%	120%	100%	70%	130%
Total Uranium	4787432		0.012	0.012	0.0%	< 0.002	92%	70%	130%	105%	80%	120%	115%	70%	130%
Total Vanadium	4787432		<0.002	<0.002	NA	< 0.002	100%	70%	130%	106%	80%	120%	119%	70%	130%
Total Zinc	4787432		<0.020	<0.020	NA	< 0.020	100%	70%	130%	98%	80%	120%	113%	70%	130%
Total Zirconium	4787432		<0.004	<0.004	NA	< 0.004	101%	70%	130%	103%	80%	120%	116%	70%	130%

Comments: NA signifies Not Applicable.
If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.
Matrix spike: Spike level < native concentration. Matrix spike acceptance limits do not apply.

Certified By: Iris Verástegui

Method Summary

CLIENT NAME: TERRAPROBE INC **AGAT WORK ORDER: 23H998705**

PROJECT: **ATTENTION TO: Paul Raepple**

SAMPLING SITE: **SAMPLED BY:ABC**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Microbiology Analysis			
Escherichia coli	MIC-93-7010	EPA 1604	Membrane Filtration
Total Coliforms	MIC-93-7010	EPA 1604	Membrane Filtration

Method Summary

CLIENT NAME: TERRAPROBE INC
PROJECT:
SAMPLING SITE:

AGAT WORK ORDER: 23H998705
ATTENTION TO: Paul Raepple
SAMPLED BY:ABC

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Electrical Conductivity	INOR-93-6000	modified from SM 2510 B	PC TITRATE
pH	INOR-93-6000	modified from SM 4500-H+ B	PC TITRATE
Saturation pH (Calculated)		SM 2320 B	CALCULATION
Langelier Index (Calculated)		SM 2330B	CALCULATION
Hardness (as CaCO3) (Calculated)	MET-93-6105	modified from EPA SW-846 6010C & 200.7 & SM 2340 B	CALCULATION
Total Dissolved Solids	INOR-93-6028	modified from EPA 1684,ON MOECC E3139,SM 2540C,D	BALANCE
Alkalinity (as CaCO3)	INOR-93-6000	Modified from SM 2320 B	PC TITRATE
Bicarbonate (as CaCO3)	INOR-93-6000	modified from SM 2320 B	PC TITRATE
Carbonate (as CaCO3)	INOR-93-6000	modified from SM 2320 B	PC TITRATE
Hydroxide (as CaCO3)	INOR-93-6000	modified from SM 2320 B	PC TITRATE
Fluoride	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Chloride	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Nitrate as N	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Bromide	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Ortho Phosphate as P	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Ammonia as N	INOR-93-6059	modified from SM 4500-NH3 H	LACHAT FIA
Ammonia-Un-ionized (Calculated)		MOE REFERENCE, PWQOs Tab 2	CALCULATION
Total Phosphorus	INOR-93-6022	modified from SM 4500-P B and SM 4500-P E	SPECTROPHOTOMETER
Total Organic Carbon	INOR-93-6049	modified from SM 5310 B	SHIMADZU CARBON ANALYZER
True Colour	INOR-93-6074	modified from SM 2120 B	LACHAT FIA
Turbidity	INOR-93-6000	modified from SM 2130 B	PC TITRATE
Total Calcium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP/MS
Total Magnesium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP/MS
Total Potassium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP/MS
Total Sodium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP/MS
Aluminum-dissolved	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Total Antimony	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Arsenic	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Barium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Beryllium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Boron	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Cadmium	MET -93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Chromium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Cobalt	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS

Method Summary

CLIENT NAME: TERRAPROBE INC
PROJECT:
SAMPLING SITE:

AGAT WORK ORDER: 23H998705
ATTENTION TO: Paul Raepple
SAMPLED BY:ABC

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Total Copper	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Iron	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Lead	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Manganese	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Dissolved Mercury	MET-93-6100	modified from EPA 245.2 and SM 3112 B	CVAAS
Total Molybdenum	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Nickel	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Selenium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Silver	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Strontium	INOR-93-6003	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Thallium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Tin	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Titanium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Tungsten	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Uranium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Vanadium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Zinc	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Zirconium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS

AGAT Laboratories

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Short Holding Time

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 23H998705

Cooler Quantity: MD COOLER

Arrival Temperatures: 2.3 | 3.0 | 3.2
3.1 | 2.8 | 3.2

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes: BAGGED ICE

Report Information:

Company: Terraprobe Inc

Contact: Paul Raepple

Address: 903 Barton St. East, Stoney Creek
unit 23

Phone: 905 643 7560 Fax:

Reports to be sent to:

1. Email: praepple@terraprobe.ca
2. Email: aburden@terraprobe.ca

Regulatory Requirements:

(Please check all applicable boxes)

☐ Regulation 153/04

Table ______ *Indicate One*

☐ Ind/Com
☐ Res/Park
☐ Agriculture

Soil Texture *(Check One)*

☐ Coarse
☐ Fine

☐ Excess Soils R406

Table ______ *Indicate One*

☐ Regulation 558

☐ CCME

☐ Sewer Use

☐ Sanitary ☐ Storm

______ *Region*

☑ Prov. Water Quality Objectives (PWQO)

☐ Other

______ *Indicate One*

Is this submission for a **Record of Site Condition?**

☐ Yes ☑ No

Report Guideline on *Certificate of Analysis*

☑ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply): ______

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project:

Site Location:

Sampled By: ABC

AGAT Quote #: ______ PO: ______

Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company:

Contact:

Address:

Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI, DOC Y / N	O. Reg 153 Metals & Inorganics	O. Reg 153 Metals - ☐ CrVI, ☐ Hg, ☐ HWSB	O. Reg 153 BTEX, F1-F4 PHCs	PAHs	PCBs	VOC	Aroclors	O. Reg 558 Landfill Disposal Characterization TCLP: TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	O. Reg 406 Excess Soils SPLP Rainwater Leach SPLP: ☐ Metals ☐ VOCs ☐ SVOCs	O. Reg 406 Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4	☐ Corrosivity: Include Moisture ☐ Sulphide ☐	WQA	E.Coli	Total Coliform				Potentially Hazardous or High Concentration (Y/N)
SA1	16Feb23	3:00 AM PM	11	GW														✓	✓	✓				
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						
		AM PM																						

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time	
Amanda Burden	17Feb23	240	DTAC	Feb17/23	240pm	'23 FEB 17 4:29 PM
DTAC	Feb 17/23	3pm				Page 1 of 1
						Nº: T - 139354

Pink Copy - Client | Yellow Copy - AGAT | White Copy- AGAT

Site Plans

APPENDIX D

Terraprobe Inc.

DRAFT PLAN OF SUBDIVISION
FILE 24T-22001/M

PART OF LOT 7 & 8
CONCESSION 4, NEW SURVEY

(GEOGRAPHIC TOWNSHIP OF TRAFALGAR)
TOWN OF MILTON
REGIONAL MUNICIPALITY OF HALTON

GARITO BARBUTO TOR

OWNER'S AUTHORIZATION

I HEREBY AUTHORIZE KORSIAK URBAN PLANNING TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION TO THE TOWN OF MILTON FOR APPROVAL.

SIGNED DATE April 20, 2022
Jason Suddergaard, A.S.O.
Mattamy (Brownridge) Limited
433 Steeles Avenue East, Suite 110
Milton, Ontario L9T 8Z4

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LANDS TO BE SUBDIVIDED AS SHOWN ON THIS PLAN AND THEIR RELATIONSHIP TO ADJACENT LANDS ARE CORRECTLY AND ACCURATELY SHOWN.

SIGNED R DenBroeder DATE November 24, 2021
Ross DenBroeder, Ontario Land Surveyor

rpe
R-PE SURVEYING LTD.
ONTARIO LAND SURVEYORS
643 CHRISLEA ROAD, SUITE 7, WOODBRIDGE, ONTARIO L4L 8A3
Tel.(416)635-5000 Fax (416)635-5001

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

A) SHOWN ON PLAN
B) SHOWN ON PLAN
C) SHOWN ON PLAN
D) SHOWN ON PLAN
E) SHOWN ON PLAN
F) SHOWN ON PLAN
G) SHOWN ON PLAN
H) MUNICIPAL AND PIPED WATER TO BE PROVIDED
I) CLAY LOAM
J) SHOWN ON PLAN
K) SANITARY AND STORM SEWERS TO BE PROVIDED
L) SHOWN ON PLAN

LAND USE SCHEDULE

Land Use	Blocks	Block Total	Area (ha)	Units
Minor Sub Node	1	1	3.01	TBD
	2-4	3	0.36	18
Single Detached	5-576	572	17.89	572
Townhouse	577-595	19	2.29	115
Medium Density Residential	596-598	3	4.10	TBD
Open Space Block	599	1	0.13	
Creek Block	600, 601	2	2.68	
Environmental Buffer Block	602-605	4	1.74	
Trail Block	606-608	3	0.44	
Woodlot Block	609, 610	2	1.89	
Woodlot Buffer Block	611, 612	2	0.49	
Servicing Block	613-618	6	0.25	
Stormwater Management Pond Block	619, 620	2	5.05	
Stormwater Pond Buffer Block	621-624	4	0.77	
Walkway Block	625, 626	2	0.08	
Grading Block	627-631	5	0.16	
0.3m Reserve	632-636	5	0.00	
16m ROW (4,188 m)			6.86	
20m ROW (476 m)			0.95	
24m ROW (263 m)			0.63	
26m ROW (820 m)			2.16	
Totals	636	636	51.93	705

DATE [D.M.Y]	REVISION	DWG	BY
20/10/22	Second Submission - revisions to road network	B	KC
18/04/22	Original Submission	A	SP

NOTES:

- * Local/Local corner radii = 5m
- * Local/Collector corner triangle = 7.5m
- * Collector/Collector corner triangle = 10m
- * Collector/Arterial corner triangle = 15m
- * Pavement illustration is diagrammatic

mattamyHOMES

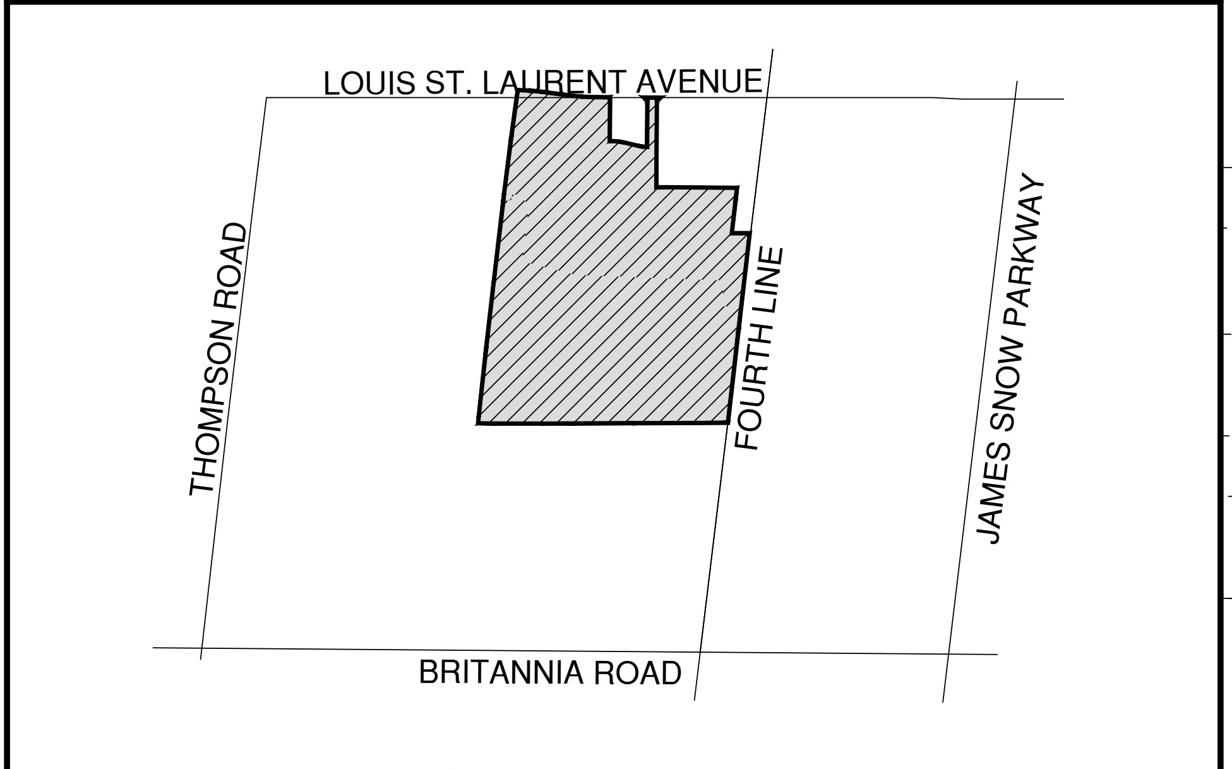
SCALE 1:2000
October 20, 2022
DRAWN BY: MS
CHECKED BY: KC
B

KORSIAK Urban Planning
206-277 Lakeshore Road East
Oakville, Ontario L6J 1H9
T: 905-257-0227
info@korsiak.com

SDE CALCULATIONS

Unit Type	Blocks	Units	SDE*
Minor Sub Node	1	TBD	TBD
	2-4	18	13.7
Single Detached	5-576	572	572.0
Townhouse	577-595	115	87.4
Medium Density Residential	596-598	TBD	TBD
Totals		705	673.1

* SDE Factors:
Single Detached - 1.00
Townhouse - 0.76
Medium Density Residential & Minor Sub Node - TBD



KEY MAP
N.T.S.

▨ SUBJECT LANDS

s:\korsiak & company\mattamy\milton phase 3\garito barbuto south tor\draft plan\2022-10\tor - draft plan - oct 20 22_kc.dwg

LEGEND

🟧	SITE BOUNDARY
⇨	STORM OVERLAND FLOW ARROW
⇨	EXTERNAL STORM OVERLAND FLOW ARROW
⇨	EMERGENCY OVERLAND FLOW ARROW
187.60	PROPOSED CENTERLINE ELEVATION
[187.24]	PROPOSED CENTERLINE ELEVATION BY OTHERS
193.50 / 193.50	PROPOSED ELEVATION EXISTING ELEVATION
244.50	EXISTING CONTOUR ELEVATION
	EXISTING WATERCOURSE

CUT-FILL DEPTH ALONG CENTER LINE:

CUT DEPTH (m)		FILL DEPTH (m)	
0 - 1	☐	0 - 1	☐
1 - 2	🟨	1 - 2	🟦
2 - 3	🟧	2 - 3	🟦
> 3	🟥	> 3	🟦

DWG # 2

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Markham, Ontario, L3R 0E7
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MATTAMY - TOR

TOWN OF MILTON

CONCEPTUAL GRADING PLAN

SCALE:	1:1000	PROJECT No.:	15-786
DATE:	FEBRUARY 2023	DRAWING:	1

LEGEND

SITE BOUNDARY

STORM OVERLAND FLOW ARROW

EXTERNAL STORM OVERLAND FLOW ARROW

EMERGENCY OVERLAND FLOW ARROW

187.60 PROPOSED CENTERLINE ELEVATION

[187.24] PROPOSED CENTERLINE ELEVATION BY OTHERS

193.50 / 193.50 PROPOSED ELEVATION / EXISTING ELEVATION

244.50 EXISTING CONTOUR ELEVATION

EXISTING WATERCOURSE

CUT-FILL DEPTH ALONG CENTER LINE:

CUT DEPTH (m)		FILL DEPTH (m)	
0 - 1	⬜	0 - 1	⬜
1 - 2	🟨	1 - 2	🟦
2 - 3	🟧	2 - 3	🟦
> 3	🟥	> 3	🟦

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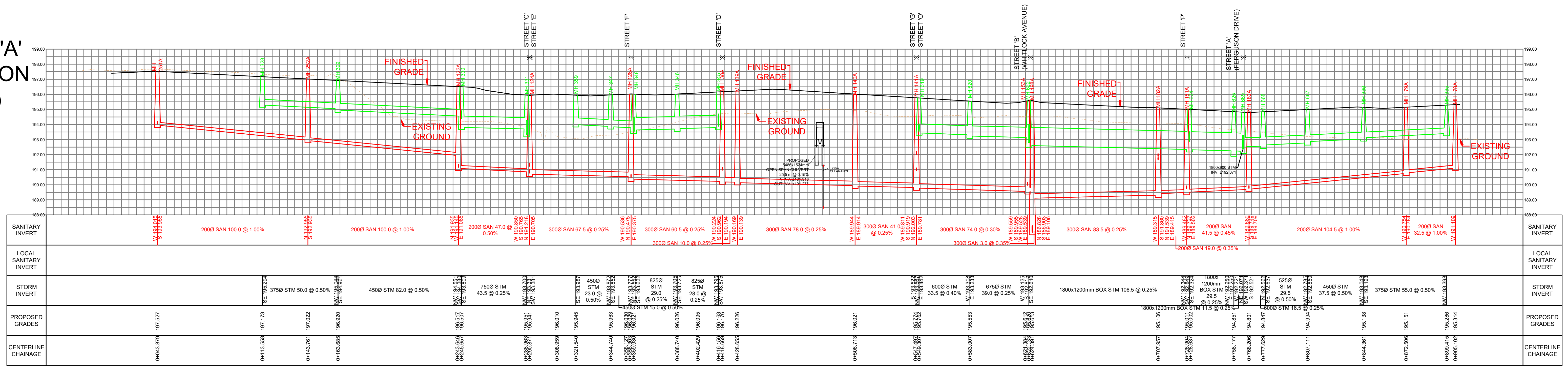
TOWN OF MILTON

CONCEPTUAL GRADING PLAN

SCALE: 1:1000
PROJECT No.: 15-786
DATE: FEBRUARY 2023
DRAWING: 2

STREET 'A'
(FERGUSON
DRIVE)



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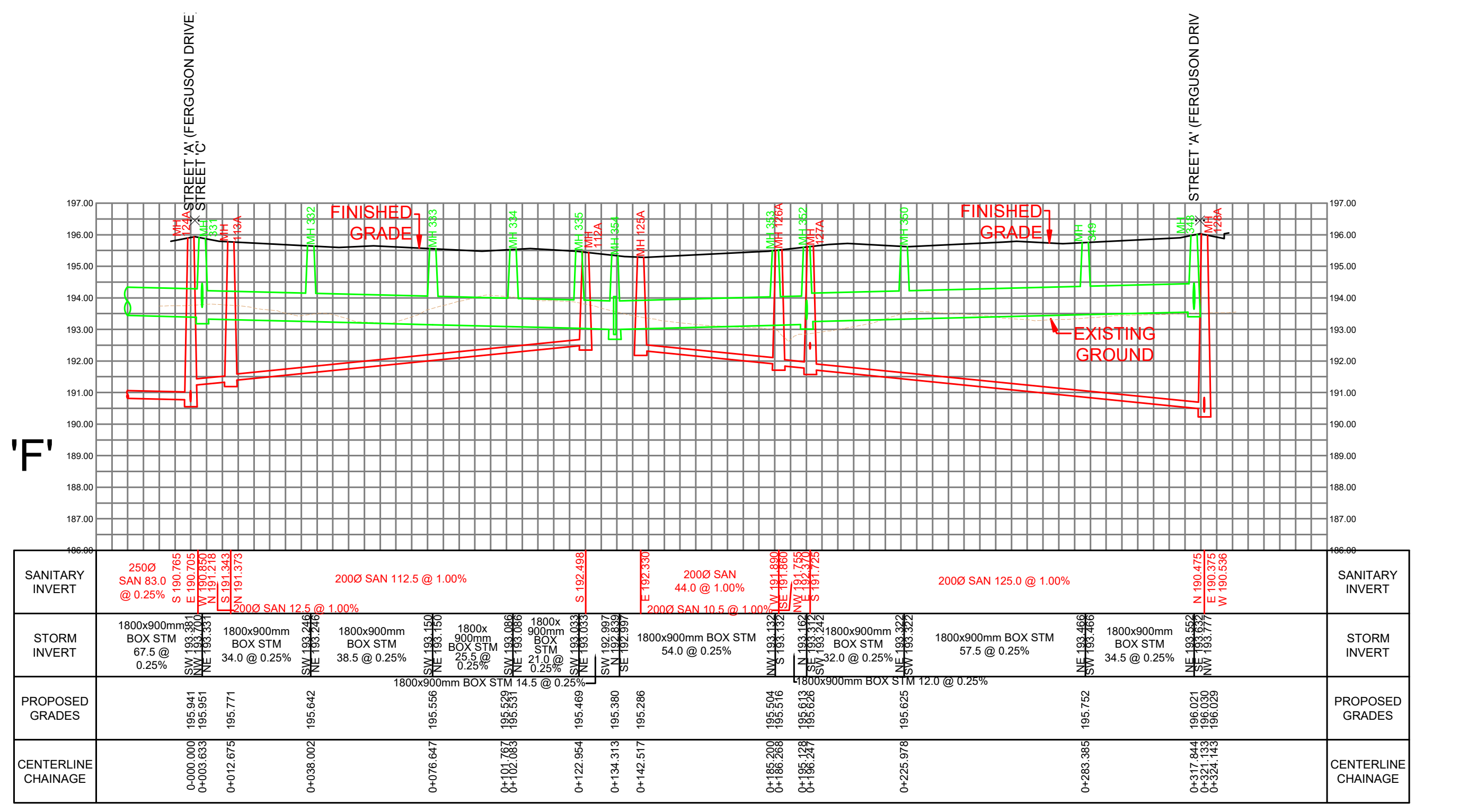

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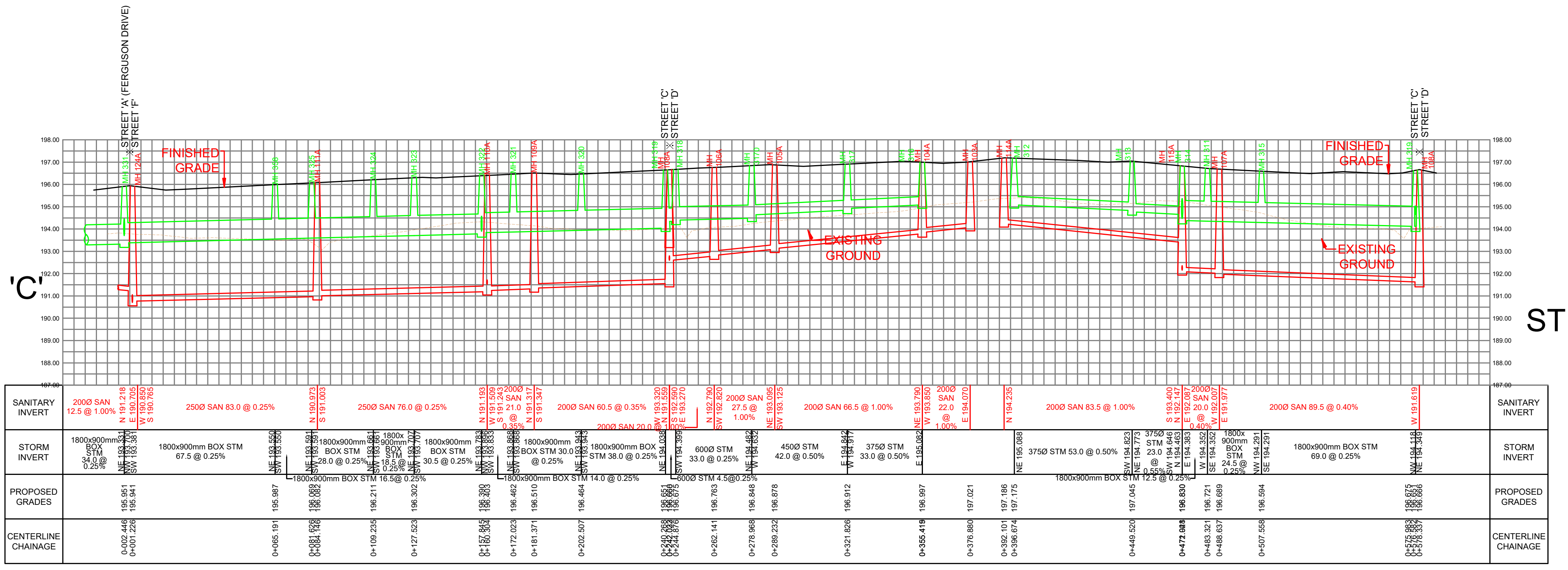

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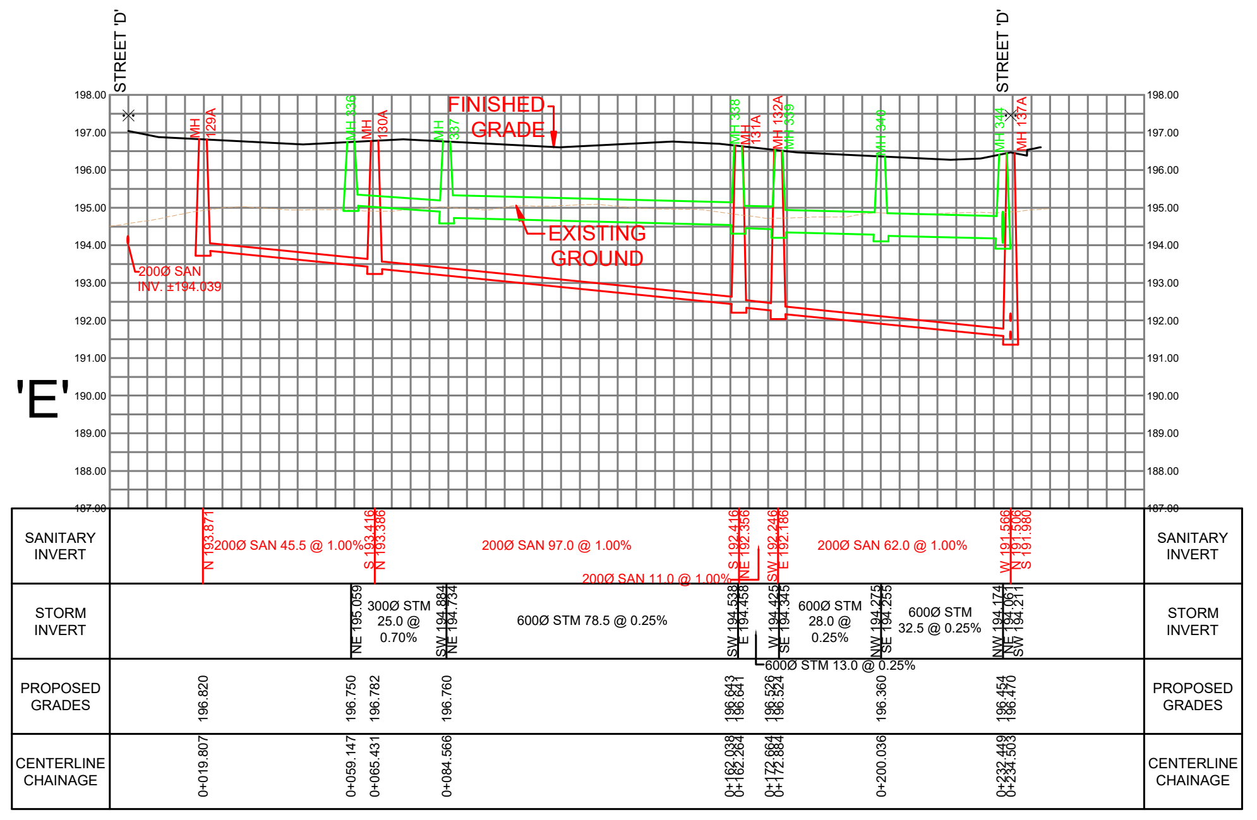
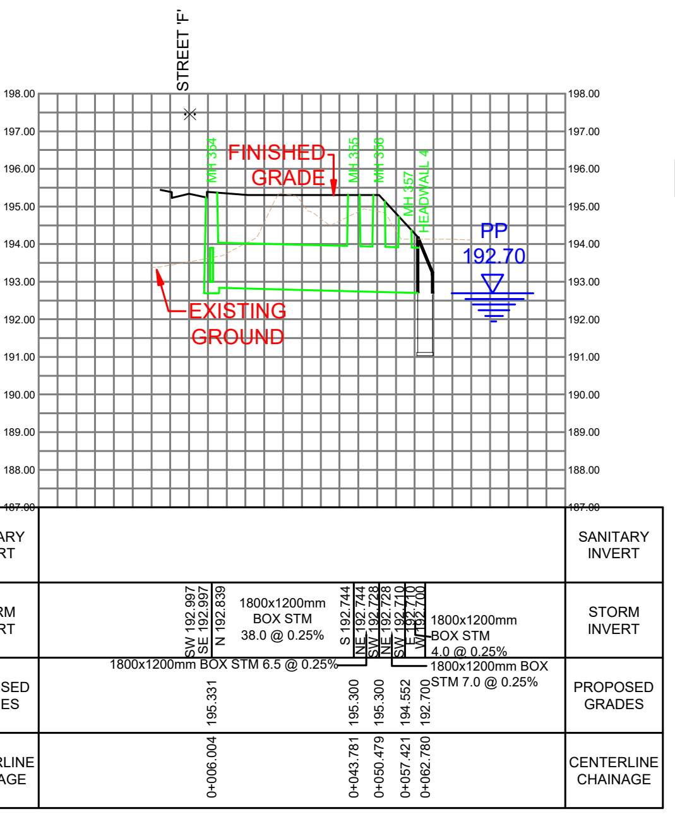
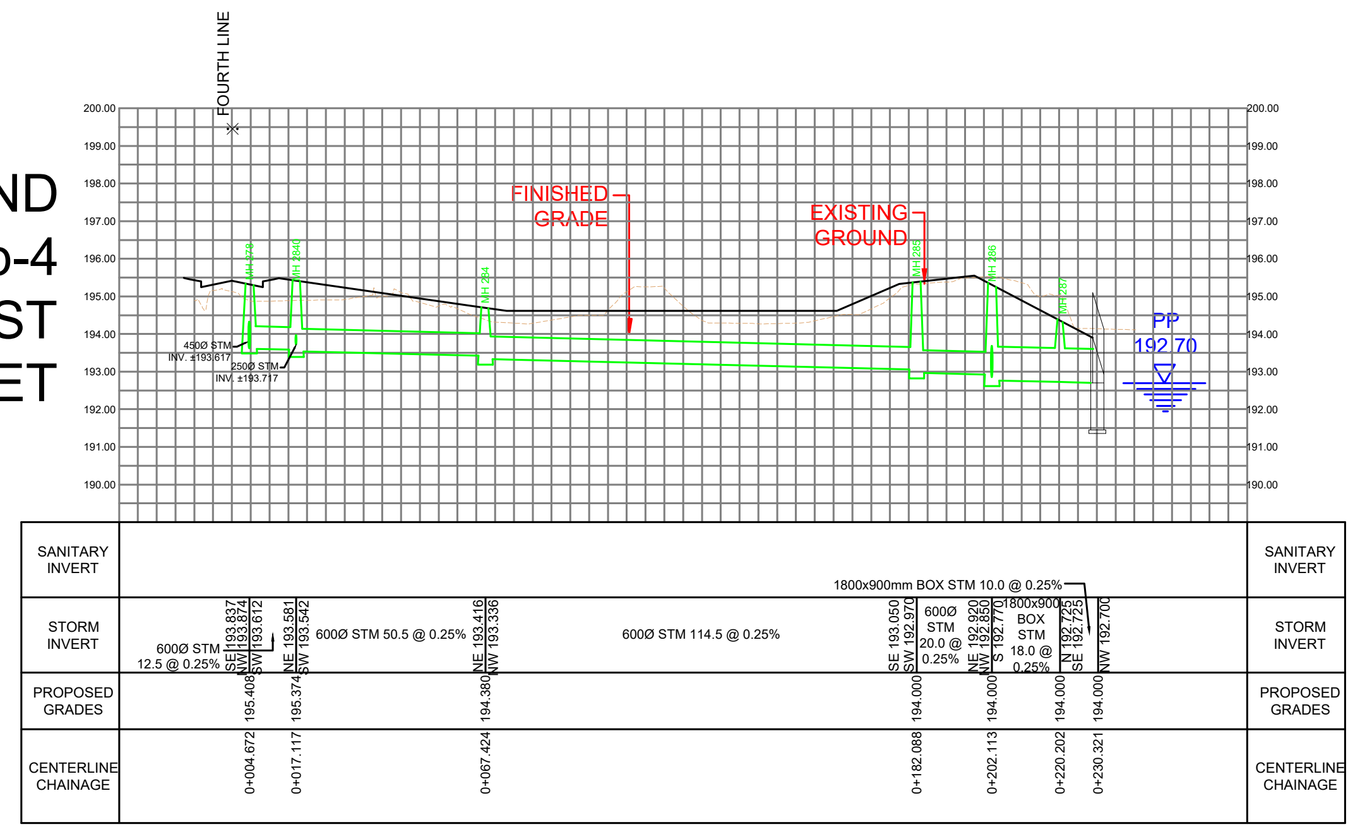


POND
S5b-4
WEST
INLET



POND
S5b-4
EAST
INLET



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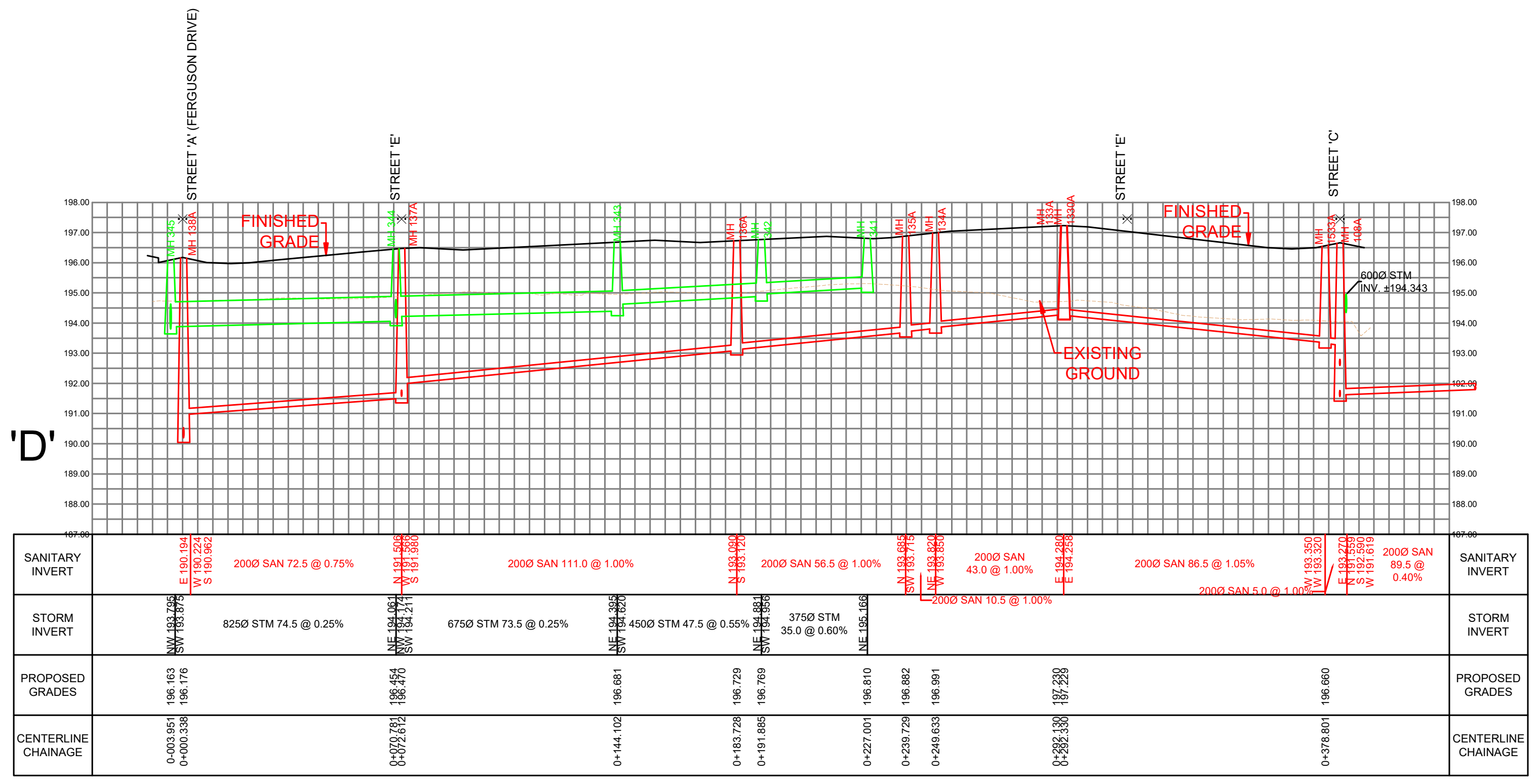
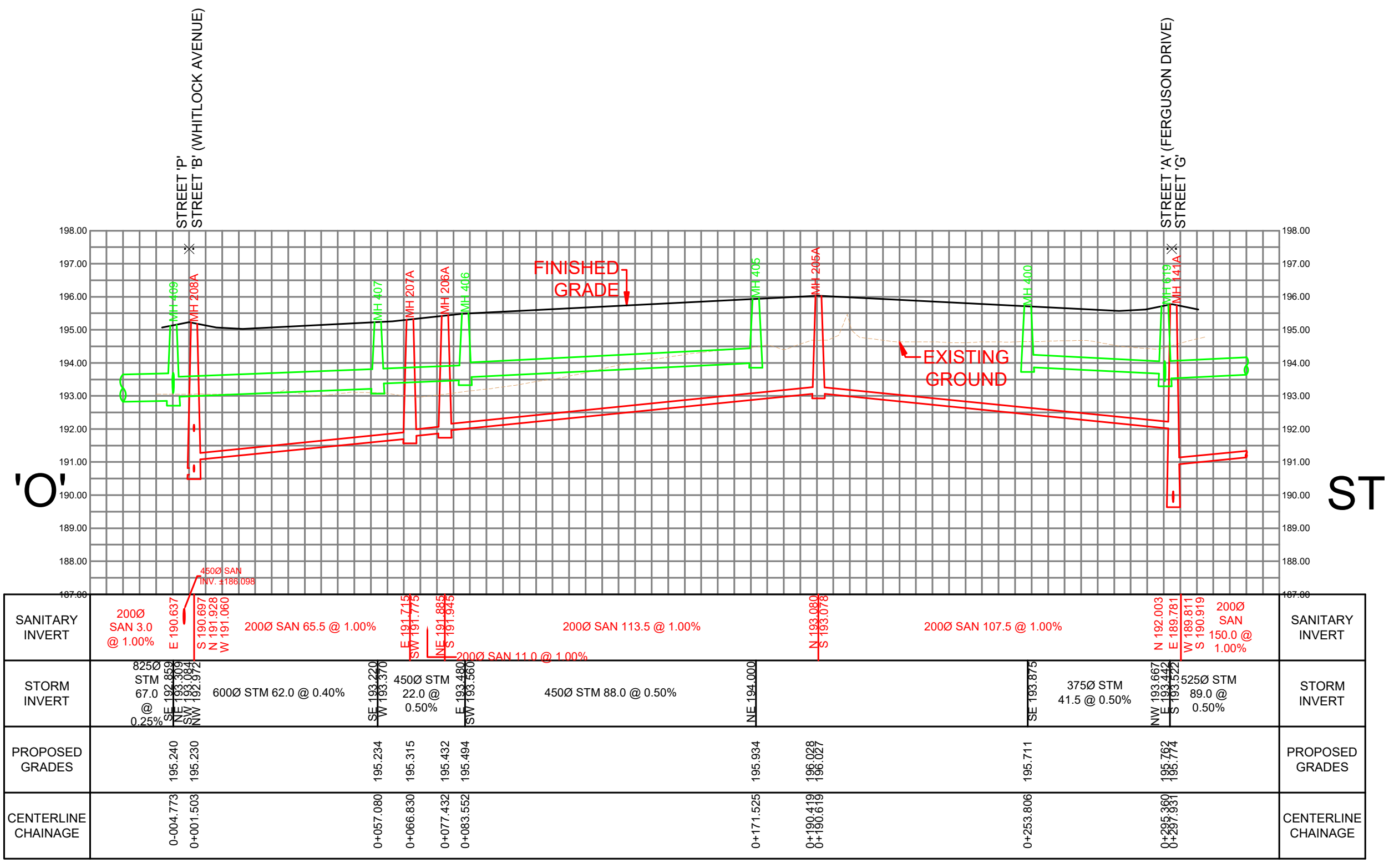
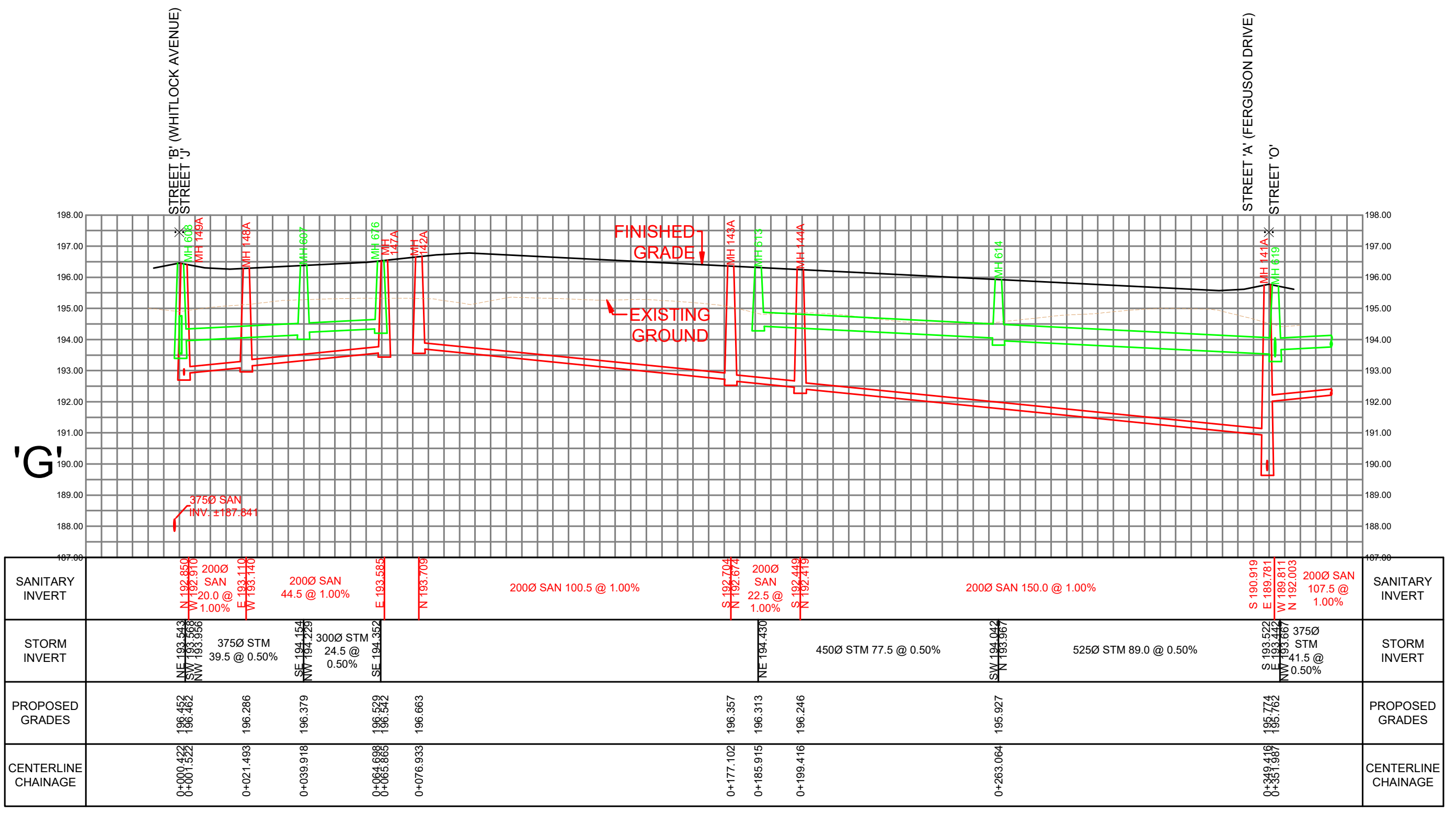


STREET 'O'



STREET 'G'



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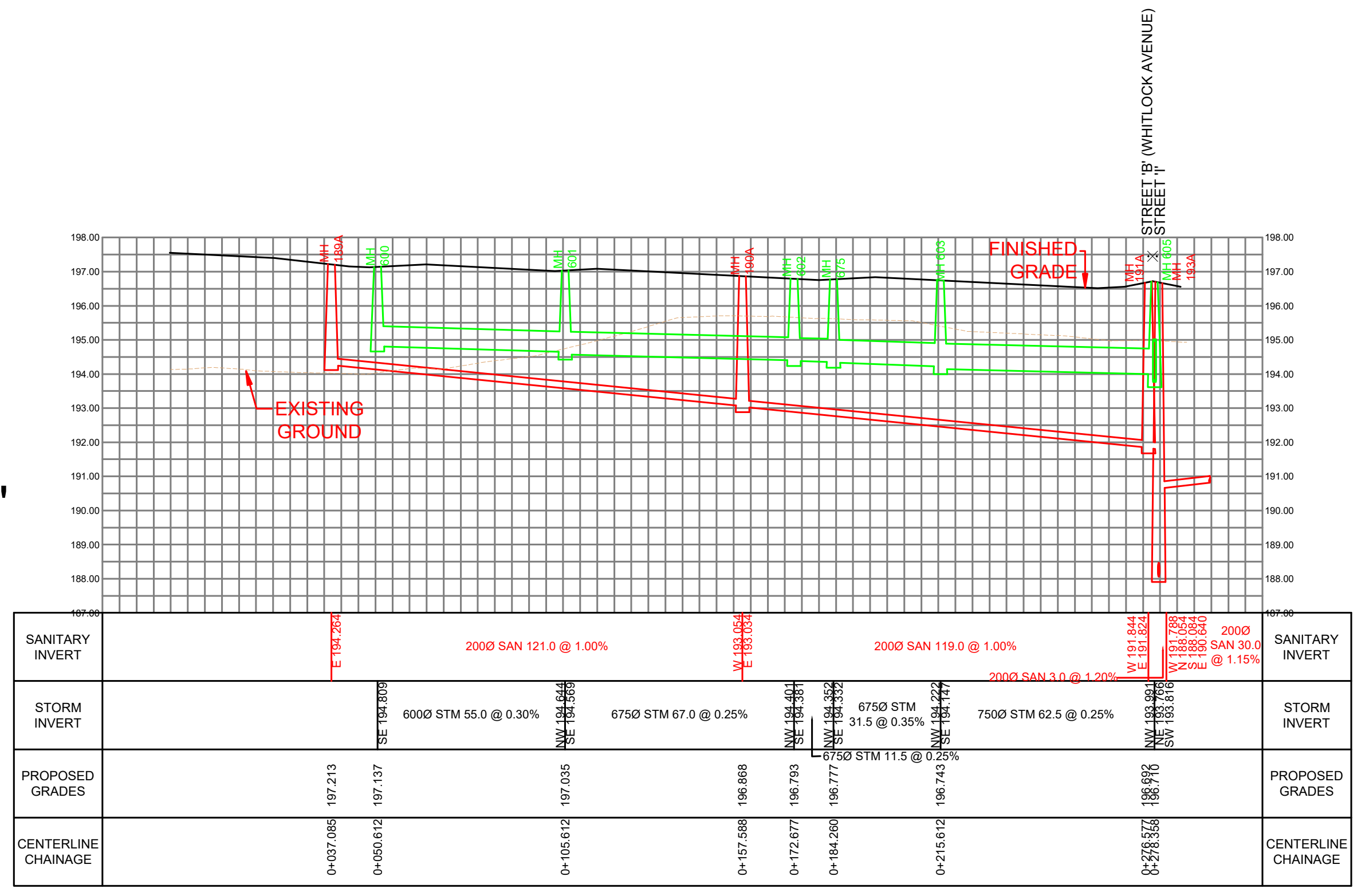
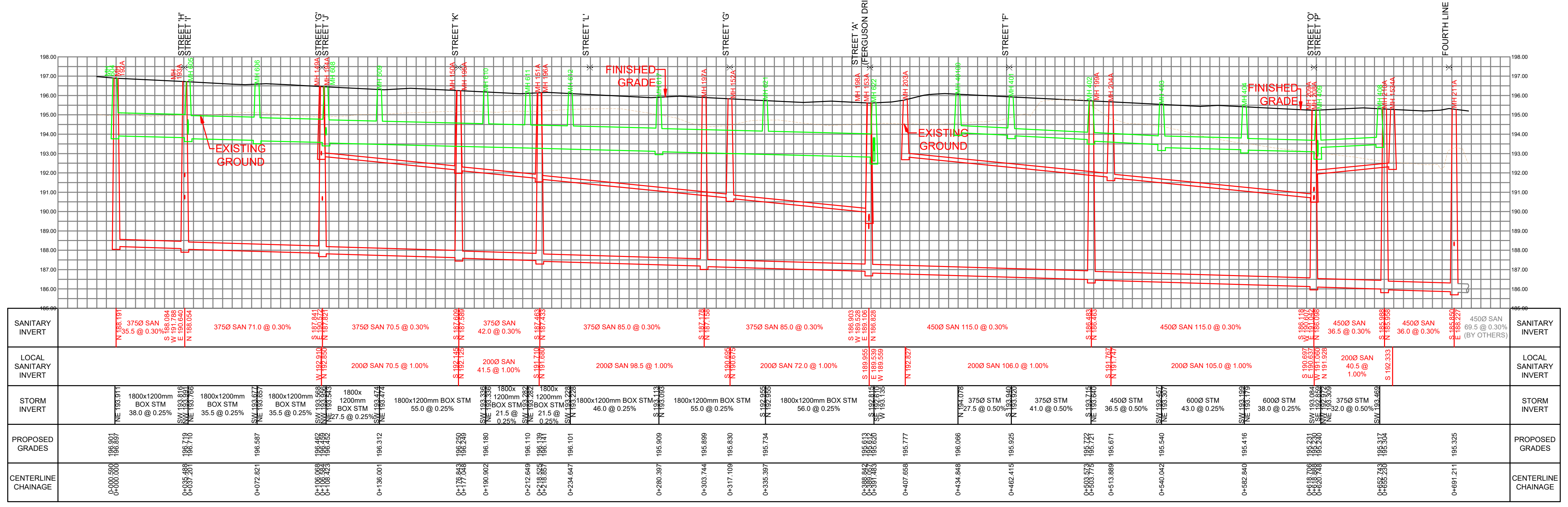
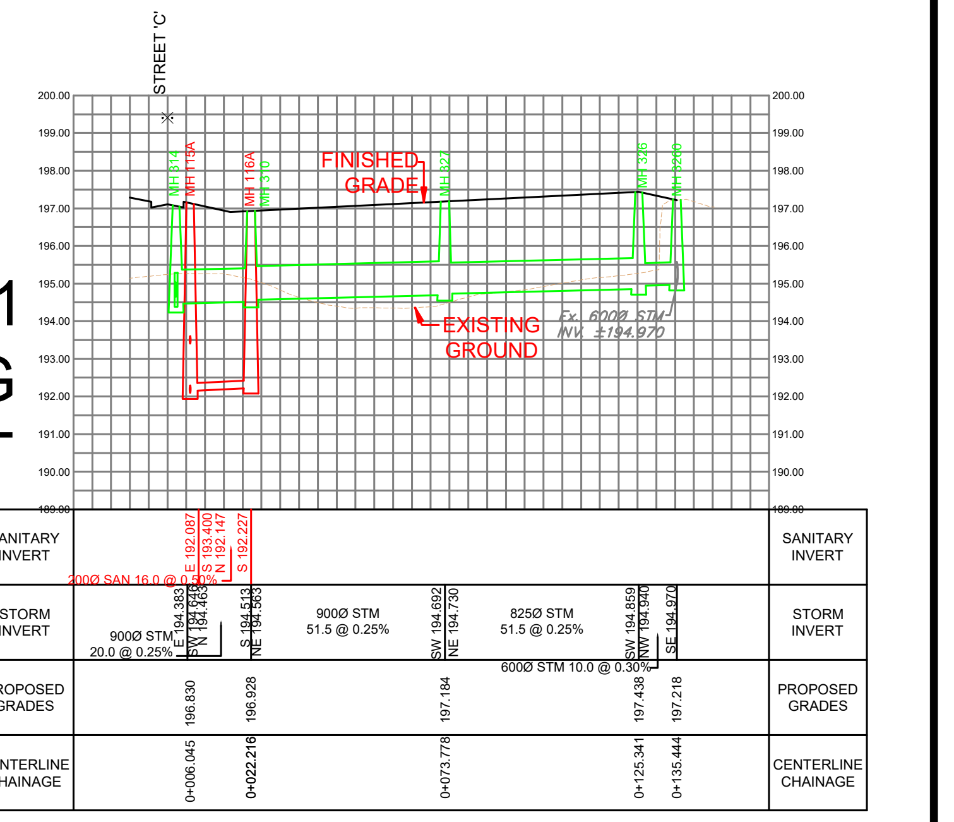


STREET 'B'
(WHITLOCK
AVENUE)



BLOCK 1
SERVICING
EASEMENT



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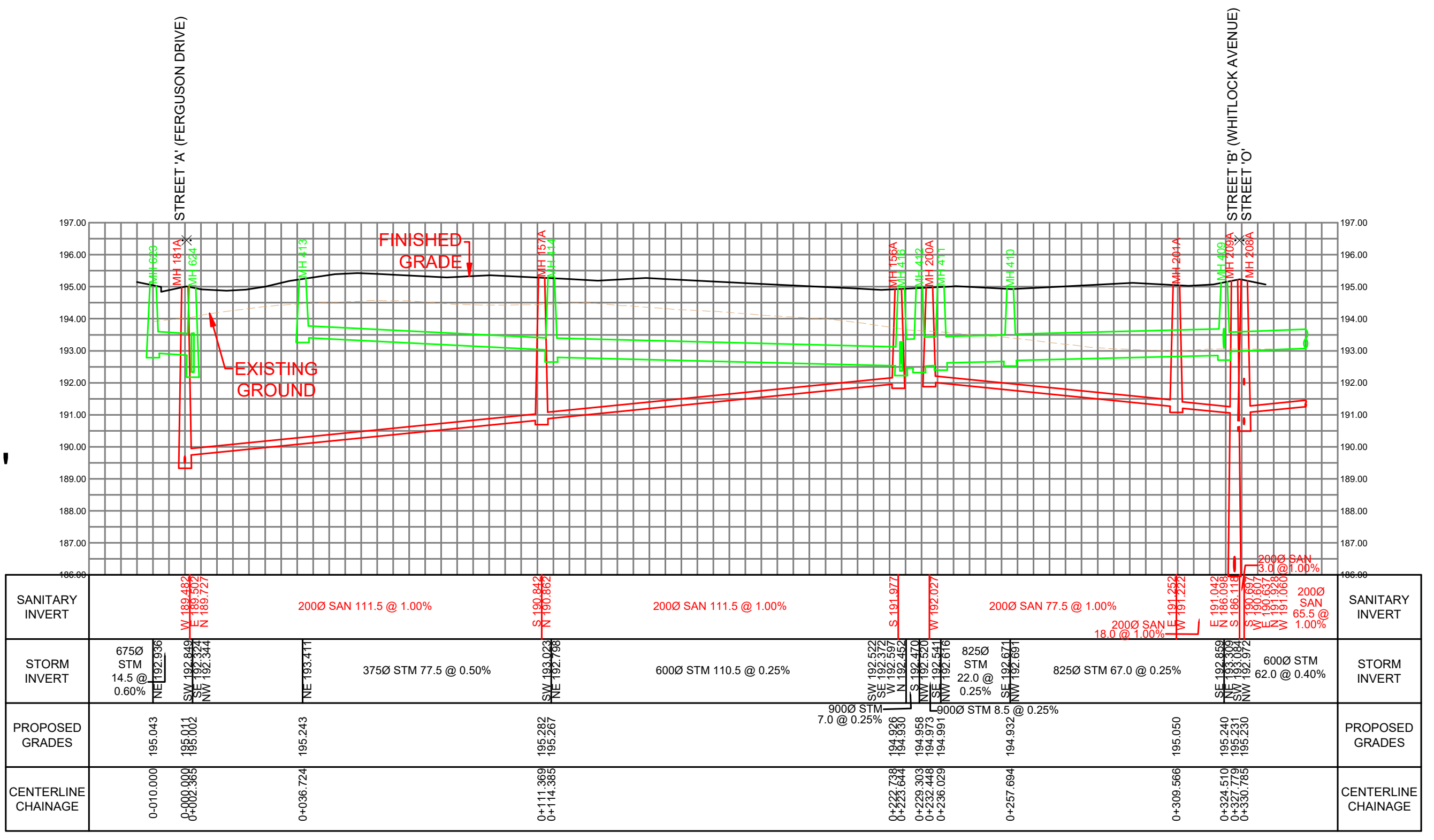
MATTAMY - TOR

TOWN OF MILTON

PLAN AND PROFILE FOR ALL ROADS, BLOCKS, AND EASEMENTS

SCALE:	1:2000	PROJECT No.:	15-786
DATE:	FEBRUARY 2023	DRAWING:	3

STREET 'P'



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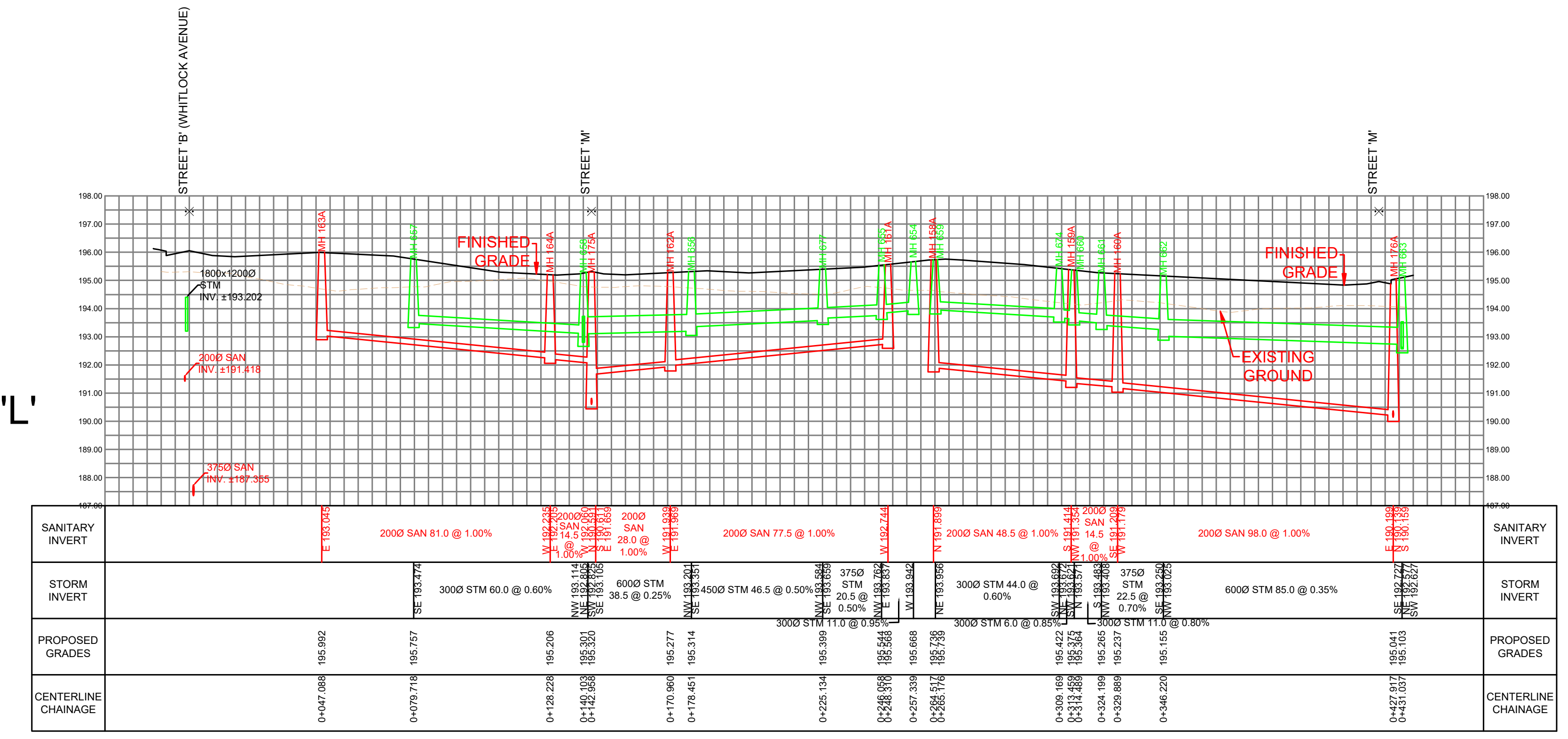

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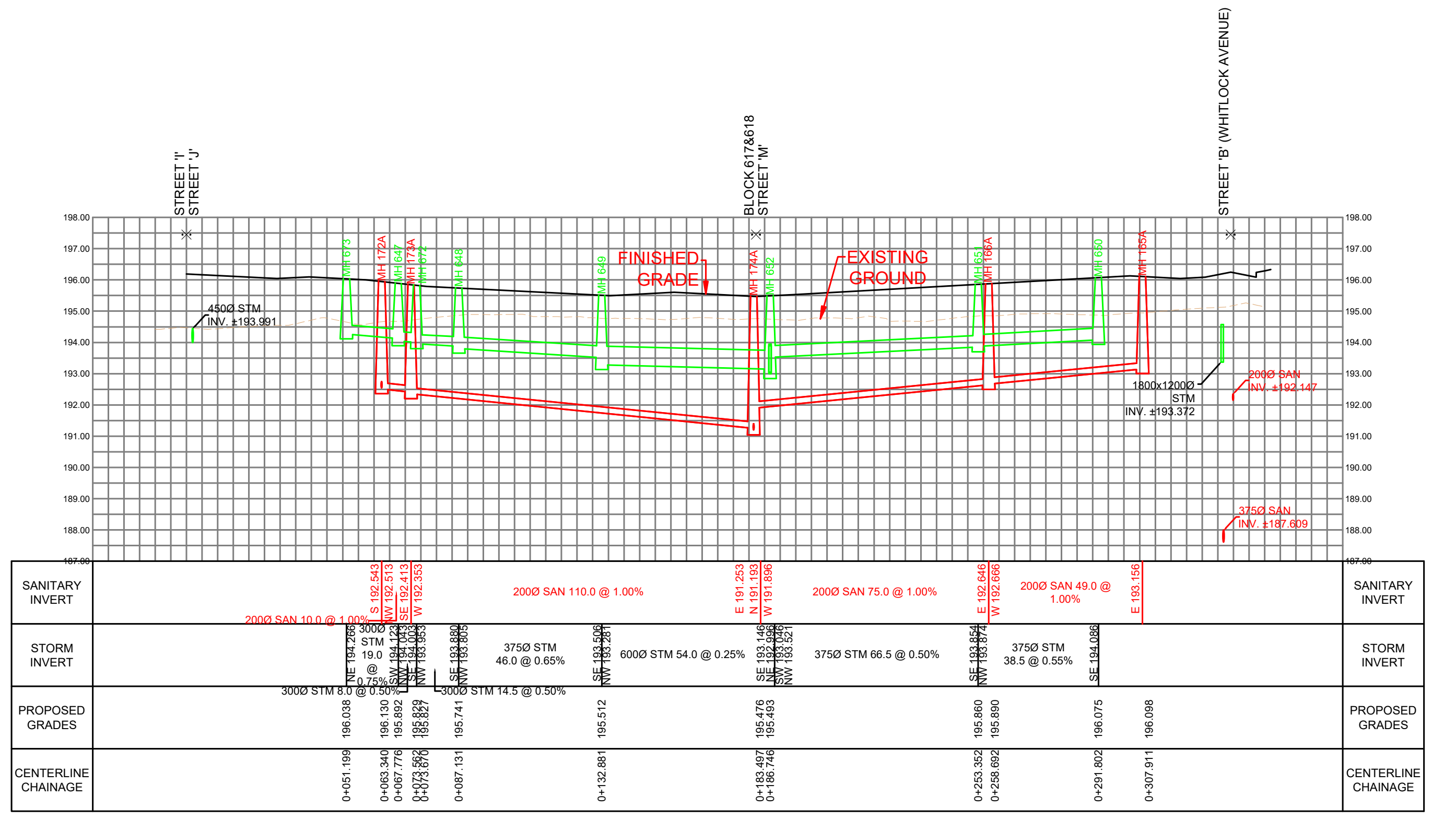

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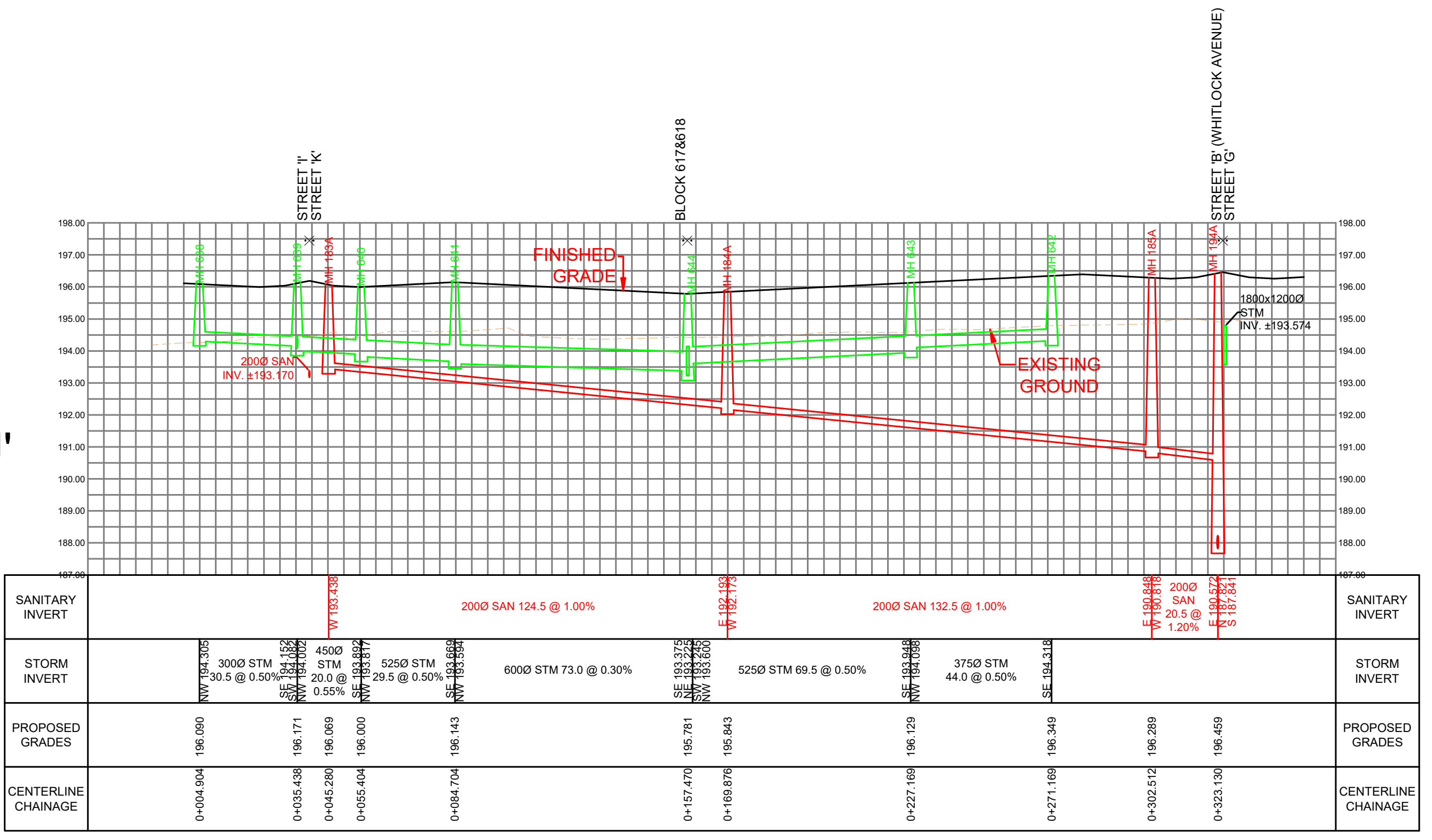

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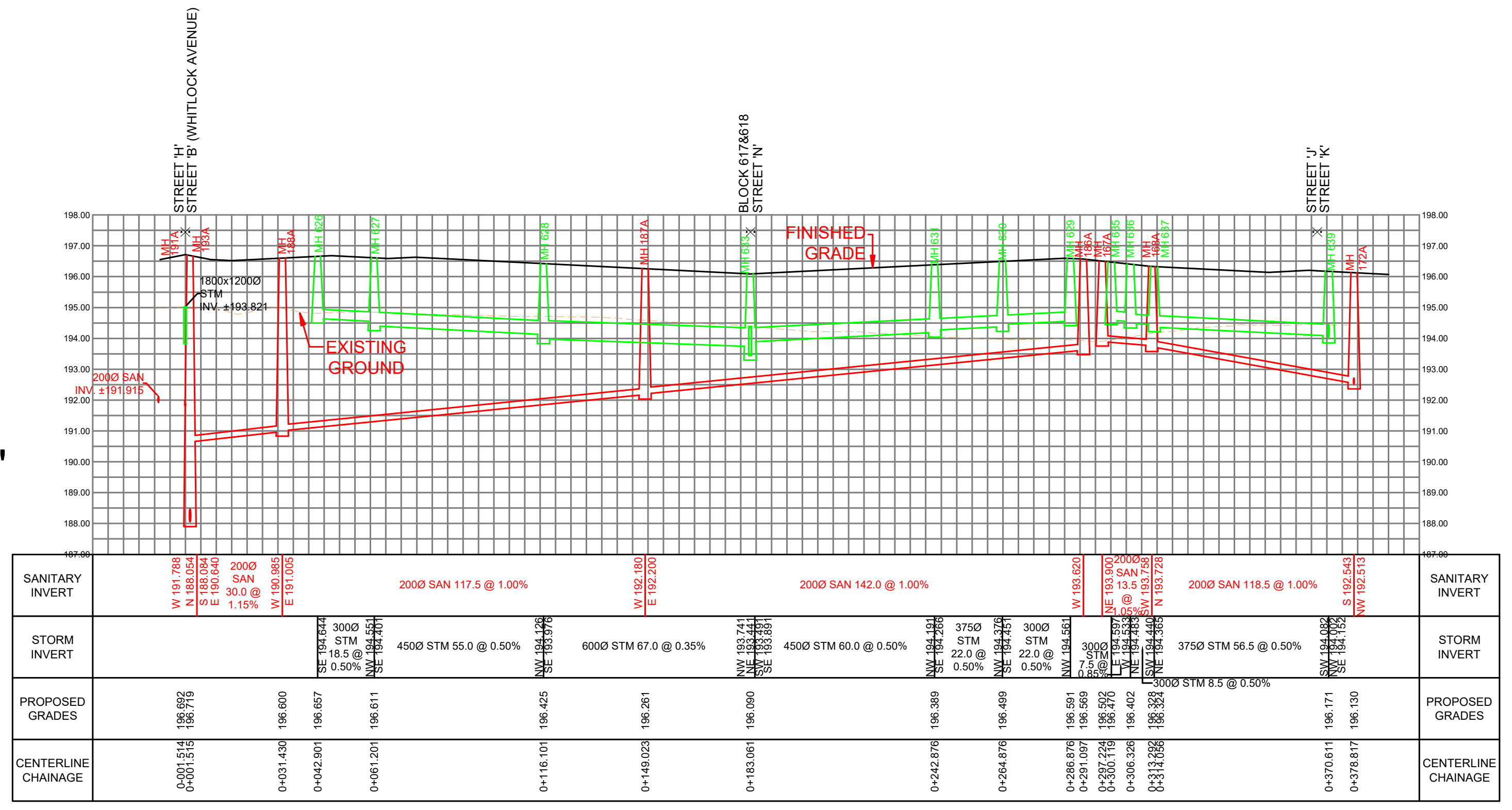

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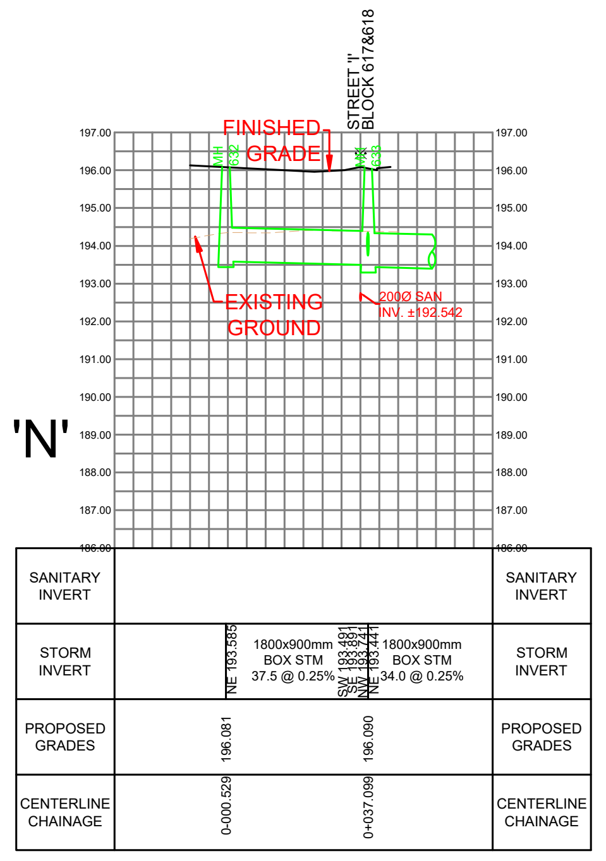
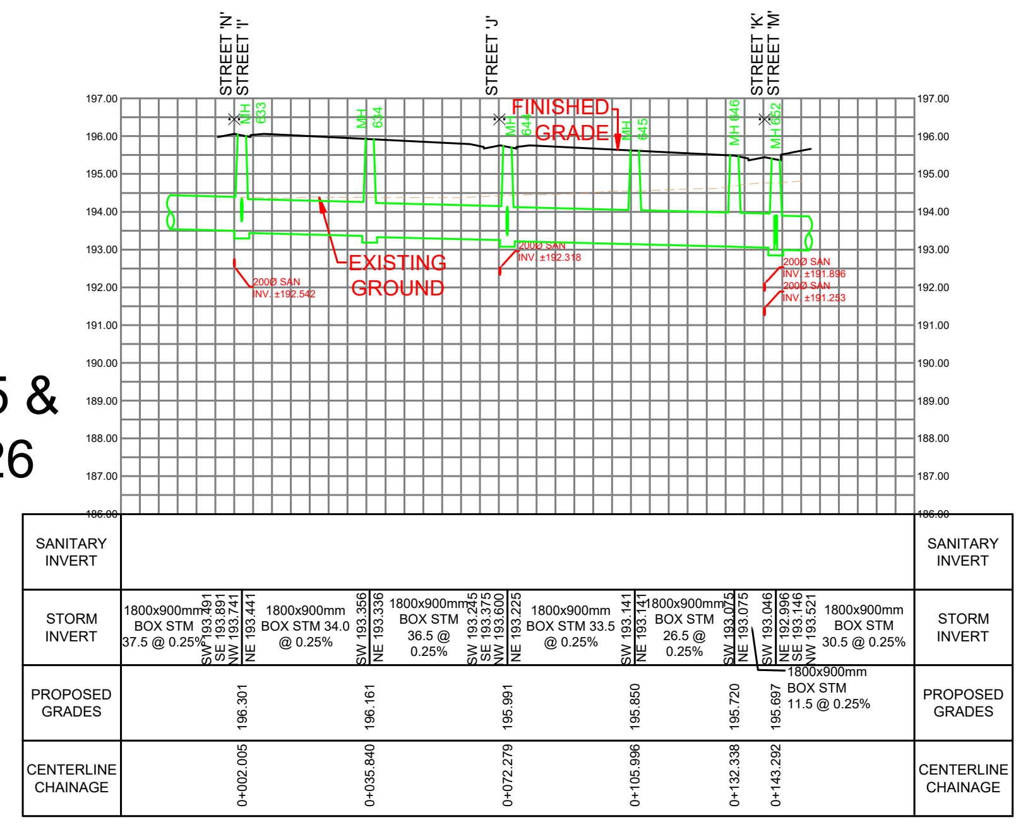
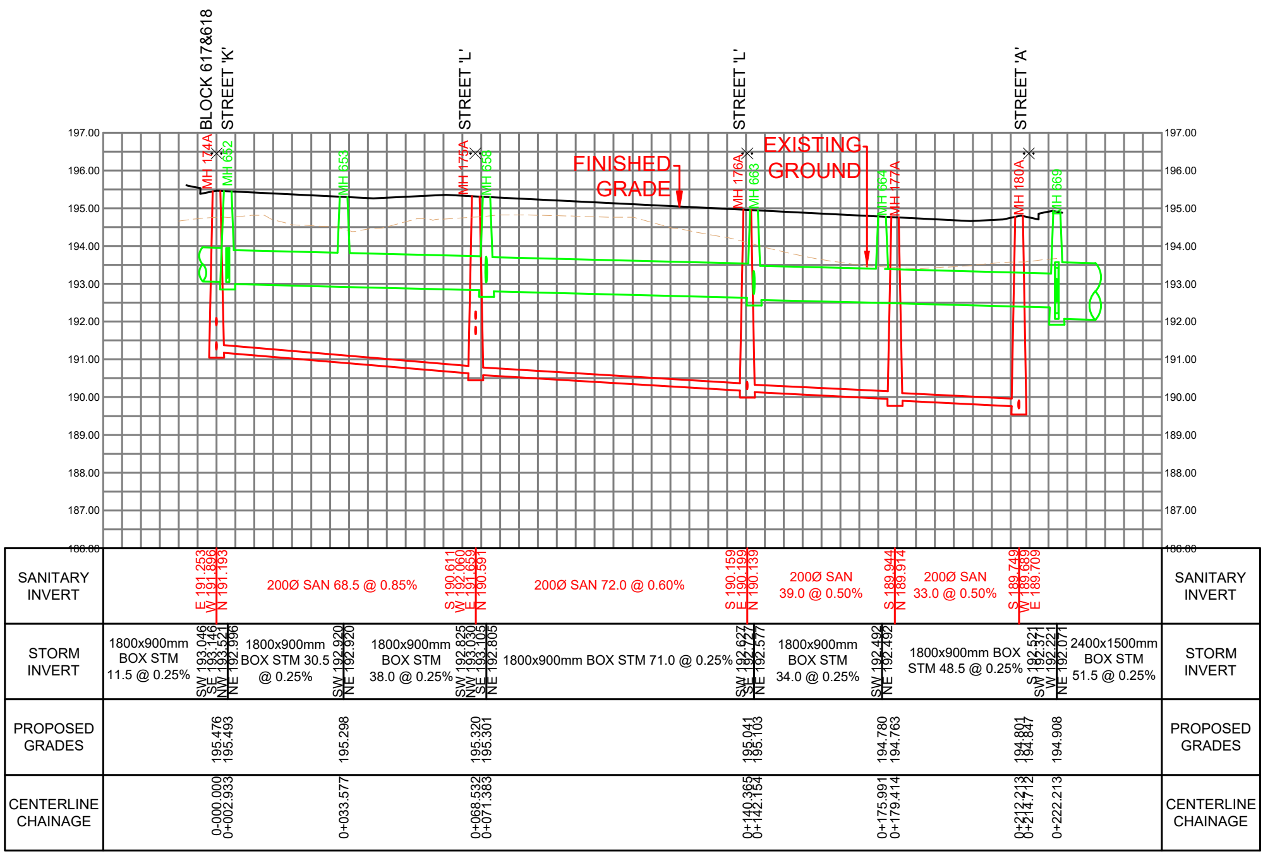


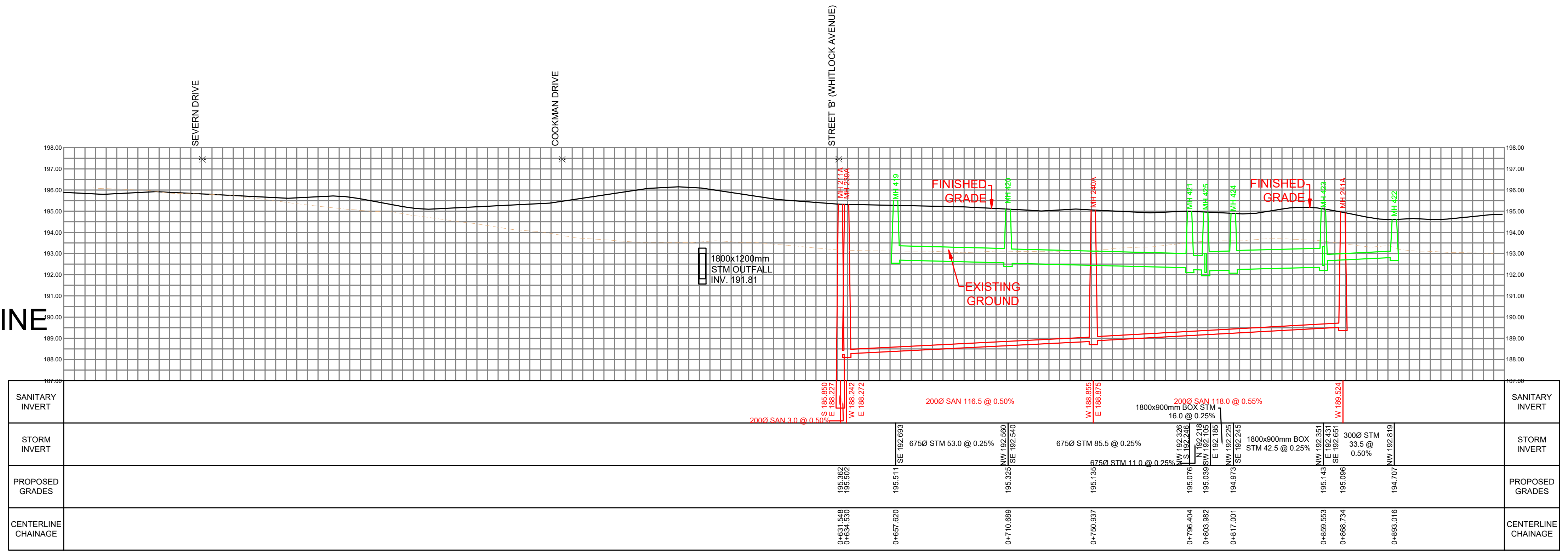
BLOCK 625 &
BLOCK 626



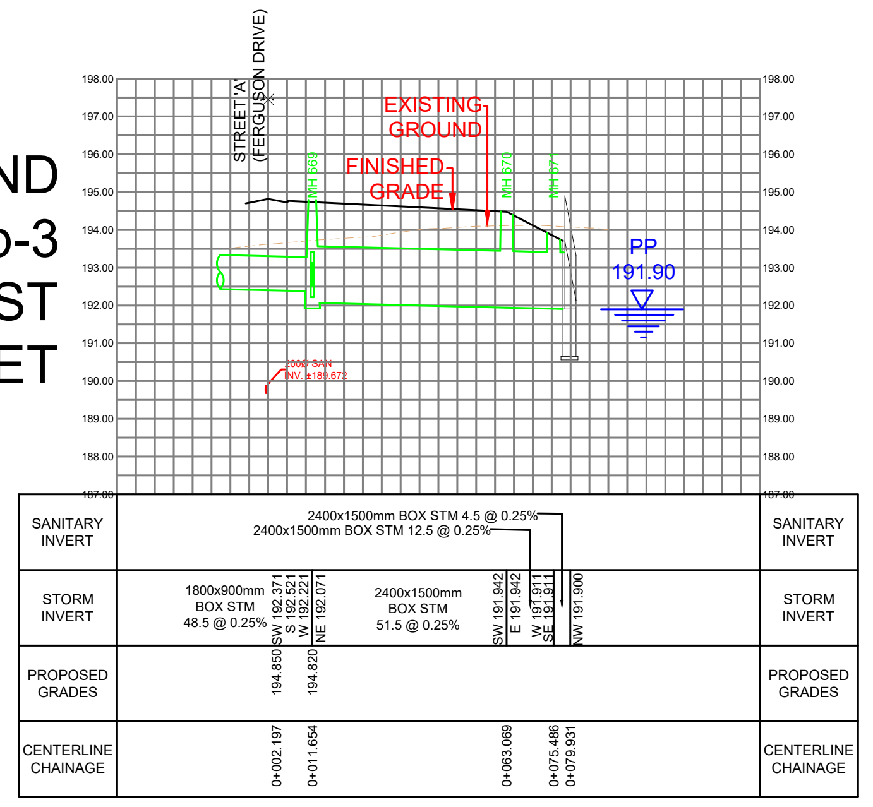
STREET M



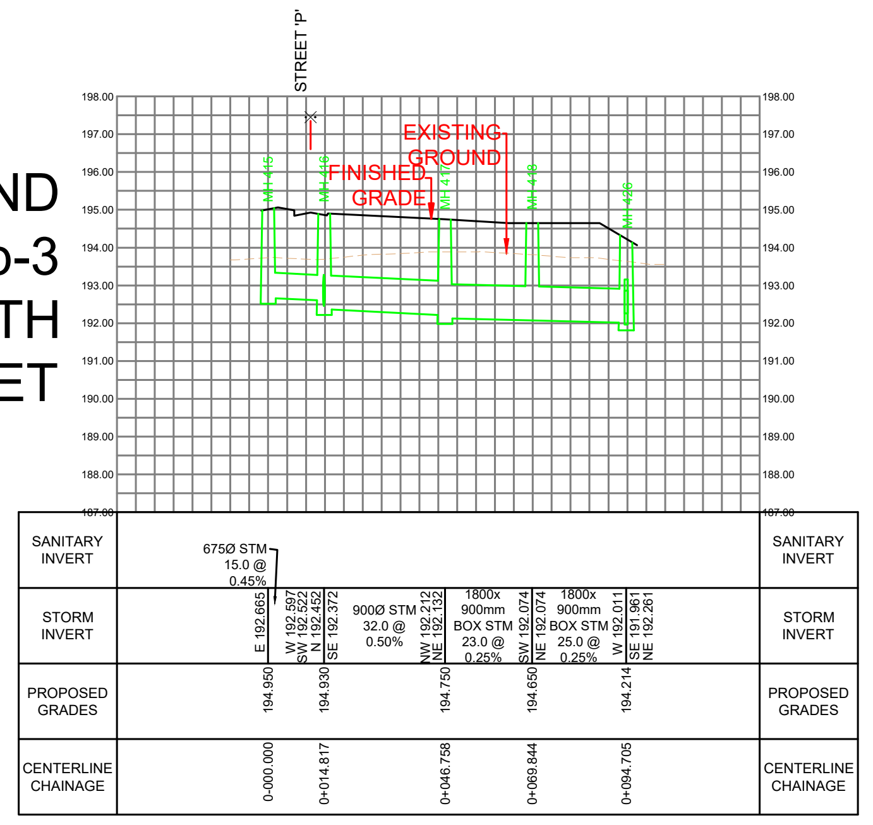
FOURTH LINE



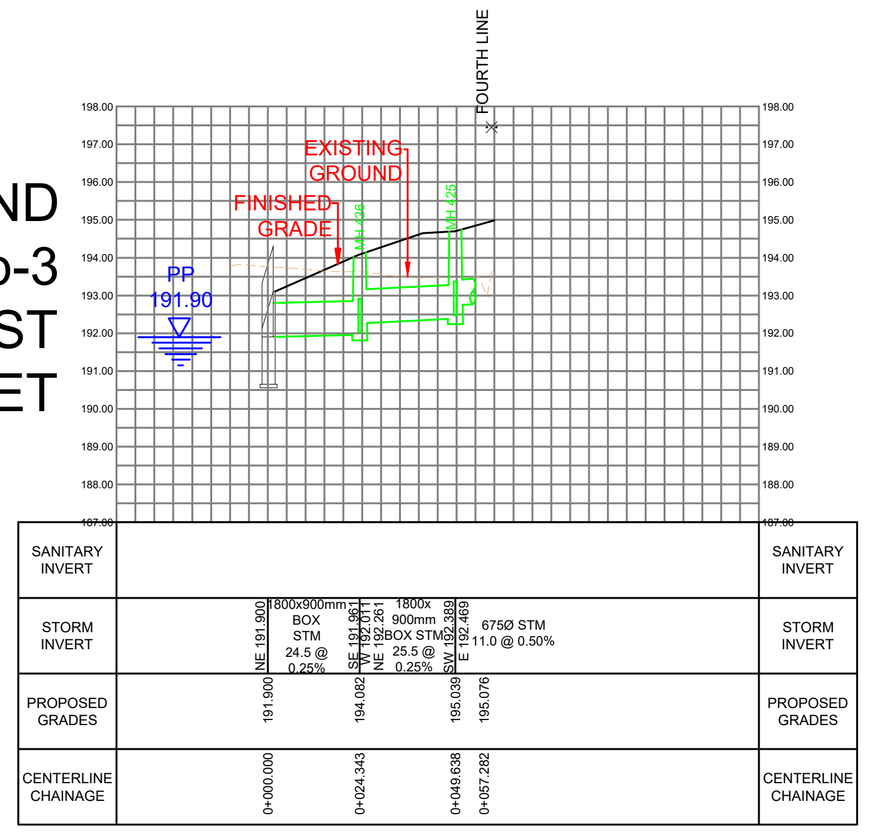
POND
S5b-3
WEST
INLET



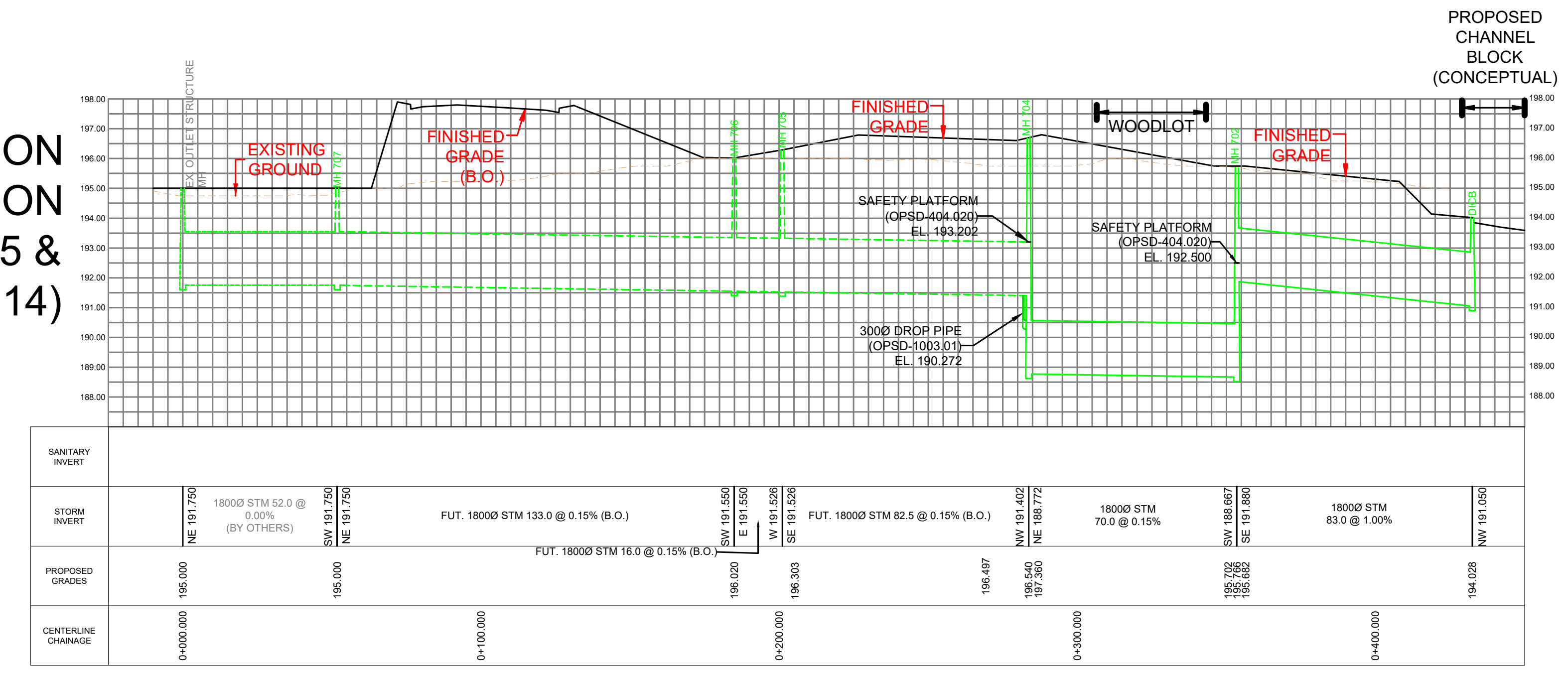
POND
S5b-3
NORTH
INLET



POND
S5b-3
EAST
INLET



SIPHON
EXTENSION
(BLOCK 615 &
BLOCK 614)



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TOWN OF MILTON

PLAN AND PROFILE FOR ALL ROADS, BLOCKS, AND EASEMENTS

SCALE:	1:2000	PROJECT No.:	15-786
DATE:	FEBRUARY 2023	DRAWING:	4

Dewatering Summary and Calculations

APPENDIX D

Terraprobe Inc.

Summary of Servicing Depths and Soil and Ground Water Conditions
Garito Barbuto Tor Poperty
Milton, Ontario

Street Name	Length of Servicing (m)	Proposed Servicing	Servicing Diameter (mm)	Deepest Invert Elevation	Nearest Borehole	Water Level (m)	Invert Soil Conditions	Base Elevation of Invert Soils (m)	Estimated Dewatering Volume (L/day)
Street A (Ferguson Drive)	862				BH106	193.5	Silty Clay Till	191.0	3,400
		Sanitary	300	189.5	BH108	193.8	Silty Clay Till	189.4	
		Storm	1800 x 1200	192.3	BH111	193.6	Silty Clay Till	187.6	
Street B (Whitlock Avenue)	691	Trunk Sanitary	450	185.9	BH113	193.9	Silty Clay Till	187.2	20,010
		Sanitary	200	189.5	BH111	193.6	Silty Sand Till	184.9	
		Storm	1800 x 1200	193.1	BH110	191.7	Silty Clay	182.7	
Street C	561	Sanitary	200	190.7	BH105	193.6	Silty Sand Till	190.7	7,990
		Storm	1800 x 900	193.3			Clayey Silt Till	192.0	
Street D	375	Sanitary	200	190.2	BH105	193.6	Clayey Sandy Silt	187.9	14,470
		Storm	875	193.8			Silty Clay Till	192.0	
Street E	215	Sanitary	200	191.5	BH106	193.5	Clayey Sandy Silt	191.0	6,060
		Storm	600	194.2			Sity Clay Till	191.8	
Street F	304	Sanitary	200	190.5	BH106	193.5	Silty Sand Till	186.9	18,890
		Storm	800 x 90	192.8			Sity Clay Till	191.8	
Street G	351	Sanitary	200	190.9	BH112	194.1	Silty Clay Till	188.1	2,520
		Storm	375	193.5			Silty Clay Till	188.1	
Street H	241	Sanitary	200	191.8	BH113	193.9	Silty Clay Till	187.9	3,040
		Storm	750	193.8			Silty Clay Till	187.9	
Sreet I	378	Sanitary	200	190.6	BH113	193.9	Silty Clay Till	187.9	2,470
		Storm	600	193.5			Silty Clay Till	187.9	
Street J	278	Sanitary	200	190.6	BH112	194.1	Silty Clay Till	188.1	2,370
		Storm	600	193.2			Silty Clay Till	188.1	
Street K	244	Sanitary	200	191.2	BH112	194.1	Silty Clay Till	188.1	2,670
		Storm	600	193.1			Silty Clay Till	188.1	
Street L	375	Sanitary	200	190.2	BH112	194.1	Silty Clay Till	188.1	2,150
		Storm	600	192.6			Silty Clay Till	188.1	
Street M	214	Sanitary	200	189.8	BH111	193.6	Silty Clay Till	187.6	2,200
		Storm	1800 x 900	192.1			Silty Clay Till	187.6	
Street N	37	Sanitary	N/A		BH113	193.9			3,740
		Storm	1800 x 900	193.4			Silty Clay Till	187.9	
Street O	297	Sanitary	200	190.7	BH110	191.7	Silty Clay Till	188.9	1,270
		Storm	825	192.9			Silty Clay Till	188.9	
Street P	324	Sanitary	200	189.5	BH110	191.7	Silty Sand Till	187.1	12,160
		Storm	675	192.3			Silty Clay Till	188.9	
Fourth Line	237	Sanitary	200	188.2	BH110	191.7	Silty Sand Till	187.1	9,730
		Storm	1800 x 900	192.2			Silty Clay Till	188.9	

APPENDIX E: Dewatering Calculations
Street A (Ferguson Drive)
Garito Barbuto Tor Residential Subdivision
Milton, ON

$$R_0 = 3000 * dH * K^{0.5}$$

(Sichart and Dryieleis, dH and R_0 in meters, K in m/sec)

$$r_e = (ab/3.14)^{0.5}$$

applies when a/b <1.5 and R_0>>r_e

$$Q = \frac{3.14 * K * (H^2 - h_w^2)}{\ln(R_0/r_e)} + 2 * \frac{x * K * (H^2 - h_w^2)}{2L_0}$$

K =	1.00E-08	m/s	Hydraulic Conductivity
or	0.00	m/day	
H =	6.0	m	From static wate table to the assumed aquifer bottom
h_w =	3.7	m	From the dewatering target to the assumed aquifer bottom
dH =	2.3	m	Dewatering Thickness
R_0 =	1	m	Radius of Influence
a =	2.3	m	Width of trench*
b =	2.3	m	Depth of trench (below ground water level)
r_e =	1.298	m	Assumed for a small rectangular area at the end of the dewatering trench
x =	100	m	Length of trench (based on construction staging)
L_0 =	1	m	Distance between maximum drawdown and zero drawdown
FS	1.25		Factor of Safety

Q =	**3.40**	**m3/day**
or	2.36	L/min

Notes: *Width of trench considered perimeter of sanitary servicing plus 1.0 m clearance from excavation walls as determined from DSEL Servicing Profiles

Reference: J. Patrick Powers… [et al.] (2007), "Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd ed." Wiley, Hoboken, NJ.

APPENDIX E: Dewatering Calculations
Street B (Witlock Avenue)
Garito Barbuto Tor Residential Subdivision
Milton, ON

$$R_0 = 3000*dH*K^{0.5}$$

(Sichart and Dryieleis, dH and R_0 in meters, K in m/sec)

$$r_e = (ab/3.14)^{0.5}$$

applies when a/b <1.5 and R_0>>r_e

$$Q = \frac{3.14*K*(H^2-h_w^2)}{\ln(R_0/r_e)} + 2*\frac{x*K*(H^2-h_w^2)}{2L_0}$$

K =	2.60E-07	m/s	Hydraulic Conductivity
or	0.02	m/day	
H =	9.0	m	From static wate table to the assumed aquifer bottom
h_w =	0.0	m	From the dewatering target to the assumed aquifer bottom
dH =	9.0	m	Dewatering Thickness
R_0 =	14	m	Radius of Influence
a =	2.5	m	Width of trench*
b =	9.0	m	Depth of trench (below ground water level)
r_e =	2.677	m	Assumed for a small rectangular area at the end of the dewatering trench
x =	100	m	Length of trench (based on construction staging)
L_0 =	14	m	Distance between maximum drawdown and zero drawdown
FS	1.25		Factor of Safety
Q =	**20.01**	**m3/day**	
or	13.90	L/min	

Notes: *Width of trench considered perimeter of sanitary servicing plus 1.0 m clearance from excavation walls as determined from DSEL Servicing Profiles

Reference: J. Patrick Powers… [et al.] (2007), "Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd ed." Wiley, Hoboken, NJ.

APPENDIX E: Dewatering Calculations
Street C
Garito Barbuto Tor Residential Subdivision
Milton, ON

$$R_0 = 3000*dH*K^{0.5}$$

(Sichart and Dryieleis, dH and R_0 in meters, K in m/sec)

$$r_e = (ab/3.14)^{0.5}$$

applies when a/b <1.5 and R_0>>r_e

$$Q = \frac{3.14*K*(H^2-h_w^2)}{\ln(R_0/r_e)} + 2*\frac{x*K*(H^2-h_w^2)}{2L_0}$$

K =	2.60E-07	m/s	Hydraulic Conductivity
or	0.02	m/day	
H =	3.9	m	From static wate table to the assumed aquifer bottom
h_w =	0.0	m	From the dewatering target to the assumed aquifer bottom
dH =	3.9	m	Dewatering Thickness
$R_{0 =}$	6	m	Radius of Influence
a =	2.2	m	Width of trench*
b =	3.9	m	Depth of trench (below ground water level)
$r_{e =}$	1.653	m	Assumed for a small rectangular area at the end of the dewatering trench
x =	100	m	Length of trench (based on construction staging)
$L_{0 =}$	6	m	Distance between maximum drawdown and zero drawdown
FS	1.25		Factor of Safety
Q =	**7.99**	**m3/day**	
or	5.55	L/min	

Notes: *Width of trench considered perimeter of sanitary servicing plus 1.0 m clearance from excavation walls as determined from DSEL Servicing Profiles

Reference: J. Patrick Powers… [et al.] (2007), "Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd ed." Wiley, Hoboken, NJ.

APPENDIX E: Dewatering Calculations
Street D
Garito Barbuto Tor Residential Subdivision
Milton, ON

$$R_0 = 3000*dH*K^{0.5}$$

(Sichart and Dryieleis, dH and R_0 in meters, K in m/sec)

$$r_e = (ab/3.14)^{0.5}$$

applies when a/b <1.5 and R_0>>r_e

$$Q = \frac{3.14*K*(H^2-h_w^2)}{\ln(R_0/r_e)} + 2*\frac{x*K*(H^2-h_w^2)}{2L_0}$$

K =	2.60E-07	m/s	Hydraulic Conductivity
or	0.02	m/day	
H =	5.7	m	From static wate table to the assumed aquifer bottom
h_w =	1.3	m	From the dewatering target to the assumed aquifer bottom
dH =	4.4	m	Dewatering Thickness
$R_{0\ =}$	7	m	Radius of Influence
a =	2.2	m	Width of trench*
b =	4.4	m	Depth of trench (below ground water level)
$r_{e\ =}$	1.756	m	Assumed for a small rectangular area at the end of the dewatering trench
x =	100	m	Length of trench (based on construction staging)
$L_{0\ =}$	7	m	Distance between maximum drawdown and zero drawdown
FS	1.25		Factor of Safety
Q =	**14.47**	**m3/day**	
or	10.05	L/min	

Notes: *Width of trench considered perimeter of trunk sanitary servicing plus 1.0 m clearance from excavation walls as determined from DSEL Servicing Profiles

Reference: J. Patrick Powers… [et al.] (2007), "Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd ed." Wiley, Hoboken, NJ.

APPENDIX E: Dewatering Calculations
Street E
Garito Barbuto Tor Residential Subdivision
Milton, ON

$$R_0 = 3000*dH*K^{0.5}$$

(Sichart and Dryieleis, dH and R_0 in meters, K in m/sec)

$$r_e = (ab/3.14)^{0.5}$$

applies when a/b <1.5 and R_0>>r_e

$$Q = \frac{3.14*K*(H^2-h_w^2)}{\ln(R_0/r_e)} + 2*\frac{x*K*(H^2-h_w^2)}{2L_0}$$

K =	2.60E-07	m/s	Hydraulic Conductivity
or	0.02	m/day	
H =	3.0	m	From static wate table to the assumed aquifer bottom
h_w =	0.0	m	From the dewatering target to the assumed aquifer bottom
dH =	3.0	m	Dewatering Thickness
$R_{0\,=}$	5	m	Radius of Influence
a =	2.2	m	Width of trench*
b =	3.0	m	Depth of trench (below ground water level)
$r_{e\,=}$	1.450	m	Assumed for a small rectangular area at the end of the dewatering trench
x =	100	m	Length of trench (based on construction staging)
$L_{0\,=}$	5	m	Distance between maximum drawdown and zero drawdown
FS	1.25		Factor of Safety
Q =	**6.06**	**m3/day**	
or	4.21	L/min	

Notes: *Width of trench considered perimeter of sanitary servicing plus 1.0 m clearance from excavation walls as determined from DSEL Servicing Profiles

Reference: J. Patrick Powers… [et al.] (2007), "Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd ed." Wiley, Hoboken, NJ.

APPENDIX E: Dewatering Calculations
Street F
Garito Barbuto Tor Residential Subdivision
Milton, ON

$$R_0 = 3000*dH*K^{0.5}$$

(Sichart and Dryieleis, dH and R_0 in meters, K in m/sec)

$$r_e = (ab/3.14)^{0.5}$$

applies when a/b <1.5 and R_0>>r_e

$$Q = \frac{3.14*K*(H^2-h_w^2)}{\ln(R_0/r_e)} + 2*\frac{x*K*(H^2-h_w^2)}{2L_0}$$

K =	2.60E-07	m/s	Hydraulic Conductivity
or	0.02	m/day	
H =	6.6	m	From static wate table to the assumed aquifer bottom
h_w =	2.6	m	From the dewatering target to the assumed aquifer bottom
dH =	4.0	m	Dewatering Thickness
R_0 =	6	m	Radius of Influence
a =	2.2	m	Width of trench*
b =	4.0	m	Depth of trench (below ground water level)
r_e =	1.674	m	Assumed for a small rectangular area at the end of the dewatering trench
x =	100	m	Length of trench (based on construction staging)
L_0 =	6	m	Distance between maximum drawdown and zero drawdown
FS	1.25		Factor of Safety

Q =	**18.89**	**m3/day**
or	13.12	L/min

Notes: *Width of trench considered perimeter of sanitary servicing plus 1.0 m clearance from excavation walls as determined from DSEL Servicing Profiles

Reference: J. Patrick Powers… [et al.] (2007), "Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd ed." Wiley, Hoboken, NJ.

APPENDIX E: Dewatering Calculations
Street G
Garito Barbuto Tor Residential Subdivision
Milton, ON

$$R_0 = 3000*dH*K^{0.5}$$

(Sichart and Dryieleis, dH and R_0 in meters, K in m/sec)

$$r_e = (ab/3.14)^{0.5}$$

applies when a/b <1.5 and $R_0 >> r_e$

$$Q = \frac{3.14*K*(H^2-h_w^2)}{\ln(R_0/r_e)} + 2*\frac{x*K*(H^2-h_w^2)}{2L_0}$$

K =	1.00E-08	m/s	Hydraulic Conductivity
or	0.00	m/day	
H =	6.0	m	From static wate table to the assumed aquifer bottom
h_w =	1.8	m	From the dewatering target to the assumed aquifer bottom
dH =	4.2	m	Dewatering Thickness
R_0 =	1	m	Radius of Influence
a =	2.2	m	Width of trench*
b =	4.2	m	Depth of trench (below ground water level)
r_e =	1.715	m	Assumed for a small rectangular area at the end of the dewatering trench
x =	100	m	Length of trench (based on construction staging)
L_0 =	1	m	Distance between maximum drawdown and zero drawdown
FS	1.25		Factor of Safety

Q = 2.52 m3/day

or 1.75 L/min

Notes: *Width of trench considered perimeter of sanitary servicing plus 1.0 m clearance from excavation walls as determined from DSEL Servicing Profiles

Reference: J. Patrick Powers… [et al.] (2007), "Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd ed." Wiley, Hoboken, NJ.

APPENDIX E: Dewatering Calculations
Street H
Garito Barbuto Tor Residential Subdivision
Milton, ON

$$R_0 = 3000*dH*K^{0.5}$$ (Sichart and Dryieleis, dH and R_0 in meters, K in m/sec)

$$r_e = (ab/3.14)^{0.5}$$ applies when a/b <1.5 and R_0>>r_e

$$Q = \frac{3.14*K*(H^2-h_w^2)}{\ln(R_0/r_e)} + 2*\frac{x*K*(H^2-h_w^2)}{2L_0}$$

K =	1.00E-08	m/s	Hydraulic Conductivity
or	0.00	m/day	
H =	6.0	m	From static wate table to the assumed aquifer bottom
h_w =	2.9	m	From the dewatering target to the assumed aquifer bottom
dH =	3.1	m	Dewatering Thickness
R_{0} =	1	m	Radius of Influence
a =	2.2	m	Width of trench*
b =	3.1	m	Depth of trench (below ground water level)
r_{e} =	1.474	m	Assumed for a small rectangular area at the end of the dewatering trench
x =	100	m	Length of trench (based on construction staging)
L_{0} =	1	m	Distance between maximum drawdown and zero drawdown
FS	1.25		Factor of Safety
Q =	**3.04**	**m3/day**	
or	2.11	L/min	

Notes: *Width of trench considered perimeter of sanitary servicing plus 1.0 m clearance from excavation walls as determined from DSEL Servicing Profiles

Reference: J. Patrick Powers… [et al.] (2007), "Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd ed." Wiley, Hoboken, NJ.

APPENDIX E: Dewatering Calculations
Street I
Garito Barbuto Tor Residential Subdivision
Milton, ON

$$R_0 = 3000 \cdot dH \cdot K^{0.5}$$

(Sichart and Dryieleis, dH and R_0 in meters, K in m/sec)

$$r_e = (ab/3.14)^{0.5}$$

applies when a/b <1.5 and $R_0 >> r_e$

$$Q = \frac{3.14 \cdot K \cdot (H^2 - h_w^2)}{\ln(R_0/r_e)} + 2 \cdot \frac{x \cdot K \cdot (H^2 - h_w^2)}{2L_0}$$

K =	1.00E-08	m/s	Hydraulic Conductivity
or	0.00	m/day	
H =	6.0	m	From static wate table to the assumed aquifer bottom
h_w =	1.7	m	From the dewatering target to the assumed aquifer bottom
dH =	4.3	m	Dewatering Thickness
R_0 =	1	m	Radius of Influence
a =	2.2	m	Width of trench*
b =	4.3	m	Depth of trench (below ground water level)
r_e =	1.736	m	Assumed for a small rectangular area at the end of the dewatering trench
x =	100	m	Length of trench (based on construction staging)
L_0 =	1	m	Distance between maximum drawdown and zero drawdown
FS	1.25		Factor of Safety
Q =	**2.47**	**m3/day**	
or	1.71	L/min	

Notes: *Width of trench considered perimeter of sanitary servicing plus 1.0 m clearance from excavation walls as determined from DSEL Servicing Profiles

Reference: J. Patrick Powers… [et al.] (2007), "Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd ed." Wiley, Hoboken, NJ.

APPENDIX E: Dewatering Calculations
Street J
Garito Barbuto Tor Residential Subdivision
Milton, ON

$$R_0 = 3000*dH*K^{0.5}$$

(Sichart and Dryieleis, dH and R_0 in meters, K in m/sec)

$$r_e = (ab/3.14)^{0.5}$$

applies when a/b <1.5 and R_0>>r_e

$$Q = \frac{3.14*K*(H^2-h_w^{\ 2})}{\ln(R_0/r_e)} + 2*\frac{x*K*(H^2-h_w^{\ 2})}{2L_0}$$

K =	1.00E-08	m/s	Hydraulic Conductivity
or	0.00	m/day	
H =	6.0	m	From static wate table to the assumed aquifer bottom
h_w =	1.5	m	From the dewatering target to the assumed aquifer bottom
dH =	4.5	m	Dewatering Thickness
$R_{0\ =}$	1	m	Radius of Influence
a =	2.2	m	Width of trench*
b =	4.5	m	Depth of trench (below ground water level)
$r_{e\ =}$	1.776	m	Assumed for a small rectangular area at the end of the dewatering trench
x =	100	m	Length of trench (based on construction staging)
$L_{0\ =}$	1	m	Distance between maximum drawdown and zero drawdown
FS	1.25		Factor of Safety
Q =	**2.37**	**m3/day**	
or	1.64	L/min	

Notes: *Width of trench considered perimeter of sanitary servicing plus 1.0 m clearance from excavation walls as determined from DSEL Servicing Profiles

Reference: J. Patrick Powers… [et al.] (2007), "Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd ed." Wiley, Hoboken, NJ.

APPENDIX E: Dewatering Calculations
Street K
Garito Barbuto Tor Residential Subdivision
Milton, ON

$$R_0 = 3000*dH*K^{0.5}$$

(Sichart and Dryieleis, dH and R_0 in meters, K in m/sec)

$$r_e = (ab/3.14)^{0.5}$$

applies when a/b <1.5 and R_0>>r_e

$$Q = \frac{3.14*K*(H^2-h_w^2)}{\ln(R_0/r_e)} + 2*\frac{x*K*(H^2-h_w^2)}{2L_0}$$

K =	1.00E-08	m/s	Hydraulic Conductivity
or	0.00	m/day	
H =	6.0	m	From static wate table to the assumed aquifer bottom
h_w =	2.1	m	From the dewatering target to the assumed aquifer bottom
dH =	3.9	m	Dewatering Thickness
R_0 =	1	m	Radius of Influence
a =	2.2	m	Width of trench*
b =	3.9	m	Depth of trench (below ground water level)
r_e =	1.653	m	Assumed for a small rectangular area at the end of the dewatering trench
x =	100	m	Length of trench (based on construction staging)
L_0 =	1	m	Distance between maximum drawdown and zero drawdown
FS	1.25		Factor of Safety

Q = 2.67 m3/day

or 1.85 L/min

Notes: *Width of trench considered perimeter of sanitary servicing plus 1.0 m clearance from excavation walls as determined from DSEL Servicing Profiles

Reference: J. Patrick Powers… [et al.] (2007), "Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd ed." Wiley, Hoboken, NJ.

APPENDIX E: Dewatering Calculations
Street L
Garito Barbuto Tor Residential Subdivision
Milton, ON

$$R_0 = 3000*dH*K^{0.5}$$

(Sichart and Dryieleis, dH and R_0 in meters, K in m/sec)

$$r_e = (ab/3.14)^{0.5}$$

applies when a/b <1.5 and R_0>>r_e

$$Q = \frac{3.14*K*(H^2-h_w^2)}{\ln(R_0/r_e)} + 2*\frac{x*K*(H^2-h_w^2)}{2L_0}$$

K =	1.00E-08	m/s	Hydraulic Conductivity
or	0.00	m/day	
H =	6.0	m	From static wate table to the assumed aquifer bottom
h_w =	1.1	m	From the dewatering target to the assumed aquifer bottom
dH =	4.9	m	Dewatering Thickness
$R_{0 =}$	1	m	Radius of Influence
a =	2.2	m	Width of trench*
b =	4.9	m	Depth of trench (below ground water level)
$r_{e =}$	1.853	m	Assumed for a small rectangular area at the end of the dewatering trench
x =	100	m	Length of trench (based on construction staging)
$L_{0 =}$	1	m	Distance between maximum drawdown and zero drawdown
FS	1.25		Factor of Safety
Q =	**2.15**	**m3/day**	
or	1.49	L/min	

Notes: *Width of trench considered perimeter of sanitary servicing plus 1.0 m clearance from excavation walls as determined from DSEL Servicing Profiles

Reference: J. Patrick Powers… [et al.] (2007), "Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd ed." Wiley, Hoboken, NJ.

APPENDIX E: Dewatering Calculations
Street M
Garuto Barbuto Tor Residential Sudivision
Milton, ON

$$R_0 = 3000*dH*K^{0.5}$$

(Sichart and Dryieleis, dH and R_0 in meters, K in m/sec)

$$r_e = (ab/3.14)^{0.5}$$

applies when a/b <1.5 and $R_0 >> r_e$

$$Q = \frac{3.14*K*(H^2-h_w^2)}{\ln(R_0/r_e)} + 2 * \frac{x*K*(H^2-h_w^2)}{2L_0}$$

K =	1.00E-08	m/s	Hydraulic Conductivity
or	0.00	m/day	
H =	6.0	m	From static wate table to the assumed aquifer bottom
h_w =	1.2	m	From the dewatering target to the assumed aquifer bottom
dH =	4.8	m	Dewatering Thickness
R_0 =	1	m	Radius of Influence
a =	2.2	m	Width of trench*
b =	4.8	m	Depth of trench (below ground water level)
r_e =	1.834	m	Assumed for a small rectangular area at the end of the dewatering trench
x =	100	m	Length of trench (based on construction staging)
L_0 =	1	m	Distance between maximum drawdown and zero drawdown
FS	1.25		Factor of Safety

Q =	**2.20**	**m3/day**
or	1.53	L/min

Notes: *Width of trench considered perimeter of sanitary servicing plus 1.0 m clearance from excavation walls as determined from DSEL Servicing Profiles

Reference: J. Patrick Powers… [et al.] (2007), "Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd ed." Wiley, Hoboken, NJ.

APPENDIX E: Dewatering Calculations
Street N
Garito Barbuto Tor Residential Development
Milton, ON

$$R_0 = 3000*dH*K^{0.5}$$

(Sichart and Dryieleis, dH and R_0 in meters, K in m/sec)

$$r_e = (ab/3.14)^{0.5}$$

applies when a/b <1.5 and R_0>>r_e

$$Q = \frac{3.14*K*(H^2-h_w^2)}{\ln(R_0/r_e)} + 2*\frac{x*K*(H^2-h_w^2)}{2L_0}$$

K =	1.00E-08	m/s	Hydraulic Conductivity
or	0.00	m/day	
H =	6.0	m	From static wate table to the assumed aquifer bottom
h_w =	4.5	m	From the dewatering target to the assumed aquifer bottom
dH =	1.5	m	Dewatering Thickness
$R_{0\ =}$	0	m	Radius of Influence
a =	3.0	m	Width of trench*
b =	1.5	m	Depth of trench (below ground water level)
$r_{e\ =}$	1.197	m	Assumed for a small rectangular area at the end of the dewatering trench
x =	100	m	Length of trench (based on construction staging)
$L_{0\ =}$	0	m	Distance between maximum drawdown and zero drawdown
FS	1.25		Factor of Safety
Q =	**3.74**	**m3/day**	
or	2.59	L/min	

Notes: *Width of trench considered perimeter of sanitary servicing plus 1.0 m clearance from excavation walls as determined from DSEL Servicing Profiles

Reference: J. Patrick Powers… [et al.] (2007), "Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd ed." Wiley, Hoboken, NJ.

APPENDIX E: Dewatering Calculations
Street O
Garito Barbuto Tor Residential Subdivision
Milton, ON

$$R_0 = 3000*dH*K^{0.5}$$

(Sichart and Dryieleis, dH and R_0 in meters, K in m/sec)

$$r_e = (ab/3.14)^{0.5}$$

applies when a/b <1.5 and R_0>>r_e

$$Q = \frac{3.14*K*(H^2-h_w^{\ 2})}{\ln(R_0/r_e)} + 2*\frac{x*K*(H^2-h_w^{\ 2})}{2L_0}$$

K =	1.00E-08	m/s	Hydraulic Conductivity
or	0.00	m/day	
H =	2.8	m	From static wate table to the assumed aquifer bottom
h_w =	0.8	m	From the dewatering target to the assumed aquifer bottom
dH =	2.0	m	Dewatering Thickness
$R_{0\ =}$	1	m	Radius of Influence
a =	2.2	m	Width of trench*
b =	2.0	m	Depth of trench (below ground water level)
$r_{e\ =}$	1.184	m	Assumed for a small rectangular area at the end of the dewatering trench
x =	100	m	Length of trench (based on construction staging)
$L_{0\ =}$	1	m	Distance between maximum drawdown and zero drawdown
FS	1.25		Factor of Safety
Q =	**1.27**	**m3/day**	
or	0.88	L/min	

Notes: *Width of trench considered perimeter of sanitary servicing plus 1.0 m clearance from excavation walls as determined from DSEL Servicing Profiles

Reference: J. Patrick Powers… [et al.] (2007), "Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd ed." Wiley, Hoboken, NJ.

APPENDIX E: Dewatering Calculations
Street P
Garito Barbuto Tor Residential Subdivision
Milton, ON

$$R_0 = 3000*dH*K^{0.5}$$

(Sichart and Dryieleis, dH and R_0 in meters, K in m/sec)

$$r_e = (ab/3.14)^{0.5}$$

applies when a/b <1.5 and R_0>>r_e

$$Q = \frac{3.14*K*(H^2-h_w^2)}{\ln(R_0/r_e)} + 2*\frac{x*K*(H^2-h_w^2)}{2L_0}$$

K =	2.60E-07	m/s	Hydraulic Conductivity
or	0.02	m/day	
H =	4.6	m	From static wate table to the assumed aquifer bottom
h_w =	1.4	m	From the dewatering target to the assumed aquifer bottom
dH =	3.2	m	Dewatering Thickness
$R_{0\,=}$	5	m	Radius of Influence
a =	2.2	m	Width of trench*
b =	3.2	m	Depth of trench (below ground water level)
$r_{e\,=}$	1.497	m	Assumed for a small rectangular area at the end of the dewatering trench
x =	100	m	Length of trench (based on construction staging)
$L_{0\,=}$	5	m	Distance between maximum drawdown and zero drawdown
FS	1.25		Factor of Safety
Q =	**12.16**	**m3/day**	
or	8.44	L/min	

Notes: *Width of trench considered perimeter of sanitary servicing plus 1.0 m clearance from excavation walls as determined from DSEL Servicing Profiles

Reference: J. Patrick Powers… [et al.] (2007), "Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd ed." Wiley, Hoboken, NJ.

APPENDIX E: Dewatering Calculations
Fourth Line
Garito Barbuto Tor Residential Subdivision
Milton, ON

$$R_0 = 3000*dH*K^{0.5}$$

(Sichart and Dryieleis, dH and R_0 in meters, K in m/sec)

$$r_e = (ab/3.14)^{0.5}$$

applies when a/b <1.5 and R_0>>r_e

$$Q = \frac{3.14*K*(H^2-h_w^{\ 2})}{\ln(R_0/r_e)} + 2*\frac{x*K*(H^2-h_w^{\ 2})}{2L_0}$$

K =	2.60E-07	m/s	Hydraulic Conductivity
or	0.02	m/day	
H =	4.6	m	From static wate table to the assumed aquifer bottom
h_w =	0.1	m	From the dewatering target to the assumed aquifer bottom
dH =	4.5	m	Dewatering Thickness
R_0 =	7	m	Radius of Influence
a =	2.2	m	Width of trench*
b =	4.5	m	Depth of trench (below ground water level)
r_e =	1.776	m	Assumed for a small rectangular area at the end of the dewatering trench
x =	100	m	Length of trench (based on construction staging)
L_0 =	7	m	Distance between maximum drawdown and zero drawdown
FS	1.25		Factor of Safety
Q =	**9.73**	**m3/day**	
or	6.76	L/min	

Notes: *Width of trench considered perimeter of sanitary servicing plus 1.0 m clearance from excavation walls as determined from DSEL Servicing Profiles

Reference: J. Patrick Powers… [et al.] (2007), "Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd ed." Wiley, Hoboken, NJ.

SWM Pond S5b-3 - Permanent Pool Mattamy-Tor

Job No. **2300931.000**

Excavation Area (m2)	Excavation Depth (mbgl)	Excavation Perimeter (m)	Water Level (mbgl)	Excavation Depth (m below water table)	Vertical Area Below Water Table (m2)	K (m/s)	Soil Stratum
18,380	4.3	981	0.8	3.5	3434	1.0E-08	Silty Clay

Darcy - flow into excavation

$$Q = kiA$$

	Q (m^3/s)	A (m^2)	i	k (m/s)	Q (m^3/hr)	Q (L/hr)	Q (gal/min)	Q (L/day)	**Factor of Safety = 1.5 Q (L/day)**
Horizontal	3.43E-06	3434	0.1	1E-08	0.0124	12	0.05	297	**445**

	Q (m^3/s)	A (m^2)	i	k (m/s)	Q (m^3/hr)	Q (L/hr)	Q (gal/min)	Q (L/day)	**Factor of Safety = 1.5 Q (L/day)**
Vertical	1.84E-05	18380	0.1	1E-08	0.0662	66	0.29	1588	**2,382**

Total estimated ground water taking

Q (L/day)

2,800

Pumping of precipitation (25 mm) faling within SWM area (11,623 sq.m) **459,500 L/day**

-

Radius of Influence - Sichardt's equation

$$\boxed{R = 3000\sqrt{k}}$$

R (m)	drawdown (m)	K (m/s)
1.1	3.5	1.00E-08

SWM Pond S5b-3 Forebay Mattamy-Tor

Job No. **2300931.000**

Excavation Area (m2)	Excavation Depth (mbgl)	Excavation Perimeter (m)	Water Level (mbgl)	Excavation Depth (m below water table)	Vertical Area Below Water Table (m2)	K (m/s)	Soil Stratum
5424	2.8	443	0.8	2	886	1.0E-08	Silty Clay

Darcy - flow into excavation

$$Q = kiA$$

	Q (m^3/s)	A (m^2)	i	k (m/s)	Q (m^3/hr)	Q (L/hr)	Q (gal/min)	Q (L/day)	**Factor of Safety = 1.5 Q (L/day)**
Horizontal	8.86E-07	886	0.1	1.00E-08	0.0032	3	0.01	77	**115**

	Q (m^3/s)	A (m^2)	i	k (m/s)	Q (m^3/hr)	Q (L/hr)	Q (gal/min)	Q (L/day)	**Factor of Safety = 1.5 Q (L/day)**
Vertical	5.42E-06	5424	0.1	1.00E-08	0.0195	20	0.09	469	**703**

Total estimated ground water taking

Q (L/day)

800

Pumping of precipitation (25 mm) faling within SWM area (4,960 sq.m) **135,600 L/day**

-

Radius of Influence - Sichardt's equation

$$R = 3000\sqrt{k}$$

R (m)	drawdown (m)	K (m/s)
0.6	2	1.00E-08

SWM Pond S5b-4 Permanent Pool Mattamy Tor

Job No. **2300931.000**

Excavation Area (m2)	Excavation Depth (mbgl)	Excavation Perimeter (m)	Water Level (mbgl)	Excavation Depth (m below water table)	Vertical Area Below Water Table (m2)	K (m/s)	Soil Stratum
9,800	6	551	0	6	3306	2.6E-07	Silty Sand

Darcy - flow into excavation

$$Q = kiA$$

	Q (m^3/s)	A (m^2)	i	k (m/s)	Q (m^3/hr)	Q (L/hr)	Q (gal/min)	Q (L/day)	**Factor of Safety = 1.5 Q (L/day)**
Horizontal	8.60E-05	3306	0.1	3E-07	0.3094	309	1.36	7427	**11,140**

	Q (m^3/s)	A (m^2)	i	k (m/s)	Q (m^3/hr)	Q (L/hr)	Q (gal/min)	Q (L/day)	**Factor of Safety = 1.5 Q (L/day)**
Vertical	2.55E-04	9800	0.1	3E-07	0.9173	917	4.04	22015	**33,022**

Total estimated ground water taking

Q (L/day)

44,200

Pumping of precipitation (25 mm) faling within SWM area (8,120 sq.m) **245,000 L/day**

-

Radius of Influence - Sichardt's equation

$$R = 3000\sqrt{k}$$

R (m)	drawdown (m)	K (m/s)
9.2	6	2.60E-07

SWM Pond S5b-4 Forebay Mattamy Tor

Job No. **2300931.000**

Excavation Area (m2)	Excavation Depth (mbgl)	Excavation Perimeter (m)	Water Level (mbgl)	Excavation Depth (m below water table)	Vertical Area Below Water Table (m2)	K (m/s)	Soil Stratum
2,423	4.5	200	0	4.5	900	2.60E-07	Silty Sand

Darcy - flow into excavation

$$Q = kiA$$

	Q (m^3/s)	A (m^2)	i	k (m/s)	Q (m^3/hr)	Q (L/hr)	Q (gal/min)	Q (L/day)	**Factor of Safety = 1.5 Q (L/day)**
Horizontal	2.34E-05	900	0.1	2.60E-07	0.0842	84	0.37	2022	**3,033**

Vertical	Q (m^3/s)	A (m^2)	i	k (m/s)	Q (m^3/hr)	Q (L/hr)	Q (gal/min)	Q (L/day)	**Factor of Safety = 1.5 Q (L/day)**
	6.30E-05	2423	0.1	2.60E-07	0.2268	227	1.00	5443	**8,165**

Total estimated ground water taking

Q (L/day)

11,200

Pumping of precipitation (25 mm) faling within SWM area (1,800 sq.m) **60,600 L/day**

-

Radius of Influence - Sichardt's equation

$$R = 3000\sqrt{k}$$

R (m)	drawdown (m)	K (m/s)
6.9	4.5	2.60E-07