Appendix B.7
Geotechnical

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Hamilton Rapid Transit Preliminary Design and Feasibility Study

B-LINE

GEOTECHNICAL DESIGN BRIEF

Version:1.0

METROLINX

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DIALOG

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1.0 Introduction

The City of Hamilton is working to implement rapid transit, with a long term vision encompassing five corridors across the City. At present, the focus is on the undertaking of the Environmental Assessment and Preliminary Design of a Light Rail Transit (LRT) system along the B-Line corridor, following Main Street, King Street and Queenston Road between McMaster University and Eastgate Square. As part of the implementation process, a preliminary review of the geotechnical conditions along the B-Line corridor has been carried out by Thurber Engineering Ltd., a sub-consultant of SNC-Lavalin Inc. SNC-Lavalin Inc. is the prime sub-consultant for the Engineering and Environmental Assessment to Steer Davies Gleave (SDG), the prime consultant to the City of Hamilton.

This report presents a summary of the anticipated geotechnical conditions along the B-Line corridor, based on published geologic data and review of existing geotechnical information obtained from the City of Hamilton. Based on the available information, preliminary recommendations regarding track bed design, platform foundations, bridge structures and other associated facilities are provided.

The evaluations and conclusions contained in this report are based on available existing information given to Thurber Engineering Ltd. The conditions of the validity of the Geotechnical Review, as well as the preliminary geotechnical recommendations for the B-Line alignment are as per the General Statement of Conditions shown in Appendix D.

2.0 Project Description

The subject section of the B-Line corridor extends from McMaster University at the west limit to Eastgate Square at the east limit, a distance of 14 km. In general, the LRT line will follow existing roadways, as follows:

Within the McMaster University campus to Main Street West (0.6 km)

Main Street West from McMaster Medical Centre to the bridge over Highway 403 (1.3 km)

The Bridge over Highway 403 (0.9 km)

King Street West from bridge over Highway 403 to James Street (1.9 km)

King Street East from James Street to Main Street East (4.1 km)

Main Street East from King Street East to Queenston Road (2.0 km)

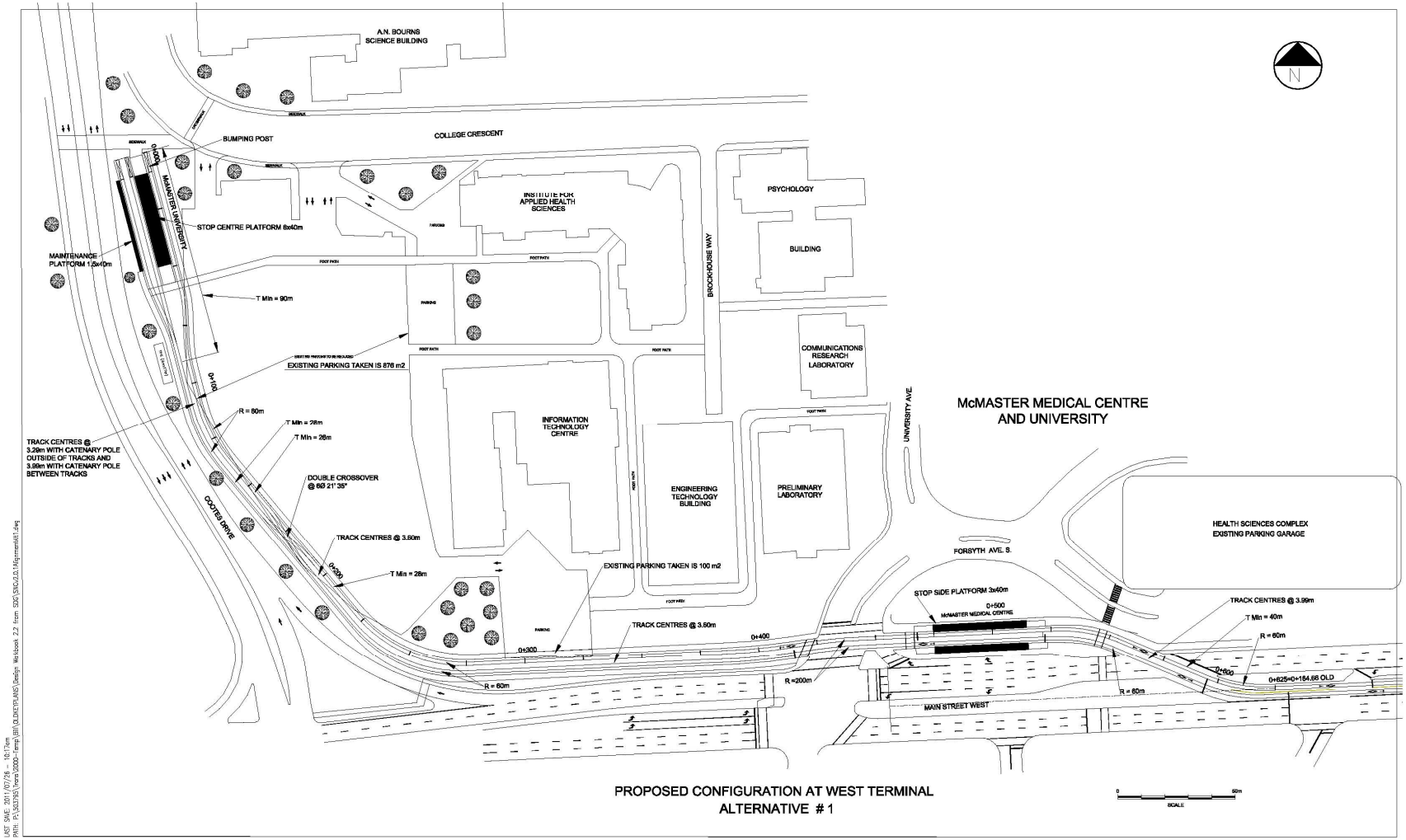
Queenston Road from Main Street East to Eastgate Square (3.2 km)

The section of corridor within the McMaster campus is not included in this report as no geotechnical information of the campus was provided at the time of writing this assessment. The preliminary alignment is shown in Figure 2.1, and will be addressed in the next design phase.

The line required to access a maintenance and storage depot will be assessed separately once a site is chosen in the next design phase.

The LRT will cross Highway 403 and the Red Hill Valley Parkway, which are situated within valleys below the level of the adjacent table lands. Construction of an elevated guideway structure is currently being considered to carry the LRT over the Highway 403 interchange and transition between Main Street West and King Street West. The LRT will cross over the Red Hill Valley Parkway on the existing Queenston Road Bridge.

Figure 2.1: Preliminary Configuration at McMaster University



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At present, 18 stop platforms are proposed, at the following locations:

Table 2.1: Stop Locations

Stop No	Designation
1	McMaster University
2	McMaster Medical Centre
3	Longwood
4	Dundurn
5	Queen
6	MacNab
7	Walnut
8	First Place
9	Wentworth
10	Sherman
11	Scott Park
12	Delta
13	Ottawa
14	Kenilworth
15	Strathearne
16	Parkdale
17	Nash
18	Eastgate

3.0 Physiographic and Geologic Setting

The proposed LRT B-Line alignment is situated on the Iroquois Plain physiographic region, bordered on the north by Lake Ontario and on the south by the Niagara Escarpment. The region consists of a lowland formerly inundated by glacial Lake Iroquois.

The near surface soils generally consist of lacustrine sands and silts deposited on the former lakebed. Locally between approximately Highway 403 and James Street, the alignment crosses a deposit of partially cemented gravel deposited as a beach along the former lake shoreline. The sand and gravel are generally underlain by silty clay to clayey silt till of the Halton Till formation. East of Ottawa Street, the sand is less prevalent and the near surface soils typically consist of the Halton Till.

Red shale bedrock of the Queenston Formation underlies the entire corridor. The shale is anticipated at depths in approximately the order of 20 to 25 m between the McMaster Medical Centre and Dundurn Street, increasing to approximately 30 m in the vicinity of Queen Street atop the gravel bar, then decreasing towards the east to less than 4 m depth between Ottawa Street and the Red Hill Valley. The depth to bedrock increases to 10 to 15 m east of the Red Hill Valley.

4.0 Summary of Geotechnical Conditions

Existing borehole data from the vicinity of the B-Line corridor was provided by the City of Hamilton to establish the geotechnical conditions pertinent to design of the LRT track bed and associated facilities. A listing of the boreholes reviewed and considered applicable to the LRT assignment is provided in Table A1, Appendix A. The borehole logs are reproduced in Appendix B.

A Borehole Plan and Stratigraphic Profile along the corridor, showing the **approximate** locations of the boreholes and the generalized soil stratigraphy derived from the existing subsurface data, is provided on Sheets 1 to 17, in Appendix C.

Based on the existing borehole data, a generalized description of the subsurface conditions along each section of the corridor is presented below. The available information is suitable only for preliminary planning purposes and is not considered adequate for detailed design of the facilities.

It should be recognized that soil conditions may vary between and beyond the borehole locations. The pavement types/thicknesses and subgrade conditions, summarized below are based on a limited number of boreholes previously drilled at selected locations during earlier geotechnical investigations. The data does not necessarily reflect the conditions along all sections of the LRT alignment, and conditions may vary both along the alignment and across the width of the roadway. Further, the current pavement structure and subgrade may differ from that encountered in the boreholes, due to subsequent utility installation and roadway reconstruction or rehabilitation carried out after drilling of the boreholes. Additional site specific investigation will be required at the next design phase to confirm and further define the current conditions along the alignment and at facility locations.

In general, the subsurface stratigraphy encountered along the corridor consists of a surficial pavement structure and/or fill layer, overlying sands, silts and clays in the western sections (McMaster Medical Centre to Highway 403), sands in the central areas, and silty clay till in the eastern sections (east of Sherman Avenue). More detailed descriptions of the individual strata are provided below.

4.1 Main Street West

4.1.1 Existing Pavement Structure

The pavement structure encountered in boreholes drilled on Main Street West between McMaster University and Highway 403) typically comprised of a composite structure with 125 to 150 mm of asphalt over 125 to 250 mm of concrete, placed directly on the subgrade or on 25 to 150 mm of sand and gravel. A flexible structure was documented in two boreholes, consisting of 250 mm of asphalt over 200 mm of sand and gravel, and 190 mm of asphalt placed directly on the subgrade.

4.1.2 Fill

Fill was encountered surficially or below the pavement structure in 14 of 21 boreholes reviewed in this section. The fill typically consisted of silty sand to sandy silt adjacent to McMaster Medical Centre and clayey silt to silty clay in the remainder of the section. The fill thickness generally ranged from 1.1 to 2.9 m with a lower boundary at depths of 1.1 to 3.1 m.

SPT N-values in the fill ranged from 1 to 17 blows/0.3 m (very loose to compact) in the cohesionless sand/silt and from 11 to 23 blows/0.3 m (stiff to very stiff) in the cohesive silt/clay. Moisture contents varied from 18 to 28%.

4.1.3 Native Soils

The native deposits underlying the pavement structure and fill in the area of Main Street West generally consist of interbedded silts, sands and clays. Locally in the central part of this section, a layer of coarse sand to sand and gravel was encountered within or below these deposits. The boreholes were terminated at depths of 2.3 to 9.6 m, 23.3 m in one borehole.

Along the west half of this section, the upper 2 to 3 m of the silt/sand/clay was very loose to compact/firm to very stiff, with SPT N-values ranging from 3 to 21 blows/0.3 m. Towards the east end, the loose to compact conditions (N-values of 9 to 25) extended to 5.2 m depth. Where exploration was extended below this level, these deposits became compact to very dense with N-values of 26 to 66 blows/0.3 m.

In the central area, clayey silt was predominant. The clayey silt was described as soft to stiff, however SPT N-values were not recorded.

Moisture contents ranged from 3 to 30%.

4.1.4 Groundwater

Piezometers were installed in five boreholes drilled along this section of the LRT. The depth to groundwater measured in the piezometers ranged from 1.9 to 7.2 m (Elev. 92.2 to 96.6 m). In addition, the soils were described as very wet to saturated below 5.5 and 5.8 m depth (Elev. 93.8 m) in two boreholes at the west end of the section, and the clayey silt in the central area was described as wet at various depths.

4.2 Highway 403 Crossing

4.2.1 Fill

The ravine through which Highway 403 was constructed was formerly used as a city landfill, and relatively thick deposits of fill consisting of sand, ashes, cinders, domestic refuse, wood and foundry sand were encountered in nearly all boreholes drilled in this area. A clay cap appears to be present over the fill on the east side of the ravine. The fill extends to depths of 0.9 to 11.6 m (Elev. 74.8 to 85.9 m).

SPT N-values recorded in the fill ranged from 3 to 37 blows/0.3 m. Moisture contents ranged from 6 to 61%.

4.2.2 Native Soils

The native soil in the Highway 403 ravine generally consisted of alluvial deposits overlying a relatively thick layer of silty clay.

The alluvial deposits primarily consisted of silty clay with organics and occasional sand, gravel, wood and peat were encountered below the fill or surficially in eight boreholes drilled within the Highway 403 valley. These deposits were 2.1 to 10.7 m thick. SPT N-values of 1 to 10 blows/0.3 m were recorded in the alluvial material, indicating a very soft to stiff consistency. Moisture contents ranged from 21 to 45%.

At four locations on the east side of the valley, a 1.6 to 4.3 m thick layer of sand and silt was encountered surficially or below the fill. SPT N-values in this layer ranged from 4 to 17 blows/0.3 m (loose to compact), and moisture contents ranged from 7 to 21%.

The underlying silty clay layer was 5.2 to 19.8 m thick and was encountered below the fill and alluvial deposits in all but one borehole. SPT N-values in the silty clay varied widely from about 6 to 40 blows/0.3 m (firm to hard) with several values of up to 90 blows/0.3 m, possibly indicating the presence of cobbles or shale fragments. Moisture contents ranged from 12 to 32%, typically about 16 to 24%.

4.2.3 Bedrock

Shale bedrock was contacted below the silty clay at depths of 16.2 to 27.5 m in all but two boreholes. The bedrock surface generally rises towards the east, from Elevation 57.0 m at the Main Street/Highway 403 structure to Elevation 75.2 m at the King Street connection.

4.2.4 Groundwater

The depth to groundwater measured in eight boreholes ranged from 1.2 to 19.5 m. The groundwater level varied from Elevation 64.6 to 83.1 m, typically Elevation 79.8 to 81.5 m.

4.3 King Street West

4.3.1 Existing Pavement Structure

In boreholes drilled between Bay and MacNab Streets, a composite structure consisting of 430 to 550 mm of asphalt over concrete combined, placed directly over the subgrade. The component asphalt and concrete thicknesses were not defined.

4.3.2 Fill

Fill was encountered to depths of 1.5 to 4.9 m in 8 of 19 boreholes reviewed along the King Street West section. The fill typically consisted of sand. Demolition debris with sand, gravel and ashes, apparently used to backfill former building basements, was in several boreholes located between Bay and MacNab Streets.

SPT N-values recorded in the fill ranged from 2 to 25 blows/0.3 m, indicating a very loose to compact condition. Moisture contents ranged from 9 to 21%.

4.3.3 Native Soils

The pavement structure and fill in this section is underlain primarily by silty fine-grained to fine to medium-grained sand, overlying a layer of coarser sand and gravel. Towards the west end of this section (west of Strathcona Avenue), the sand is overlain or interbedded with silts and clays, similar to the stratigraphy documented to the west of Highway 403. Silty clay to silty clay/clayey silt till was encountered below the sand and gravel in several deeper boreholes drilled near the east end of this section.

The interbedded clays, sands and silts encountered near the west end of the section extended to depths of 3.9 to 6.7 m. SPT N-values in these deposits ranged from 4 to 5 blows/0.3m in the non-cohesive sands/silts, and from 7 to 15 blows/0.3 m (firm to stiff) in the cohesive clays/silts. Moisture contents of 12 to 25% were measured in the sands/silts and 19 to 29% in the clayey silts/clays.

The predominant silty fine-grained to fine to medium-grained sand layer ranged in thickness from 1.2 m to greater than 5.5 m. In general, the sand is very loose to compact (N-values of 2 to 28 blows/0.3 m) with dense to very dense zones. Moisture contents varied from 2 to 21%.

The coarser sand and gravel layer underlying the fine to medium-grained sand was typically dense to very dense with SPT N-values ranging from 31 to greater than 100 blows/0.3 m. Compact zones with N-values of 10 to 30 blows/0.3 m were also present. Moisture contents varied from 3 to 24%, with the higher values measured in samples obtained from below the groundwater level. The majority of the boreholes were terminated in the sand and gravel layer. Where defined, this layer was 3.8 to 5.6 m thick.

Silty clay to silty clay/clayey silt till was encountered below the sand and gravel at 13.7 m depth in one borehole near the west end of this section and at 9.5 to 10.1 m depth in four boreholes near the east limit. The clay/silt layer was 8.5 m thick at the west location and extended below the maximum exploration depth of 29.9 m in the east boreholes. SPT N-values varied from 8 to 90 blows/0.3 m (stiff the hard) and moisture contents ranged from 11 to 28%. Moisture contents ranged from 9 to 14%.

4.3.4 Bedrock

Shale bedrock was contacted in one borehole located near the west limit of this section. The bedrock surface was at 22.2 m depth (Elev. 76.8 m).

4.3.5 Groundwater

Groundwater was observed in three boreholes and measured in two piezometers at depths of 7.1 to 10.8 m (Elev. 88.2 to 91.2 m). This water was generally encountered within the sand and gravel above the underlying silty clay. Water was also observed at 1.6 to 2.9 m depth in two boreholes, perched in the layered clays, silts and sands at the west end of the section and within fill at the east end.

4.4 King Street East

4.4.1 Existing Pavement Structure

The existing pavement structure varied between a flexible and composite design. The flexible structure consisted of 150 to 200 mm of asphalt over 250 to 860 mm of sand and gravel. The composite structure consisted of 100 to 150 mm of asphalt over 150 to 380 mm of concrete placed directly on the subgrade or on 150 mm of sand and gravel.

4.4.2 Fill

Fill was encountered to depths of 0.8 to 3.4 m in 14 of 23 boreholes reviewed along the King Street East section. The fill typically consisted of silty sand to sandy silt. SPT N-values recorded in the fill typically ranged from 4 to 18 blows/0.3 m, indicating a loose to compact condition. Moisture contents generally ranged from 8 to 20%.

4.4.3 Native Soils

A stratum of sands, silty sands and sandy silts was encountered below the pavement structure and fill in all boreholes located along King Street East between James Street and Wentworth Street. Where defined, the thickness of this layer ranged from 1.0 to 3.7 m. SPT N-values recorded in the sand/silt typically ranged from 4 to 35 blows/0.3 m, indicating a loose to dense condition. Very dense zones were encountered locally, as evidenced by N-values of up to 90 blows/0.3 m. Moisture contents varied from 5 to 30%, typically 10 to 16%.

Sand and gravel was encountered below the sand/silt in five boreholes located between James Street and Walnut Street. This layer was 1.8 to 4.5 m thick where the lower boundary was defined. The sand and gravel was compact to very dense with N-values of 27 to 60 blows/0.3 m. Moisture contents of 9 to 21% were measured.

The thickness of the sands/silts/gravel generally decreased towards the east from 8.5 m to 2.6 m, below which depth silty clay till was encountered. East of Sherman Avenue, the silty clay/till was encountered directly below the pavement structure and fill. SPT N-values in the clay till typically ranged from 10 to 28 blows/0.3 m, indicating a stiff to very stiff consistency. Moisture contents generally varied from 15 to 21%. The boreholes were terminated in the clay till where contacted.

4.4.4 Groundwater

Groundwater was measured at depths of 3.6 to 5.5 m (Elev. 82.1 to 89.6 m, rising to the west) in five boreholes drilled along this section. Perched water was also encountered locally in the surficial fill.

4.5 Main Street East

4.5.1 Existing Pavement Structure

No data was available on the existing pavement structure along Main Street East.

4.5.2 Fill

Fill was encountered to depths of 1.5 to 2.6 m in 3 of 6 boreholes reviewed along the Main Street East section. The fill typically consisted of silty clay/clayey silt. SPT N-values recorded in the fill ranged from 6 to 12 blows/0.3 m, indicating a firm to stiff condition. Moisture contents ranged from 7 to 22%.

4.5.3 Native Soils

The native soils in the vicinity of Main Street East generally comprised silty clay till locally overlain by an approximate 1.5 m thick layer of loose sandy silt to silty sand. The clay till was stiff to hard, typically very stiff, with SPT N-values ranging from 10 to 33 blows/0.3 m. N-values in excess of 100 were recorded at one location. Moisture contents ranged from 10 to 19%.

4.5.4 Groundwater

Groundwater was observed at 1.0 m depth in one borehole; this water appears to be perched in fill overlying clay till. Groundwater was not observed in the remaining boreholes.

4.6 Queenston Road

4.6.1 Existing Pavement Structure

In boreholes drilled between Parkdale Avenue and Adair Avennue, a composite structure consisting of 75 to 100 mm of asphalt over 165 to 255 mm of concrete was encountered directly over the subgrade or up to 255 mm of sand and gravel.

4.6.2 Fill

Fill was encountered in 4 of 9 boreholes reviewed along the Queenston Road section. The fill typically consisted of silty clay to clayey silt. The fill extended to depths of 4.2 and 1.0 m in single boreholes located to the west and east of the Red Hill Valley, respectively. Two boreholes drilled from the road embankment crossing the Red Hill Valley encountered fill to depths of 10.3 and 10.8 m (Elev. 81.2 and 81.8 m).

SPT N-values recorded in the fill typically ranged from 3 to 22 blows/0.3 m, indicating a soft to very stiff condition. Moisture contents generally ranged from 15 to 23%.

4.6.3 Native Soils

Silty clay/clayey silt till was encountered in three boreholes drilled on the table lands in this section. SPT N-values in the till ranged from 9 to 58 blows/0.3 m (stiff to hard). Moisture contents ranged from 12 to 20%.

In two boreholes located east of Parkdale Avenue, shale bedrock was contacted directly below the pavement structure and fill.

In four boreholes drilled either at the base of the Red Hill Creek Valley or through embankment fill crossing the valley, creek deposits comprising clayey silt, silty sand, and sand and gravel were encountered over bedrock. These deposits were 1.1 to 2.5 m thick.

4.6.4 Bedrock

Shale bedrock was contacted at depths of 0.3 to 4.2 m (Elev. 94.9 to 99.2 m) in three boreholes drilled just east of Parkdale Avenue. Within the Red Hill Creek Valley, shale was contacted at depths of 1.4 to 11.9 m (Elev. 80.1 to 81.0 m).

4.6.5 Groundwater

At the Red Hill Creek Valley, groundwater was measured at depths of 1.1 m below the valley base to 10.4 m below the Queenston Road embankment. The groundwater elevation was 81.1 to 82.8 m. Groundwater was not observed in the boreholes drilled on the table lands.

5.0 Geotechnical Evaluation and Preliminary Recommendations

This section provides preliminary geotechnical recommendations pertinent to track bed design, platform foundations, and bridge structures required for planning of the Hamilton LRT B-Line.

The recommendations are based on the subsurface soil and groundwater conditions documented in available information provided by the City of Hamilton, and are suitable only for preliminary planning purposes. The existing data and associated recommendations are not considered adequate for detailed design of the facilities. The soil conditions may vary between and beyond the borehole locations, and accordingly additional investigation will be required to confirm and define the conditions along the alignment and at specific facility locations.

5.1 Track Bed Design

Preliminary design of the typical cross sections for the LRT indicate that the minimum track design will consist of 200 mm of reinforced concrete (second pour) over approximately 250 mm thick slab of levelling concrete (first pour), placed over a minimum of 300 mm of compacted granular fill. The portions of the guideway cross-section outside the range of the tracks (approximately 2.2 m) will be filled with compacted Granular 'A' fill (See Figure 1)

The thickness of the granular layers may be modified in the next design phase once the actual subgrade conditions are provided.

Based on the available borehole data, the native subgrade soils along the corridor, as per the sampled locations, are expected to consist predominantly of the following:

- interbedded sands, silts and clays along the western section (McMaster Medical Centre to approximate Strathcona Avenue);
- silty sand and fine to medium-grained sand in the central section (Strathcona Avenue to Sherman Avenue); and
- silty clay till along the east section (Sherman Avenue to Eastgate Square).

Throughout the alignment, fill materials are present as a result of past roadway construction, underground utility/service installation, and possible localized basement backfill. With the exception of the landfill in the Highway 403 ravine and embankment fill across the Red Hill Creek Valley, the fill encountered in the boreholes does not appear to be related to bulk filling operations for land and road development. Therefore the presence, thickness and quality of the fill can be expected to vary over short distances, and delineation of specific limits of fill over the length of the corridor is not possible from the available information.

Track bed subgrade preparation should include compaction and proofrolling of the exposed subgrade with a heavy roller and examination to identify any areas of unstable subgrade. Any soft/wet areas identified should be subexcavated and replaced with approved material within 2% of optimum moisture content and compacted to at least 98% of SPMDD.

Loose to very loose conditions were identified in the upper 1 to 2 m of the fill and native soil subgrade, primarily in the western half of the corridor. Allowance should be made for possible subexcavation and recompaction/replacement of some material below the track bed sub-ballast to improve the uniformity of support over these areas.

The silts in the interbedded deposits west of Highway 403 may be particularly susceptible to changes in moisture content, and a rolling, unstable subgrade may be encountered if construction is carried out during wet seasons or rainy periods. Subgrade preparation considerations should also include allowance for replacement of wet silts with imported granular material.

The compacted subgrade should be graded with a crossfall of 3% to promote drainage towards subdrains. Minimum 100 mm diameter perforated subdrains, placed in a clear stone trench wrapped with geotextile as per OPSD 216.021, should be installed below the edges of the track bed to provide drainage of the sub-ballast. The subdrains should have frost free outlets draining into catchbasin structures.

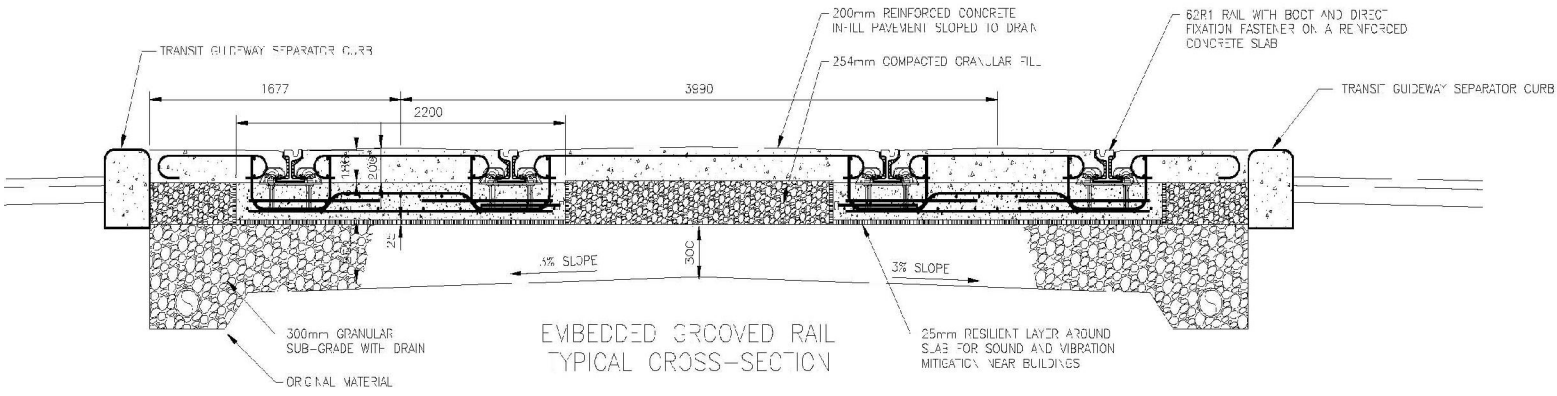
Provided the subgrade is properly prepared, the modulus of subgrade reaction recommended for preliminary design of the track slab along each section of the alignment are as follows:

Table 5.1: Track Slab Subgrade Modulus

Stationing	Primary Subgrade Material	Modulus of Subgrade Reaction (MN/m³)
0+000 to 3+000	Interbedded silts, sands and clays; loose to compact/firm to very stiff	15
3+000 to 6+500	Silty/fine to medium sand; very loose to compact	25
6+500 to 13+500	Silty clay till; stiff to hard	35
--	Granular engineered fill	50

The silts and silty sands at the subgrade level in some of the west and central sections of the alignment could be frost susceptible. To minimize the potential for heaving of the track slab due to frost action, it is recommended that these soils be removed from within the frost depth (1.2 m) and be replaced with non-frost susceptible granular material. It is recommended that these sections be identified during a detailed geotechnical investigation prior to the detailed design phase.

Figure 5.1: Track Bed Typical Cross-Section



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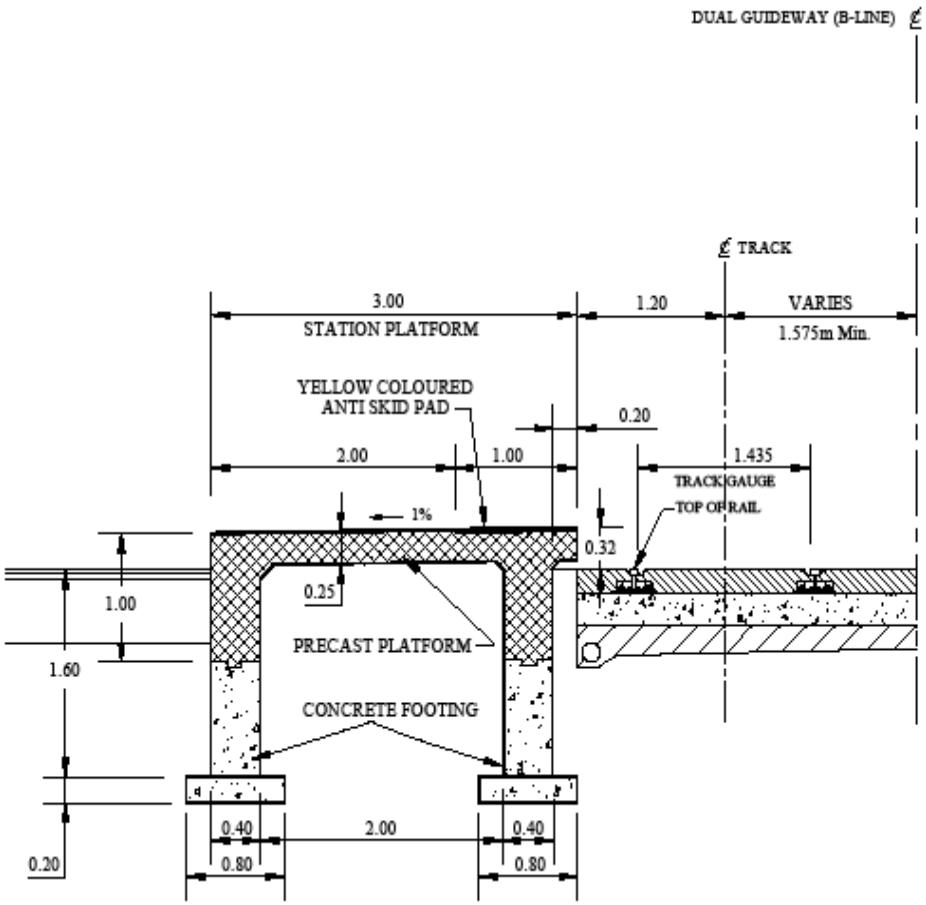
5.2 Stop Foundations

Stop platforms are planned for 18 locations along the B-Line corridor. It is envisioned that the platforms will consist of prefabricated concrete slabs supported on point footings or augered caissons.

Based on the existing borehole data, it is anticipated that spread footings or shallow augered piers (essentially circular spread footings) founded on the native soils will be suitable for support of the stop platforms. However, in many cases, it may be necessary to extend the footings or caissons below the normal depth for frost protection (1.2 m) to penetrate fill and very loose soils.

The footings should be founded a minimum 1.2 m below finished grade as protection against frost action (See Figure 5.2).

Figure 5.2: Typical Stop Platform Detail



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5.3 Catenary Pole Foundations

Based on the available borehole data, it is anticipated that conventional catenary pole foundation design consisting of short augered caissons will be suitable. Lengthening of the caissons to penetrate poor quality fills or very loose deposits may be necessary locally. During augering for pole foundation installation, the potential will exist for encountering obstructions, such as demolition rubble in the fill and cobbles/boulders in the native sand/gravel and clay till.

5.4 Highway 403 Structure Foundations

Conceptual plans call for the LRT to cross the Highway 403 interchange on an elevated guideway supported on a new 11-span structure linking Main Street West with King Street West.

The subsurface stratigraphy along the structure alignment generally comprises a relatively thick fill layer and thin alluvial deposits overlying a thick stratum of very soft to very stiff silty clay, underlain by shale bedrock. The bedrock surface was contacted at depths of 16.2 to 27.5 m, rising towards the east from Elevation 57.0 m at the Main Street/Highway 403 crossing to Elevation 75.2 m at the King Street connection.

In anticipation of relatively heavy structural loads, the geotechnically preferred foundation system is augered caissons (drilled piers) socketed into shale bedrock. The information available regarding the soundness/quality of the shale at the site is limited and will need to be investigated to confirm foundation design parameters for the rock sockets.

Steel liners will be required to support the sidewalls of caissons during installation, particularly where the shafts will extend through landfill and wet alluvial deposits.

Steel H-piles driven to refusal in the shale bedrock may also be considered. For preliminary design purposes, HP 310x110 piles driven to refusal in shale should be designed using the following geotechnical resistances:

Factored Geotechnical Resistance at ULS	1,600 kN
Geotechnical Resistance at SLS	1,200 kN

The pile tips should be reinforced to provide protection from damage while driving into the bedrock.

The depth of frost penetration in Hamilton is 1.2 m. The base of pile caps should be placed a minimum 1.2 m below finished grade as protection against frost action.

5.5 Relocation of Underground Utilities

We understand that underground utilities and municipal services below the track slab will be abandoned and relocated under the adjacent roadway. In constrained areas, a cast-in-place concrete utility tunnel is proposed to carry the utilities.

5.5.1 Trench Excavation

Excavation for open cut installation of underground utilities will primarily extend through the roadway pavement structure and fill layers, and into native silts/sands/clays in the west part of the corridor, sands in the central section, and silty clay till in the eastern part. Shale bedrock may be encountered along Queenston Road.

All temporary excavations must be carried out in accordance with the current Occupational Health and Safety Act (OHSA) of Ontario and local regulations. In general, the fill and native soils within the relatively shallow excavation depths anticipated for utility installations are classified as a Type 3 soil under OHSA.. Where space restrictions preclude excavation of inclined slopes, service installation may be carried out using a trench box or temporary shoring.

Where the trench depth exceeds 6 m in fill or till, the support system must be designed specifically for this project. The design of the support system should include the effects of surcharge loads such as those imposed by construction equipment, roadway traffic, adjacent buildings and other facilities.

Use of a hydraulic excavator should be suitable for trench excavation. Provision should be made for handling and removal of the pavement materials, possible obstructions in the fill, and cobbles, boulders or chunks of shale and limestone in the till soils during excavation.

Excavation in the upper 1 to 3 m of the Queenston shale formation should be possible using heavy excavation equipment and rippers, supplemented by pneumatic rock breakers where thick layers of hard material are encountered. The shale below this depth is harder and less weathered, and intensive use of pneumatic/hydraulic breakers or other methods of loosening the bedrock will likely be required. Near vertical sidewalls may be employed in shale bedrock.

Water was measured at depths of 1.2 to 19.5 m in previous boreholes drilled along the corridor. Localized zones of perched water were also encountered in the fill or seams/layers of more permeable sands within layered deposits. In general, removal of seepage entering trenches should be feasible using sumps and pumps where excavation depths are less than about 4 m and for excavations in silty clay till (east part of corridor). Where the trench depths in sands and silts exceed about 4 m, the potential increases that excavation will encounter groundwater and more extensive dewatering will be required. The impacts of groundwater in areas of deeper excavation, if planned, must be further assessed.

5.5.2 Pipe Bedding and Backfill

Pipe bedding materials, compaction and cover should follow OPSD and/or City of Hamilton specifications. In areas where a less competent subgrade is encountered, it may be necessary to increase the bedding thickness.

Trench backfill materials should be placed in loose lift thicknesses not exceeding 200 mm and compacted to at least 98% of its SPMDD. To minimize the potential for post-construction settlement of the track and roadway surface, it is recommended that OPSS Granular A or B material, or unshrinkable fill, be employed to backfill the trenches.

If reuse of the excavated materials as trench backfill is contemplated to reduce costs, the potential for settlement and the need for re-establishing the roadway surface over trenches must be accepted.

In general, the predominant sands in the central section of the corridor and the clay till in the eastern section are considered suitable for reuse, provided they meet environmental requirements, are free of organics, debris and other deleterious materials, and the placement moisture content is within about 2% of the optimum moisture content for efficient compaction. The clay till must be adequately broken down and compacted in the trench. Fill containing demolition rubble and other debris, such as that encountered in boreholes between Bay and MacNab Streets, should not be reused.

The interbedded silts, sands and clays in the west section of the corridor along the grass medians (west of Dundurn Street) appear to be typically wet of the optimum moisture content for efficient compaction. Reuse of these materials as trench backfill is not recommended. Reuse of excavated shale is not recommended.

5.6 Pavement Restoration

The existing pavement structure documented in the available boreholes is highly variable and comprises areas of both flexible and composite design. Establishing recommendations for restoration of the existing pavement thickness over backfilled trenches is therefore not practical at this stage, and generalized guidelines are presented below.

Main Street, King Street and Queenston Road are classified as major arterial roadways. The minimum pavement structure typically specified by the City of Hamilton for this type of roadway is as follows:

HL-1 Surface Course Asphalt	40 mm
HL-8 (HS) Binder Course Asphalt	120 mm
OPSS Granular A Base	150 mm
OPSS Granular B Type II Sub-base	450 mm

The required pavement thickness should be assessed during detailed design when traffic volumes and additional borehole information is available. For preliminary planning purposes, we recommend that an increased Granular B sub-base thickness of 600 mm be assumed. Further, the use of premium hot mixes (DFC, HDBC) and Superpave mix design should be considered to reduce rutting in heavily travelled sections.

Acceptance, placement and compaction of the pavement materials should be carried out in accordance with the applicable City of Hamilton or OPS specifications. The pavement granular material should be compacted to 100% of SPMDD.

5.7 Environmental Considerations

The soil descriptions provided on the borehole logs were reviewed for indications of potential environmental impact. The following potential areas of concern were identified based on this review:

- pockets of grey and black silt were documented within a sand layer in one borehole located in front of McMaster Medical Centre;
- Clayey silt fill encountered in three boreholes between Newton Avenue and Paisley Avenue were described as mottled reddish brown and black or containing black clay seams;
- Boreholes were drilled in association with underground storage tank removal at a service station located on the northwest corner of Longwood Road and Main Street West;
- Deep deposits of refuse fill are present in the Highway 403 valley;
- Ashes, cinders and demolition rubble were present within the fills between Bay Street and MacNab Street; and
- Pavement granular materials between Walnut and Wellington Streets contains slag.

Chemical analysis of soil samples was carried out during several investigations conducted along the corridor. In general, these results indicated elevated values of Electrical Conductivity (EC) and Sodium Adsorption Ratio (SAR). The EC and SAR values are believed to reflect the effects of road de-icing salt, and may impact vegetation growth if reused in applications near the ground surface. Concentrations of metals such as cadmium, beryllium and zinc exceeded anticipated background levels at isolated locations.

Due to the inherent variability of subsurface conditions, detailed investigation and testing will be required to evaluate the quality of the excess excavated soils and establish soil management procedures. The need for off-site disposal of landfill materials from the Highway 403 corridor, demolition rubble from the Bay-MacNab Street area, and other localized materials should be anticipated. Acceptance criteria stipulated by individual receivers may vary, and some receivers may not accept this material.

5.8 Recommendations for Further Investigation

A number of gaps have been identified in the existing subsurface data for which additional investigation is recommended for preliminary design. To advance in the next design phase, it is recommended that the supplementary geotechnical investigations include:

- At least one borehole at each stop platform location;
- At least three boreholes including bedrock coring within the Highway 403 valley to evaluate the quality of the underlying shale bedrock and assess parameters for design of caissons to support the guideway structure;
- In the order of 15 additional boreholes at locations between stops where existing information is not available, primarily in the section east of Victoria Avenue;
- Investigation of the foundation conditions at the proposed maintenance and storage yard to assess the presence and quality of any fill on site and determine foundation requirements for buildings and track slabs;
- Installation of piezometers to further assess the groundwater levels along the corridor; and
- Supplemental chemical testing of soil samples recovered from the boreholes.

Further geotechnical investigation will be required during the detailed design stage to provide detailed recommendations for design and construction of the proposed facilities. As a minimum, this investigation should include an additional borehole at each stop location, at least one borehole with bedrock coring at each pier and abutment of the guideway structure over Highway 403 (in accordance with MTO investigation requirements), boreholes along the track alignment conceptually at a spacing in the order of 100 m, and foundation investigation for the maintenance and storage facility.

DOCUMENT END

Disclaimer

This document contains the expression of the professional opinion of Steer Davies Gleave North America Inc. ("SDG") as to the matters set out herein, using its professional judgment and reasonable care. It is to be read in the context of the agreement (the "Agreement") between SDG and the City of Hamilton (the "Client") for the Rapid Transit Preliminary Design and Feasibility Study (reference C11-12-10), and the methodology, procedures and techniques used, SDG's assumptions, and the circumstances and constrains under which its mandate was performed. This document is written solely for the purpose stated in the Agreement, and for the sole and exclusive benefit of the Client, whose remedies are limited to those set out in the Agreement. This document is meant to be read as a whole, and sections or parts thereof should thus not be read or relied upon out of context.

SDG has, in preparing the Agreement outputs, followed methodology and procedures, and exercised due care consistent with the intended level of accuracy, using its professional judgment and reasonable care.

However, no warranty should be implied as to the accuracy of the Agreement outputs, forecasts and estimates. This analysis is based on data supplied by the client/collected by third parties. This has been checked whenever possible, however SDG cannot guarantee the accuracy of such data and does not take responsibility for estimates in so far as they are based on such data.

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APPENDIX A

TABLES

TABLE A1
SUMMARY OF AVAILABLE BOREHOLES

Section	Approximate Stationing	Borehole Designations	Year Drilled	Consultant
Main Street West	-0+110 to -0+130	91-5B, 6B	1966	E.M. Peto Associates Ltd.
	-0+080 to 0+200	GTR_1019-1, 4, 5, 7, 8	2004	Soil-Mat Engineers & Consultants Ltd.
	0+290 to 0+450	GTR_1153-1, 2	2005	Landtek Limited
	0+640	625-1B	1991	Warnock Hersey Professional Services Ltd.
	0+830 to 1+630	580-1, 2, 3, 4, 5, 6, 7, 8, 580A-21,	1990	Trow
	1+370 to 1+400	MW-204, 211	2004	Jacques Whitford Environmental Limited
Highway 403	2+070 to 2+130	029-4, 5	1959	Department of Highways
	2+070 to 2+290	030-H3, H4, H5, H7, H9, H10, J12B	1960	Department of Highways
	2+330 to 2+470	870-02, 03, 04, 05, 20, 21	1994	Mountainview Geotechnical
King Street West	2+590	565A-2	1962	E.M. Peto Associates Ltd.
	2+750 to 3+930	94A-1, 2, 3, 4, 5, 6, 7, 8, 9	1977	Peto MacCallum Ltd.
	3+380 to 3+540	765ORG-20, 21	1995	Mountainview Geotechnical
	4+080 to 4+230	500-4P, 5, 6P, 7	1973	Peto Associates Ltd.
	3+980 to 4+250	111A-3, 5, 6	1971	Racey, MacCallum and Bluteau Ltd.
King Street East	4+370	908-1	2001	Trow Consulting Engineers
	4+440	283A-1	2001	Trow Consulting Engineers
	4+520	GTR1076-16	2004	Shaheen and Peaker
	4+540 to 4+620	736-C, D	1994	Golder Associates
	4+750	430-5	1986	Sitest Engineering
	4+850 to 4+960	845-A, B	1999	AGRA Earth and Environmental
	4+930	999-3	2002	Terraprobe Ltd.
King Street East	4+960 to 5+250	832A-1, 2, 3	1998	Trow Consulting Engineers
	5+280	749-7	1995	Golder Associates

TABLE A1
SUMMARY OF AVAILABLE BOREHOLES

Section	Approximate Stationing	Borehole Designations	Year Drilled	Consultant
	5+280	GTR1031B-6-1	2003	Soil-Mat Engineers and Consultants Ltd.
	5+490	181A-2	1969	Peto Associates Ltd
	5+900	528-3	1989	Sitest Engineering
	6+150	898-1	2001	Trow Consulting Engineers
	7+050 to 7+520	29-1, 4, 6	1976	Peto MacCallum Ltd.
	7+920 to 8+250	517-1, 2, 3	1989	Sitest Engineering
Main Street East	8+960	993-1	2002	Peto MacCallum Ltd.
	9+050	GTR1059-1	2003	Terraprobe Ltd.
	9+130	462-1	1987	Sitest Engineering
	9+460	319A-1	1982	Trow Consulting Engineers
	9+870	80-1	1986	Trow Consulting Engineers
	10+130	675-1- 3	1992	Warnock Hersey
Queenston Road	10+550	853-2	1999	Landtek Ltd.
	11+320 to 11+470	616-1, 2, 3	1991	Mountainview Geotechnical
	11+870	562A-22	1962	E.M. Peto Associates Ltd
	11+990 to 12+090	963-304, 308	1989	Golder Associates
	12+050	GTR1268-Q5	1998	Peto MacCallum Ltd
	12+940	124-1	1970	Peto Associates Ltd

APPENDIX B

RECORD OF BOREHOLE SHEETS

MAIN STREET WEST

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 1

PROJECT Watermain, Sewer and Road Reconstruction — *OUR PROJECT NO.* 02HF051
LOCATION London St. N. (Dunsmure Rd. to Roxborough Ave.) — *BORING DATE* 2002 07 20 — *ENGINEER* P. Cullen
BORING METHOD Continuous Flight Solid Stem Augers — *TECHNICIAN* M. Rapsey

DEPTH in METRES	DESCRIPTION (GROUND ELEVATION 90.60)	LEGEND	ELEVATION	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/0.3m N - VALUES	GROUND WATER OBSERVATIONS AND REMARKS
0.25	PAVEMENT STRUCTURE: 130 mm asphaltic concrete over 110 mm granular "A" crushed limestone		90	1	SS	5	
1.5 1.65	SILT: Loose, brown, fine sandy silt, damp		89	2	SS	24	
2.40	CLAY TILL: Very stiff, brown, silty clay, some sand and gravel, low to medium plastic, D.T.P.L. becoming grey, A.P.L.		88				
3.0				3	SS	17	
3.60	BOREHOLE TERMINATED AT 3.60 m		87				Upon completion of augering, no water, no cave

SHEAR STRENGTH C_u kPa (50 100 150 200) ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3M (20 40 60 80)
LIQUID LIMIT W_L — PLASTIC LIMIT W_P — WATER CONTENT W
WATER CONTENT % (10 20 30)

NOTES

CHECKED BY

BHLOG WITH PML LOGO 02HF051D.GPJ PETOMAC.GDT 2002 06 12

Terraprobe

PROJECT No: 7-03-0122-6
CLIENT: The City of Hamilton
LOCATION: Edgemont Street

LOG OF BOREHOLE 1

BORING DATE: September 24, 2003
ELEVATION DATUM: Geodetic
SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD	DEPTH SCALE IN METRES	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUE
CME 75 TRUCKMOUNT	0	GROUND SURFACE		90.68			
		100mm Asphalt		0.0	1	AS	
		150mm Concrete					
		(FILL) Granular Road Base		0.30	2	SS	11
	1	(FILL)			3	SS	6
		Firm, brown and grey; CLAYEY SILT to silty clay, trace topsoil, some sand and gravel with pieces of shale			4	SS	4
	2			88.08	5	SS	12
		Stiff to very stiff, brown and grey; SILTY CLAY, trace sand and ocassional gravel (TILL)		2.60			
	3			87.17	6	SS	16
		END OF BOREHOLE		3.51			
	4						
	5						
	6						
	7						
	8						
	9						

PENETRATION RESISTANCE PLOT (20 40 60 80) SHEAR STRENGTH kPa (20 40 60 80)
WATER CONTENT (%) (W_P — W — W_L) (10 20 30)
INSTALLATION INFORMATION

NOTES:
Borehole dry upon completion of drilling.

SHEET 1 OF 1

A. CUMMINGS
7-03-0122-6-1.DWG

SITEST ENGINEERING DATA SHEET FOR BOREHOLE 1 DRAWING 2 (SHEET OF)

Project No. 8732 (Your No.)
Project PARK ROW SEWERS
Location PARK ROW STREET
HAMILTON, ONTARIO
Hole Location SEE DRAWING NO: 1
Date Drilled JULY 13, 1987 Hole VERTICAL
Drilled by HOLLOW STEM AUGER 80 mm I.D.
Datum GEODETIC

Field: 3" O.D Split Tube; 3", 2" I.D Shelby Tube; Rotary Core Sample; Auger or Wash Sample; 2" Dia. Cone; Field Vane; Pressure Meter; Sampler Pushed (pressure) P( ); Water Table (definite, apparent)

Laboratory: Natural Moisture; Plastic & Liquid Limit; Lab Vane Test; Torvane; Unconfined Compression; Undrained Triaxial at Overburden Pressure; Strain at Failure; Sensitivity

Symbol	Description / Classification	Elevation metres	Depth metres	Penetration Resistance, N, 350 ft lbs blows/ft. 10 20 30 40 — Shear Strength	Natural Water Content & Atterberg Limits (% dry weight) 10 20 30 — Sensitivity	Sample Type & Number	Unit weight / Recovery %
	ASPHALT		0.10				
	CONCRETE		0.25				
	SILTY CLAY TILL embedded sand and gravel occasional cobbles brownish grey very stiff to hard		1	20		1	90
	occasional red shale inclusions		2	33		2	100
	grey @ 1.8 m		3				
			4	23		3	100
				22		4	100
	BOREHOLE TERMINATED		5.03				

Notes 1. Borehole was moist and open to 5 metres on completion.
2. Borehole was backfilled on completion of the fieldwork.

Borehole Log

Trow Ltd

Auger Sample; SPT (N) Value; Dynamic Cone Test; Shelby Tube; Field Vane Test +s; Lab Vane Test
Natural Moisture; Plastic and Liquid Limit; Undrained Triaxial at Overburden Pressure % Strain at Failure; Penetrometer

Project Sewer Construction Dwg. No. 2
Wexford and Monterey Avenues Borehole No. 1
Hamilton, Ontario Project No H4462-G
Hole location and datum see drawing No. 1

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH m
	F	90 mm ASPHALT 460 mm GRANULAR BASE CRUSHER-RUN LIMESTONE FILL-silty clay,wet,firm	92.8 (304.5)	0
		SILTY CLAY-brownish grey,with traces of sand and fine gravel, very stiff	90.8 (297.9)	2
		SILTY CLAY-grey,moist, firm	88.8 (291.4)	4
		TERMINATED	87.78 (288.0)	5

N Value (ASTM) D1586-CSA A119.1: 20 40 60 80 — Shear Strength MPa

Natural Moisture Content and Atterberg Limits % Dry Weight: 10 20 30

Natural Unit Weight kN/m³ (pcf): 20.3 (128.8); 20.0 (127.1)

NOTES:
1. Borehole put down uncased with continuous flight auger equipment on September 28, 1982.
2. Water level at 1 m depth on completion.

TL10fr0

BOREHOLE LOG

PROJECT No. H2397 BOREHOLE No. 1 DRAWING No. 2

PROJECT Proposed Sewer Installation
LOCATION 3 Intersections
Hamilton, Ontario
HOLE LOCATION AND DATUM SEE DRAWING No. 1

AUGER SAMPLE
2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
2" DIA. CONE
PUSHED
VANE TEST AND SENSITIVITY (S)
NATURAL MOISTURE
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE

SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.
2" ASPHALT	305.4	0
7" CONCRETE	304.7	
SAND: fine to med., silty, occ. gravel sizes, red-brown to brown, wet to moist, (compact)	299.9	5
SILTY CLAY TILL: sand and gravel sizes, horizontally layered, some silt pockets, grey, moist to very moist, (very stiff)		10
		15
		20
		25
		30
		35
		40
		45
		50
TERMINATED	283.9	

PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80
SHEAR STRENGTH K.S.F.
NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT 10 20 30
NATURAL UNIT WEIGHT P.C.F.

NOTES:

1 Borehole advanced uncased by continuous flight auger equipment to termination at 21½ feet depth on Sept.7/86 by S.O.I.L.

2. Water Level Records:

ELAPSED TIME	DEPTH TO W.L.(ft)	HOLE OPEN TO (ft)
on completion	dry	19.5

William Trow Associates (Hamilton) Ltd.

BORING LOG

Warnock Hersey

PROJECT THE REGIONAL MUNICIPALITY OF ~~HAMILTON-WENTWORTH~~
PROPOSED SEWERS, GROUP 3
PARKDALE AVE.S., AT QUEENSTON RD.,
CONTRACT NO. 050319-C700-435600 ~~HAMILTON~~
DATUM GEODETIC

BORING BH 1-5
PAGE 1 OF 1
BORING DATE None
CASING H.S.A.

SAMPLE CONDITION: DISTURBED, GOOD, LOST
SAMPLE TYPES: SS SPLIT SPOON; ST THIN WALLED OPEN (SHELBY); PS PISTON SAMPLER; WS WASH SAMPLE; RC ROCK CORE
ABBREVIATIONS: GS GRAIN SIZE ANALYSIS; γ WET UNIT WEIGHT - kN/m³; C CONSOLIDATION; K PERMEABILITY - cm/s; DS DIRECT SHEAR; Q TRIAXIAL QUICK

DEPTH m	ELEVATION - m DEPTH	DESCRIPTION	SYMBOL	WATER LEVEL	OTHER TESTS	CONDITION	TYPE AND NUMBER	RECOVERY %	STANDARD PENETRATION - N BLOWS/0.3m
	99.24	GROUND SURFACE ASPHALT 90							
		CONCRETE 150 SAND AND GRAVEL 370							
1	0.61	VERY STIFF TO HARD BROWN TO GREY BROWN SILTY CLAY TRACE SAND AND GRAVEL					SS1	22	21
2							SS2	72	71
3	96.61				SO_4		SS3	83	75
4	3.23	HARD RED BROWN, AND GREY SILT LAYERED TRACE SAND AND GRAVEL							
5							AS4	-	175
6									
7	92.59 6.65	END OF BOREHOLE BOREHOLE DRY UPON COMPLETION					SS5	100	100 for 100 mm

TESTS: UNDRAINED SHEAR STRENGTH - kPa; Q TEST; FIELD VANE: INTACT, REMOULDED; FALL CONE: INTACT, REMOULDED; WATER CONTENT - W_n%; LIQUID LIMIT - W_L%; PLASTIC LIMIT - W_p%; DYNAMIC PENETRATION TEST - BLOWS/0.3 m; SAMPLES

QUEENSTON ROAD

LANDTEK LIMITED

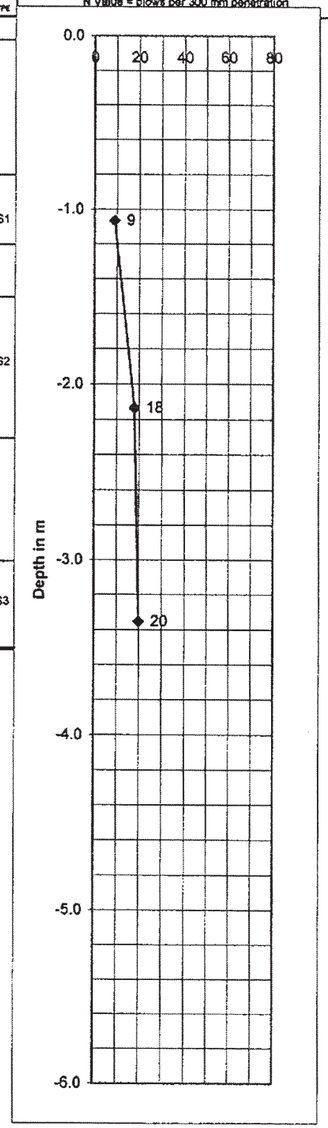
Consulting Engineers

LOG OF BOREHOLE NO. 2

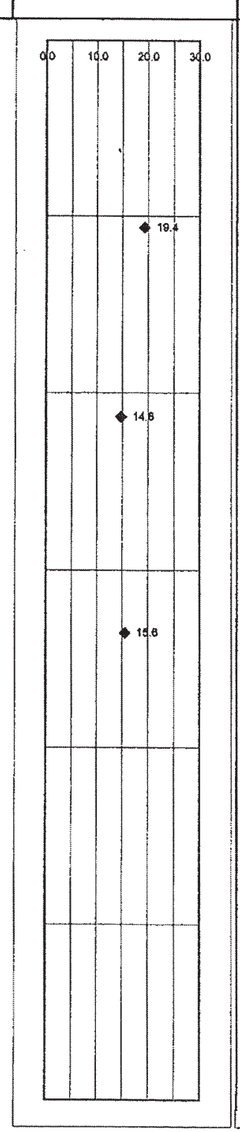
Project #	99075	Drilling Date	20-Jul-99	Drawing No. 3
Client:	Region of Hamilton-Wentworth	Drilling Method	[x] solid stem continuous flight	
Project:	Proposed Watermain Construction		[ ] hollow stem	
Location:	Bell Avenue, Hamilton		[ ] diamond drill	
Bench Mark:	Geodetic	Contract Drilling Co.	Geo-Environmental Drilling	

SOIL DESCRIPTION	WATER LEVEL	STRATA ELEV. / DEPTH	SAMPLE TYPE
		95.0	
75 mm of Asphalt over 125 mm Concrete 25 mm of Granular		0.0	
TILL (Halton Formation) silty clay, gravel sizes, brown, red shale fragments, grey fractures, red-brown, moist (Stiff to Very Stiff)			SS1
			SS2
			SS3
		91.5	
BOREHOLE TERMINATED		3.5	

STANDARD PENETRATION TEST
N Value = blows per 300 mm penetration



SOIL MOISTURE PROFILE



DATA & COMMENTS

Notes: 1. Borehole was dry and open to 3.0 m on completion.

MOUNTAINVIEW GEOTECHNICAL LTD.

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Lab Vane Test
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at Overburden Pressure
% Strain at Failure
Penetrometer

Project Proposed Storm Sewer — Dwg. No. 2
Queenston Road — Borehole No. 1
Hamilton — Project No S0145

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH m
		89mm Asphalt 165mm Concrete 203 mm Sand and Gravel	99.1	0
		Fill - silty clay, gravel sizes, cobbles & Boulders, Shale fragments, organic Pockets, Reddish-Brown, moist, (soft to firm)	98.6	1
		Shale - weathered changing to sound Shale at 4.9m, Siltstone layers, red, (hard)	94.9	4
		End of Borehole	94.1	5
		Notes: 1) Borehole advanced on April 2/91 using continuous Flight Solid Auger Equipment 2) Borehole open to full depth and dry on completion.		6

N Value (ASTM) D1586-CSA A119.1)
20 40 60 80
Shear Strength MPa

Natural Moisture Content and Atterberg Limits % Dry Weight
10 20 30

Natural Unit Weight kN/m³

MOUNTAINVIEW GEOTECHNICAL LTD.

Auger Sample ⊠ | Natural Moisture ×
SPT (N) Value ○ ○ ▨ | Plastic and Liquid Limit ⊢○
Dynamic Cone Test ——— | Undrained Triaxial at Overburden Pressure
Shelby Tube ● ● ■ | % Strain at Failure 0 15 5 10
Field Vane Test +s | Penetrometer ▲
Lab Vane Test t

Project: Proposed Storm Sewer — Dwg. No: 3
Queenston Road — Borehole No: 2
Hamilton — Project No: S0145

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH m	N Value (ASTM) D1586-CSA A119 1) 20 40 60 80 Shear Strength MPa	Natural Moisture Content and Atterberg Limits % Dry Weight 10 20 30	Natural Unit Weight kN/m³
		76mm Asphalt	99.5	0			
		230mm Concrete	99.2				
		Shale - weathered to clay consistency, gravel size, Siltstone cobbles, moist changing to sound Shale at 3.4m, Red, (hard)		1			
				2			
		End of Borehole	96.0	3			
				4			
		Notes: 1) Borehole advanced on April 2/91 using continuous Flight Solid Stem Auger Equipment 2) Borehole open to full depth and dry on completion.		5			
				6			
				7			
				8			
				9			
				10			

MOUNTAINVIEW GEOTECHNICAL LTD.

Auger Sample ⊠ | Natural Moisture ×
SPT (N) Value ○ ○ ▨ | Plastic and Liquid Limit ⊢○
Dynamic Cone Test ——— | Undrained Triaxial at Overburden Pressure
Shelby Tube ● ● ■ | % Strain at Failure 0 15 5 10
Field Vane Test +s | Penetrometer ▲
Lab Vane Test t

Project: Proposed Storm Sewer — Dwg. No: 4
Queenston Road — Borehole No: 3
Hamilton — Project No: S0145

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH m	N Value (ASTM) D1586-CSA A119 1) 20 40 60 80 Shear Strength MPa	Natural Moisture Content and Atterberg Limits % Dry Weight 10 20 30	Natural Unit Weight kN/m³
		100mm Asphalt	99.3	0			
		255mm Concrete					
		255mm Sand & Gravel	98.7				
		Silty Clay Till - gravel Sizes, Limestone boulders, Red Shale and siltstone fragments, moist, reddish-brown (hard)		1			
				2			
		Silt Till- occasional gravel sizes, red shale fragments, oxidized olive-brown, moist, (hard)	96.1	3			
		Shale - siltstone layers red, (hard)	95.4	4			
		End of Borehole	94.7				
				5			
		Notes: 1) Borehole advanced on April 2/91 using continuous Flight Solid Auger Equipment 2) Borehole open to full depth and dry on completion.		6			
				7			
				8			
				9			
				10			

this margin reserved for binding

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Redhill Creek Sewer | Job No.: 61182/1 | Borehole No.: 22

Client: City of Hamilton | Casing: BX | Boring Date: Jan. 10 - 11 , 1962

Elevation: 269.8 | Compiled By: J. F. G. | Checked By: S. B.

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

A.S. AUGER SAMPLE
C.S. CASING SAMPLE
S.S. 2" STANDARD SPLIT TUBE SAMPLE
S.L. SPLIT BARREL WITH LINERS
S.T. THIN-WALLED SHELBY TUBE SAMPLE
W.S. WASH SAMPLE
R.C. ROCK CORE

ABBREVIATIONS

V.T. IN SITU VANE SHEAR TEST
C. SOIL SHEAR STRENGTH LBS/SQ.FT.
W.L. WATER LEVEL IN CASING
W.T. GROUND WATER TABLE IN SOIL
W.T.P.L. WETTER THAN PLASTIC LIMIT
D.T.P.L. DRIER THAN PLASTIC LIMIT

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth / Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per Ft	Natural Moisture Content	WATER LEVELS & REMARKS
			GROUND SURFACE						
Silty fine sand - organic	Red brown		1'0"		1	C.S.			Very moist.
Clayey silt	Red brown				2	C.S.			Very moist.
Clayey silt - fine sand content	Red brown	Loose to Compact			3	S.S.	6	27.3	Very moist
River Gravel	Red brown		4'3" / 4'9"		4	C.S.			Saturated.
Highly weathered shale	Red brown	Extremely Dense	6'6" / 7'8"		5	S.S.	93	9.3	Moist.
Queenston shale	Red & blue		13'0"			R.C.			Rust pocket at 9 feet. Recovery 95% Odd broken seam
Thin gypsum seam			15'9"						
Queenston shale	Red & blue		18'0"			R.C.			Recovery 100%
Fissure at 22'10"			22'10"						
Queenston shale	Red & blue					R.C.			Recovery 100%
Soft seam or fissure at 25'6"			25'6"						
			28'2"						
			Boring Terminated at 28'2"						Note: Arrows denote soft seams.

WATER CONDITIONS.

Date	Time	Depth Casing	Depth Hole	Depth Water	Remarks
Jan. 10/62		0'	4'4"	3'7"	Hole should be at 6 ft. seepage from 4'3" to 4'9'
Jan. 11/62	10:30 a.m.	8'	18'	6'2"	Unable to lower W.L. below 6'2' by bailing.
	10:31 a.m.	8'	18'	3'7"	
	10:36 a.m.	8'	18'	3'7"	
	12:30 p.m.	8'	18'	3'7"	

RECORD OF BOREHOLE 304

SHEET 1 of 2

LOCATION SEE FIGURE 2 | BORING DATE AUGUST 29,1989 | DATUM GEODETIC

SAMPLER HAMMER, 63.5kg, DROP, 760mm | PENETRATION TEST HAMMER, 63.5kg, DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (M)	SAMPLES: NUMBER	TYPE	BLOWS/0.3M	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: SHEAR STRENGTH Cu, kPa (nat.V.- + O.- ● rem.V.- ⊕ U.- O)	HYDRAULIC CONDUCTIVITY, k, CM/SEC: WATER CONTENT, PERCENT (Wp, W, WL; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	CME-65 POWER AUGER BORING 165mm DIA. SOLID STEM AUGERS	GROUND SURFACE		92.00 / 0.00							Backfill
1		Granular road base. FILL.		91.20 / 0.80	1	50 DO	8			MH	
2		Firm to stiff, grey silty clay, trace to some sand and gravel, trace organics (wood and peat) FILL.			2	50 DO	6				
3					3	50 DO	8				
4					4	50 DO	10				
5					5	50 DO	12				
6		Red-brown sand, some gravel. FILL.		87.40 / 4.80	6	50 DO	8				
7		Firm to stiff, brown to grey clayey silt, some sand, trace gravel, some sandy silt pockets/layers, occ. organics. FILL. Topsoil layer (about 200mm thick) at 6m depth.		86.70 / 5.30	7	50 DO	7				
8					8	50 DO	18				
9					9	50 DO	19				
10		CONTINUED ON SHEET 2		82.00 / 10.00							

0 / 15 / 10 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE 1 : 50

Golder Associates

LOGGED RF

CHECKED ASP

RECORD OF BOREHOLE 304

SHEET 2 of 3

LOCATION SEE FIGURE 2
SAMPLER HAMMER, 63.5kg, DROP, 760mm
BORING DATE AUGUST 29,1989
PENETRATION TEST HAMMER, 63.5kg, DROP, 760mm
DATUM GEODETIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3M	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat.V.- + Q.- ●, rem.V.- ⊕ U.- ○)	HYDRAULIC CONDUCTIVITY, k, CM/SEC; WATER CONTENT, PERCENT (Wp, W, WL; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10		CONTINUED FROM SHEET 1		82.00							Backfill
		SEE DESCRIPTION ON PREVIOUS PAGE.		10.00							
				81.40							
		Possible boulder (inferred from auger resistance).									
11		Stiff, mottled brown and grey CLAYEY SILT with sand and gravel, occ. sand seams.		10.80	10	60 DO	13				
				80.10							
12		Red-brown completely weathered calcareous mudstone.		11.90	11	50 DO	82/.5				
				79.68							
				12.42							
13		FOR BEDROCK CORING INFORMATION REFER TO SHEET 3.									Water level in borehole open to 12.4m depth, at Elev. 81.3m on completion of overburden drilling.
14											
15	CME-55 POWER AUGER BORING 165mm DIA. HOLLOW STEM AUGERS										
16											
17											
18											
		END OF HOLE		73.38 18.84							
19											
20											

D
18 ⊕ 6 PERCENT AXIAL STRAIN AT FAILURE
19

DEPTH SCALE
1 : 50

Golder Associates

LOGGED RF
CHECKED ASP

RECORD OF BOREHOLE 304

SHEET 3 of 3

LOCATION SEE FIGURE 2
INCLINATION AZIMUTH
DRILLING DATE AUGUST 29,1989
DRILL RIG CME-55 POWER AUGER BORING
DRILLING CONTRACTOR NX CORING
DATUM GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/MIN)	% RETURN COLOUR FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3M	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		FR-FRACTURE CL-CLEAVAGE SH-SHEAR VN-VEIN						F-FAULT J-JOINT P-POLISHED S-SLICKENSIDED					SM-SMOOTH R -ROUGH ST-STEPPED PL-PLANAR		FL-FLEXURED UE-UNEVEN W -WAVY C -CURVED	
10		FOR SOILS INFORMATION REFER TO SHEET 2		82.00												
				10.00												
11																
12	NQ RC	Red-brown completely weathered calcareous mudstone. (QUEENSTON SHALE)		80.10												
				11.90												
				79.58												
13	NQ RC			12.42	12	09	80%						BROKEN CORE SEAMS			Backfill
					13	.06	80%						BROKEN CORE SEAMS			
14													BROKEN CORE SEAMS			
15	DRILLING NQ RC	Red-brown, moderately to slightly weathered, fine grained, thinly bedded, calcareous mudstone. (QUEENSTON SHALE)			14	.05	30-60%						BROKEN CORE SEAMS			
16	ROTARY NQ RC				15								BROKEN CORE SEAMS			Bentonite Seal
17																Granular Filter
18	NQ RC				16	.04	30-60%						BROKEN CORE SEAMS			
				73.36									BROKEN CORE SEAMS			
		END OF HOLE		18.64												Water level in piezometer at Elev. 81.6m on Oct. 4, 1989.
19																
20																

DEPTH SCALE
1 : 50

Golder Associates

LOGGED RF
DATE AUG. 29,1989
CHECKED ASP

RECORD OF BOREHOLE 308

SHEET 1 of 2

LOCATION SEE FIGURE 2

BORING DATE SEPT. 5,1989

DATUM GEODETIC

SAMPLER HAMMER, 63.5kg, DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg, DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	SAMPLES: NUMBER	TYPE	BLOWS/0.3M	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat.V.- +Q.- ● rem.V.- ⊕ U.- ○)	HYDRAULIC CONDUCTIVITY, k, CM/SEC; WATER CONTENT, PERCENT (Wp W Wl, 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	CME-55 POWER AUGER BORING 165mm DIA. SOLID STEM AUGERS	GROUND SURFACE		92.09							
		Compact, grey sand and gravel (granular road base). FILL.		0.00							
1				90.92	1	50 DO	10				
				1.17							
2		Stiff, grey-brown silty clay, trace to some sand, trace gravel, occ. organics, topsoil seam at 2.5m depth. FILL.			2	50 DO	9			MH	
					3	50 DO	16				
3					4	50 DO	9				
4				88.09	5	50 DO	8				
				4.00							
5		Stiff to very stiff, red-brown clayey silt, some gravel, weathered shale/residual soil. FILL.			6	50 DO	9				
6					7	50 DO	22				
7				84.59							
				7.50							
8		Mixture of very stiff red-brown clayey silt, trace to some sand and gravel; and dense brown silty sand, trace clay; occ. organics, occ. asphalt fragments. FILL.			8	50 DO	30				
9					9	50 DO	18				
10		CONTINUED ON SHEET 2		82.09							
				10.00							

0 10 ⊕ 6 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE 1 : 50

Golder Associates

LOGGED RF

CHECKED ASP

RECORD OF BOREHOLE 308

SHEET 2 of 2

LOCATION SEE FIGURE 2

BORING DATE SEPT. 6,1989

DATUM GEODETIC

SAMPLER HAMMER, 63.5kg, DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg, DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	SAMPLES: NUMBER	TYPE	BLOWS/0.3M	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat.V.- +Q.- ● rem.V.- ⊕ U.- ○)	HYDRAULIC CONDUCTIVITY, k, CM/SEC; WATER CONTENT, PERCENT (Wp W Wl, 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10	CME-55 POWER AUGER BORING 165mm DIA. SOLID STEM AUGERS	CONTINUED FROM SHEET 1		82.09							
		SEE DESCRIPTION ON SHEET 1		10.00							
				81.79							
		Loose, brown SAND AND GRAVEL.		10.30							
11				81.29	10	50 DO	48				
		Very stiff, mottled brown CLAYEY SILT, some sand, trace gravel.		10.80							
				80.69							
		Highly weathered, red-brown calcareous mudstone. (QUEENSTON SHALE)		11.40							
12				80.24							
		END OF HOLE		11.85							Water level in open borehole at Elev. 82.6m on completion of drilling.
13											
14											
15											
16											
17											
18											
19											
20											

0 10 ⊕ 6 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE 1 : 50

Golder Associates

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CHECKED ASP

PetoMacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. Q5 & Q6

PROJECT NORTH-SOUTH SECTION OF FREEWAY PROJECT — OUR PROJECT 97HF098
LOCATION Glen Castle Drive to Barton Street, Hamilton, Ontario — BORING DATE March 31, 1998 — ENGINEER M. Anderson
BORING METHOD Continuous Flight Hollow Stem Augers — TECHNICIAN L. Watson

DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/0.3m N-VALUES	SHEAR STRENGTH C_u / DYNAMIC CONE PENETRATION x / STANDARD PENETRATION TEST • BLOWS/0.3M (20 40 60 80)	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W — W_P W W_L WATER CONTENT % (10 20 30)	GROUNDWATER OBSERVATIONS AND REMARKS
	BOREHOLE Q5								
	GROUND ELEVATION 83.45								
0									
0.30	TOPSOIL : Dark brown sandy silt, trace of clay, low organic		83						
1.35	SILT : Soft reddish brown clayey silt, some sand and gravel, slightly plastic, W.T.P.L		82	1	SS	11	•	⊕	
1.5	becoming sandy, gravelly, wet, trace of decayed organics, numerous shale particles, mottled black and grey								
2.45			81						
2.60	SHALE : Weathered red shale								
3.0	BOREHOLE TERMINATED AT 2.60m		80						Upon completion of augering, no free water, no cave.
	BOREHOLE Q6								
	GROUND ELEVATION 82.03								
0									
0.30	TOPSOIL : Dark brown sandy silt, trace of clay, low organic								
0.90	SAND : Reddish brown silty sand, trace of clay, wet		81						
1.35	SILT : Layered grey and reddish brown sandy and clayey silts, wet								
1.5	BOREHOLE TERMINATED UPON REFUSAL TO AUGER AT 1.35m BEDROCK ASSUMED		80						Upon completion of augering, no free water, no cave.

NOTES:
1. Refer to Drawing 1d for location.

CHECKED BY:

PETO ASSOCIATES LTD. — CONSULTING SOIL ENGINEERS

RECORD OF BOREHOLE NO. 1

JOB NO. 70F154 — JOB NAME Watermain - Nash Road, Hamilton, Ontario — TECHNICIAN B.P.
BORING DATE Dec. 21/70 — CLIENT Corporation of the City of Hamilton — ENGINEER GDP/PK
GROUND ELEV. Not Recorded — BOREHOLE TYPE 4" Flight Auger — TYPED BY V.S.

DEPTH ELEV.	DESCRIPTION	LEGEND	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/FOOT	DYNAMIC CONE PENETRATION BLOWS/FOOT / STANDARD PENETRATION TEST BLOWS/FOOT / SHEAR STRENGTH C_u LB/SQ.FT.	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W — W_P W W_L WATER CONTENT % (10 20 30)	REMARKS
0'0"	FILL-Clayey, high in organic content, very moist, dark brown							
3'4"±	CLAYEY SILT TILL-Brown fine, moist, mainly fine gravel with occasional medium gravel							
14'0"	BH terminated at 14'0"							At completion BH open and dry 1 hr. later same

this margin reserved for binding

e.m.peto associates ltd. — Consulting soil engineers

RECORD OF BOREHOLE NO. 5-B

JOB NO. 65329 | JOB NAME King Street West Relocation | TECHNICIAN JF
BORING DATE Jan.7/66 | CLIENT Corporation of the City of Hamilton | ENGINEER JH
GROUND ELEV. 325.86 | BOREHOLE TYPE Standard Rig | TYPED BY HF

DEPTH ELEV.	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS/FOOT
0'0"					
0'6"	TOPSOIL				
	CLAY, reddish brn. fine sandy clay V. Wet		1	SS	19
	COMPACT TO LOOSE		2	SS	6
7'0"					
	SAND, reddish brown clayey fine sand Saturated		3	SS	12
	COMPACT		4	SS	26
12'0"					
	SAND, reddish brn. silty clayey very fine sand		5	SS	36
			6	SS	36
	SATURATED				
	DENSE		7	SS	38
23'0"					
	SILT, brown very fine sandy silt Some sand and clay seams		8	SS	38
	SATURATED				
	DENSE		9	SS	33
31'6"					
	Hole terminated at 31'6"				

DYNAMIC CONE PENETRATION BLOWS/FOOT
STANDARD PENETRATION TEST BLOWS/FOOT ——
10 20 30 40 50
SHEAR STRENGTH C_u LB/SQ.FT.

LIQUID LIMIT ——— W_L
PLASTIC LIMIT ——— W_p
WATER CONTENT ——— W
W_p W W_L
WATER CONTENT %
10 15 20 25

18.9 33.4
17.0 17.2
16.9 29.4

REMARKS

this margin reserved for binding

e.m.peto associates ltd. — Consulting soil engineers

RECORD OF BOREHOLE NO. 6-B

JOB NO. 65329 | JOB NAME King Street West Relocation | TECHNICIAN JF
BORING DATE Jan.10/66 | CLIENT Corporation of the City of Hamilton | ENGINEER JH
GROUND ELEV. 326.86 | BOREHOLE TYPE Standard Rig | TYPED BY HF

DEPTH ELEV.	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS/FOOT
0'0"					
0'6"	TOPSOIL				
	CLAY, reddish brn. sandy clay		1	SS	9
	V. WET TO MOIST		2	SS	9
			3	SS	31
	LOOSE TO DENSE				
10'0"					
	SAND, reddish brown clayey sand		4	SS	28
	Some pockets of grey and black silt		5	SS	55
15'0"					
	SILT, brown fine sandy silt with some fine sand seams		6	SS	32
	VERY WET				
			7	SS	31
	DENSE		8	SS	36
26'6"					
	CLAY, brown silty clay, DRY				
	V. STIFF		9	SS	66
31'6"					
	Hole terminated at 31'6"				

DYNAMIC CONE PENETRATION BLOWS/FOOT
STANDARD PENETRATION TEST BLOWS/FOOT — —
10 20 30 40 50
SHEAR STRENGTH C_u LB/SQ.FT.

LIQUID LIMIT ——— W_L
PLASTIC LIMIT ——— W_p
WATER CONTENT ——— W
W_p W W_L
WATER CONTENT %
10 15 20

14.2 20.0
18.7 39.2

REMARKS

Project No: SM 041546-G

Project: Watermain Replacement

Location: Main Street West, Hamilton

Client: Sutton & Associates

Log of Borehole No. 1

Borehole Location: See Drawing No. 1

Project Manager: Ian Shaw, B. Eng., EIT

Soil-Mat

SUBSURFACE PROFILE				SAMPLE						Moisture Content w% 10 20 30 40 / Standard Penetration Test • blows/300mm • 20 40 60 80
Depth (ft / m)	Symbol	Description	Elevation	Type	Number	Blows/300mm	PP (kgf/cm2)	U.Wt.(kN/m3)	Recovery	
0 / 0		Ground Surface	0.00							
		Asphaltic Concrete Approximately 40 millimetres	-0.24							
		Granular Base Approximately 200 millimetres								
2		***Sand and Gravel Fill*** Brown, medium to coarse grained, compact	-1.00	SS	1	22				
4		***Silty Sand/Sandy Silt*** Brown, layered/stratified, loose		SS	2	9				
6 / 2				SS	3	7				
			-2.30							
8		End of Borehole								
10		NOTES: 1. Borehole advanced using solid stem continuous flight auger equipment on February 11, 2004 to a depth of 2.3 metres. 2. No free groundwater present at the completion of drilling. Borehole backfilled with auger cuttings. 3. Soil samples will be discarded after three months unless otherwise directed by the client.								
12										
14 / 4										
16										
18										

Drill Method: Solid Stem Auger

Drill Date: Feb 11, 2004

Hole Size: 100mm

SOIL-MAT ENGINEERS & CONSULTANTS LTD.
130 Lancing Drive, Hamilton, ON L8W 3A1
Phone: (905) 318-7440 Fax: (905) 318-7455
e-mail: info@soil-mat.on.ca

Datum: Ground Surface

Checked by: IS

Sheet: 1 of 1

Project No: SM 041546-G

Project: Watermain Replacement

Location: Main Street West, Hamilton

Client: Sutton & Associates

Log of Borehole No. 4

Borehole Location: See Drawing No. 1

Project Manager: Ian Shaw, B. Eng., EIT

Soil-Mat

SUBSURFACE PROFILE				SAMPLE						Moisture Content w% 10 20 30 40 / Standard Penetration Test • blows/300mm • 20 40 60 80
Depth (ft / m)	Symbol	Description	Elevation	Type	Number	Blows/300mm	PP (kgf/cm2)	U.Wt.(kN/m3)	Recovery	
0 / 0		Ground Surface	0.00							
		Topsoil Approximately 50 millimetres	-0.30							
		Silty Sand and Gravel Fill Brown, medium to coarse grained, compact		SS	1	12				
2		***Silty Sand/Sandy Silt*** Brown, layered/stratified, occasional layers of medium sand, compact to loose		SS	2	17				
4										
6 / 2				AS	3					
			-2.30							
8		End of Borehole								
10		NOTES: 1. Borehole advanced using solid stem continuous flight auger equipment on February 11, 2004 to a depth of 2.3 metres. 2. No free groundwater present at the completion of drilling. Borehole backfilled with auger cuttings. 3. Soil samples will be discarded after three months unless otherwise directed by the client.								
12										
14 / 4										
16										
18										

Drill Method: Solid Stem Auger

Drill Date: Feb 11, 2004

Hole Size: 100mm

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Datum: Ground Surface

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Sheet: 1 of 1

Project No: SM 041546-G

Project: Watermain Replacement

Location: Main Street West, Hamilton

Client: Sutton & Associates

Log of Borehole No. 5

Borehole Location: See Drawing No. 1

Project Manager: Ian Shaw, B. Eng., EIT

Soil-Mat

SUBSURFACE PROFILE				SAMPLE						Moisture Content w% 10 20 30 40 / Standard Penetration Test • blows/300mm • 20 40 60 80
Depth (ft / m)	Symbol	Description	Elevation	Type	Number	Blows/300mm	PP (kgf/cm2)	U.Wt.(kN/m3)	Recovery	
0 / 0		Ground Surface	0.00							
		Topsoil Approximately 50 millimetres								
2		***Silty Sand Fill*** Brown, traces of medium to coarse gravel, compact	-1.10	SS	1	17				
4		***Silty Sand/Sandy Silt*** Brown, layered/stratified, occasional layers of medium sand, compact to loose		SS	2	12				
6 / 2				SS	3	6				
8		End of Borehole	-2.30							
10		NOTES: 1. Borehole advanced using solid stem continuous flight auger equipment on February 11, 2004 to a depth of 2.3 metres. 2. No free groundwater present at the completion of drilling. Borehole backfilled with auger cuttings. 3. Soil samples will be discarded after three months unless otherwise directed by the client.								
12										
14 / 4										
16										
18										

Drill Method: Solid Stem Auger

Drill Date: Feb 11, 2004

Hole Size: 100mm

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130 Lancing Drive, Hamilton, ON L8W 3A1
Phone: (905) 318-7440 Fax: (905) 318-7455
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Datum: Ground Surface

Checked by: IS

Sheet: 1 of 1

Project No: SM 041546-G

Project: Watermain Replacement

Location: Main Street West, Hamilton

Client: Sutton & Associates

Log of Borehole No. 7

Borehole Location: See Drawing No. 1

Project Manager: Ian Shaw, B. Eng., EIT

Soil-Mat

SUBSURFACE PROFILE				SAMPLE						Moisture Content w% 10 20 30 40 / Standard Penetration Test • blows/300mm • 20 40 60 80
Depth (ft / m)	Symbol	Description	Elevation	Type	Number	Blows/300mm	PP (kgf/cm2)	U.Wt.(kN/m3)	Recovery	
0 / 0		Ground Surface	0.00							
		Asphaltic Concrete Approximately 40 millimetres	-0.35							
		Granular Base Approximately 300 millimetres								
2		***Silty Sand and Gravel Fill*** Brown, medium to coarse grained, compact	-1.10	SS	1	21				
4		***Silty Sand/Sandy Silt*** Brown, layered/stratified, occasional layers of medium sand, compact to loose		SS	2	10				
6 / 2				SS	3	11				
8		End of Borehole	-2.30							
10		NOTES: 1. Borehole advanced using solid stem continuous flight auger equipment on February 11, 2004 to a depth of 2.3 metres. 2. No free groundwater present at the completion of drilling. Borehole backfilled with auger cuttings. 3. Soil samples will be discarded after three months unless otherwise directed by the client.								
12										
14 / 4										
16										
18										

Drill Method: Solid Stem Auger

Drill Date: Feb 11, 2004

Hole Size: 100mm

SOIL-MAT ENGINEERS & CONSULTANTS LTD.
130 Lancing Drive, Hamilton, ON L8W 3A1
Phone: (905) 318-7440 Fax: (905) 318-7455
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Datum: Ground Surface

Checked by: IS

Sheet: 1 of 1

Project No: SM 041546-G

Project: Watermain Replacement

Location: Main Street West, Hamilton

Client: Sutton & Associates

Log of Borehole No. 8

Borehole Location: See Drawing No. 1

Project Manager: Ian Shaw, B. Eng., EIT

Soil-Mat

SUBSURFACE PROFILE				SAMPLE						Moisture Content w% 10 20 30 40 / Standard Penetration Test blows/300mm 20 40 60 80
Depth (ft / m)	Symbol	Description	Elevation	Type	Number	Blows/300mm	PP (kgf/cm2)	U.Wt.(kN/m3)	Recovery	
0 / 0		Ground Surface	0.00							
		Asphaltic Concrete Approximately 40 millimetres								
2		***Sand and Gravel Fill*** Brown, medium to coarse grained, compact	-1.10	SS	1	17				
4		***Silty Sand/Sandy Silt*** Brown, layered/stratified, occasional layers of medium sand, compact to loose		SS	2	16				
6 / 2			-2.30	SS	3	9				
8		End of Borehole								
10		NOTES: 1. Borehole advanced using solid stem continuous flight auger equipment on February 11, 2004 to a depth of 2.3 metres. 2. No free groundwater present at the completion of drilling. Borehole backfilled with auger cuttings. 3. Soil samples will be discarded after three months unless otherwise directed by the client.								
12 / 4										
14										
16										
18										

Drill Method: Solid Stem Auger

Drill Date: Feb 11, 2004

Hole Size: 100mm

SOIL-MAT ENGINEERS & CONSULTANTS LTD.
130 Lancing Drive, Hamilton, ON L8W 3A1
Phone: (905) 318-7440 Fax: (905) 318-7455
e-mail: info@soil-mat.on.ca

Datum: Ground Surface

Checked by: IS

Sheet: 1 of 1

LANDTEK LIMITED — LOG OF BOREHOLE NO. 1

Project No.:	05161	Drill Date:	December 2, 2005
Project:	GTR-1153; Watermain & Roads Reconstruction Projects	Drill Method:	[x] solid stem [ ] hollow stem [ ] vibratory
Location:	Traymore Avenue, Hamilton	Datum:	Geodetic

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	SPT "N" Value (Scale m)	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Surface		98.0			0 25 50 75 100	0 25 50			
100 mm Asphalt 150 mm Concrete 75 mm Granular		0.0			0.0				
FILL sandy silt, organics, brown to dark brown, moist to very moist (VERY LOOSE)		96.5	1	SS	-0.5 -1.0 -1.5 (1)	◆ 28.2			
SILT with fine sand, iron staining, brown, moist (LOOSE)		95.4	2	SS	-2.0 -2.5 (8)	◆ 22.9			
BOREHOLE TERMINATED		2.6			-3.0 -3.5 -4.0 -4.5 -5.0 -5.5 -6.0 -6.5 -7.0 -7.5 -8.0				

Notes: 1. On completion, borehole open to 2.6 m and dry.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

LANDTEK LIMITED
205 Nebo Road, Unit 3
Hamilton, Ontario, Canada, L8W 2E1
Ph: (905) 383-3733 Fax: (905) 383-8433
www.landteklimited.com

LANDTEK

LANDTEK LIMITED — LOG OF BOREHOLE NO. 2

Project No.:	05161	Drill Date:	December 2, 2005
Project:	GTR-1153; Watermain & Roads Reconstruction Projects	Drill Method:	[x] solid stem [ ] hollow stem [ ] vibratory
Location:	Traymore Avenue, Hamilton	Datum:	Geodetic

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	SPT "N" Value (Scale (m))	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Surface		98.9							
50 mm Asphalt 100 mm Concrete 75 mm Granular		0.0							
SILT with traces of fine sand and clay, fractured, iron stains, brown, moist (VERY LOOSE TO COMPACT)			1	SS	3	24.9			
					15	22.6			
			2	SS					
		96.3							
BOREHOLE TERMINATED		2.6							

SPT "N" Value: 0 25 50 75 100 — Soil Moisture (%): 0 25 50

Scale (m): 0.0, -0.5, -1.0, -1.5, -2.0, -2.5, -3.0, -3.5, -4.0, -4.5, -5.0, -5.5, -6.0, -6.5, -7.0, -7.5, -8.0

Notes: 1. On completion, borehole open to 2.6 m and dry.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

LANDTEK LIMITED
205 Nebo Road, Unit 3
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www.landteklimited.com

NATURAL

Wiwnock Hersey — BORING LOG

PROJECT: The Regional Municipality of Hamilton-Wentworth Proposed Storm Sewers Haddon Avenue, Hamilton, Ontario — BORING: RH1-B — PAGE: 1 OF 1
CONTRACT NO.: L03784-50319-C7-424600 — BORING DATE: 91.02.18
DATUM: Geodetic (Supplied) — CASING: None

SAMPLE CONDITION: DISTURBED, GOOD, LOST
SAMPLE TYPES: SS - SPLIT SPOON; ST - THIN WALLED OPEN (SHELBY); PS - PISTON SAMPLER; WS - WASH SAMPLE; RC - ROCK CORE
ABBREVIATIONS: GS - GRAIN SIZE ANALYSIS; γ - WET UNIT WEIGHT - kN/m³; C - CONSOLIDATION; k - PERMEABILITY - cm/s; DS - DIRECT SHEAR; Q - TRIAXIAL QUICK

DEPTH - m	ELEVATION - m / DEPTH - m	DESCRIPTION	SYMBOL	WATER LEVEL	UNDRAINED SHEAR STRENGTH - kPa (● TEST; FIELD VANE: ◇ INTACT, ◆ REMOULDED; FALL CONE: ▽ INTACT, ▼ REMOULDED; WATER CONTENT - W%; LIQUID LIMIT - W_L%; PLASTIC LIMIT - W_P%; DYNAMIC PENETRATION TEST - BLOWS/0.3 m)	OTHER TESTS	SAMPLES: CONDITION	TYPE AND NUMBER	RECOVERY %	STANDARD PENETRATION - N BLOWS/0.3m
	99.12	Road Surface								
	98.82	Asphalt 75mm								
	0.30	Concrete 225mm								
1		Loose to Compact Brown Sandy Silt Traces of Clay, Gravel, Organics Occasional Layer Brown Silty Sand						SS1	56	6
2								SS2	100	4
3								SS3	100	12
4								SS4	83	21
5								SS5	100	17
6								SS6	83	17
	93.34									
	5.79	END OF BOREHOLE								
		Borehole Dry at Completion								

Log of Borehole 1

Trow

Auger Sample	☒	Natural Moisture	X
SPT (N) Value	○ ○ ■	Plastic and Liquid Limit	├──○
Dynamic Cone Test	------	Undrained Triaxial at Overburden Pressure % Strain at Failure	⊕ (0, 5, 10, 15)
Shelby Tube	● ● ■		
Field Vane Test	+ s	Penetrometer	▲

Project: Proposed Storm Sewers — Dwg. No. 7

Region of Hamilton -Wentworth Main St. at Dow St.

Hamilton, Ontario. — Project No. H01760-G

Hole location and datum see drawing No. 1

GWL	SYMBOL	Soil Description	ELEV. m
		250 mm asphalt over 200 mm granular material over FILL : clayey silt, brown, mottled light and dark brown in first 0.75 m, fine to medium gravel, occasional clay seams, below 1.5 m., moist, soft	99.55
		CLAYEY SILT: brown, occasional clay seams, silty fine sand layers below 3.0 m., less clay with depth, cohesive, trace fine gravel below 4.6 m., moist becoming wet below 3.8m soft	97.3
		TERMINATED	94.06

NOTES:-

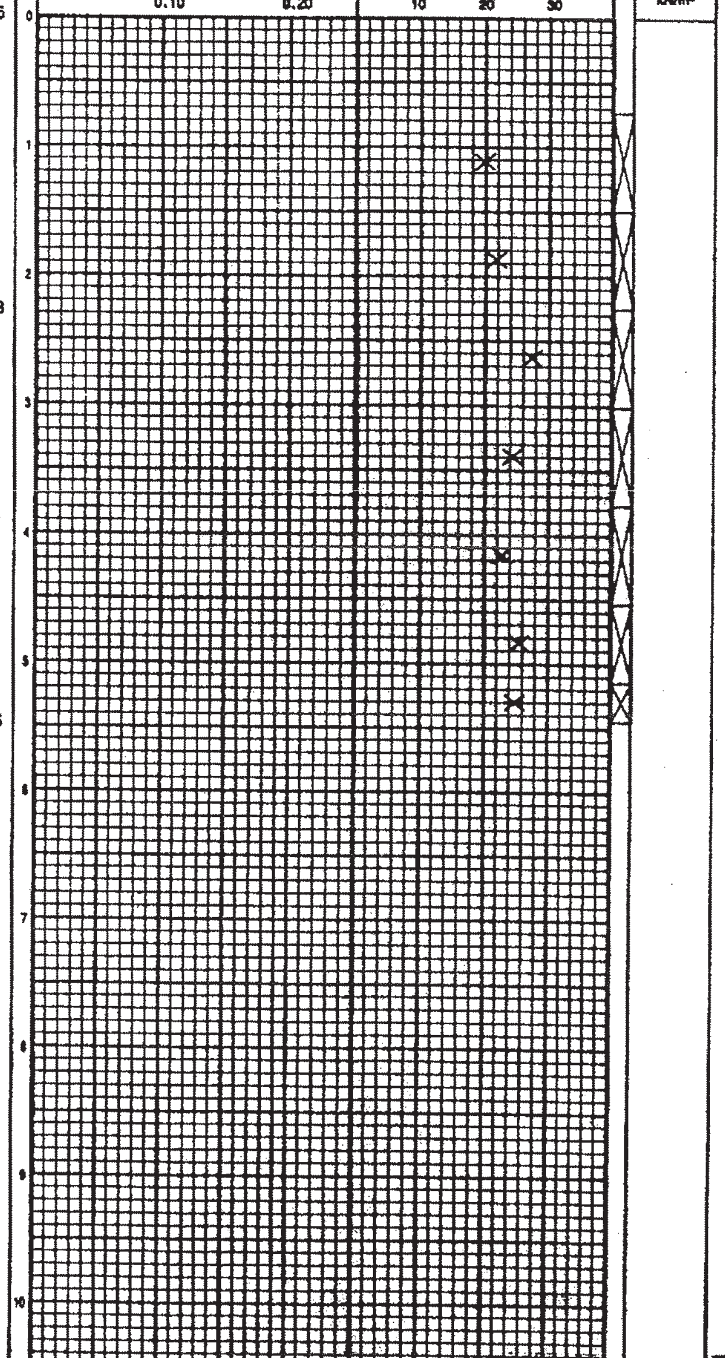
(1) Borehole advanced uncased by solid stem augers to termination at 5.5 m depth, on January 15,1990, by Drilltech

(2) Water Level Record :-

Time Elapsed	Depth to W.L.,m
10 days	4.7

(3) Standpipe installed.

DEPTH (m): 0–10 | N Value: 20, 40, 60, 80 | Shear Strength MPa: 0.10, 0.20 | Natural Moisture Content and Atterberg Limits % Dry Weight: 10, 20, 30 | Natural Unit Weight kN/m³



NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS.

Log of Borehole 2

Trow

Auger Sample	☒	Natural Moisture	X
SPT (N) Value	○ ○ ■	Plastic and Liquid Limit	├──○
Dynamic Cone Test	------	Undrained Triaxial at Overburden Pressure % Strain at Failure	⊕ (0, 5, 10, 15)
Shelby Tube	● ● ■		
Field Vane Test	+ s	Penetrometer	▲

Project: Proposed Storm Sewers — Dwg. No. 8

Region of Hamilton -Wentworth, Main St. at Newton Ave.

Hamilton, Ontario. — Project No. H01760-G

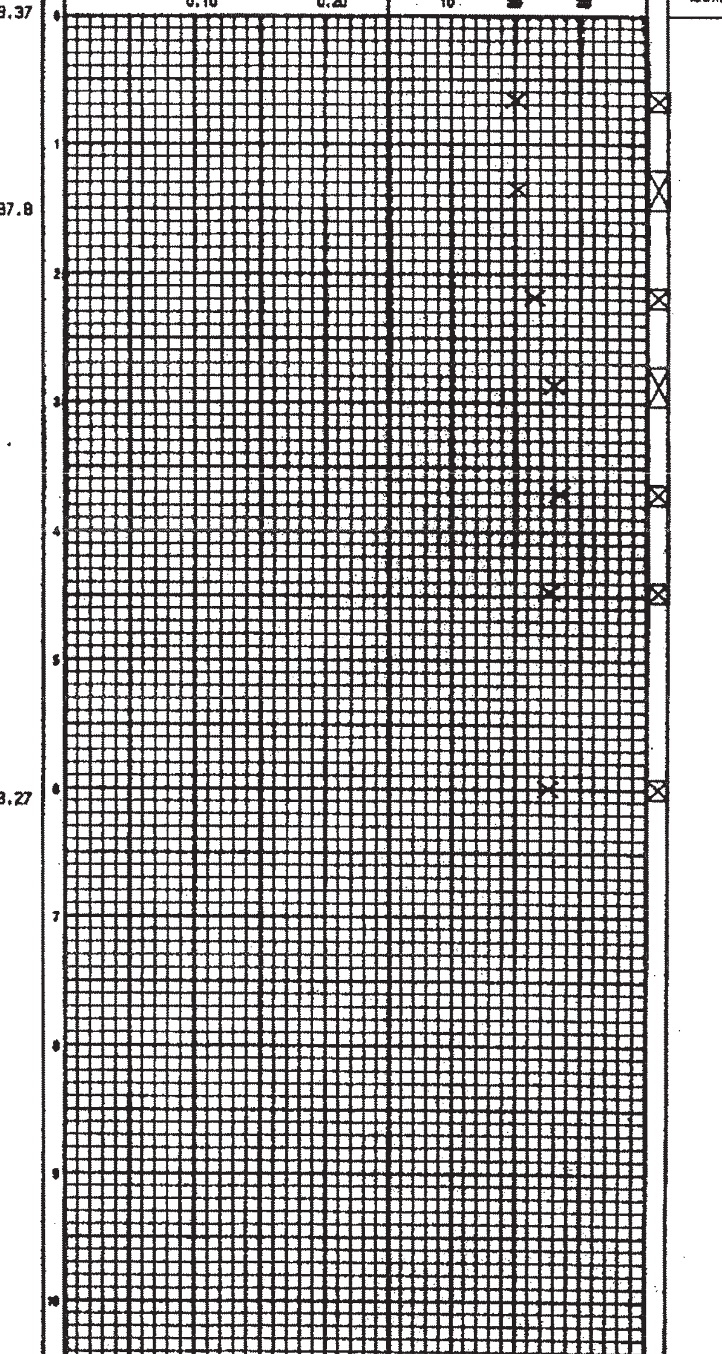
Hole location and datum see drawing No. 1

GWL	SYMBOL	Soil Description	ELEV. m
		150 mm asphalt over 200 mm concrete over 150 mm granular material FILL : clayey silt, greyish brown to 0.75 m then mottled reddish brown and black, some fine gravel, silt seams,clay seams, cohesive, moist.	99.37
		CLAYEY SILT: brown, trace fine to medium gravel, increased clay between 3.0 to 3.8 m., layered silt and clay moist, becoming wet below 3.8 m., firm becoming soft below 3.8 m.	97.8
		TERMINATED	93.27

NOTES:-

(1) Borehole advanced uncased by solid stem augers to termination at 6.1 m depth, on January 15,1990, by Drilltech

DEPTH (m): 0–10 | N Value: 20, 40, 60, 80 | Shear Strength MPa: 0.10, 0.20 | Natural Moisture Content and Atterberg Limits % Dry Weight: 10, 20, 30 | Natural Unit Weight kN/m³



NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS.

Log of Borehole 3

Trow

Auger Sample ☒ | SPT (N) Value ○○▨ | Dynamic Cone Test ——— | Shelby Tube ● ● ■ | Field Vane Test + s

Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at Overburden Pressure % Strain at Failure | Penetrometer

Project Proposed Storm Sewers — Dwg. No. 9

Region of Hamilton -Wentworth, Main St. at Paisley Ave.

Hamilton, Ontario. — Project No. H01760-G

Hole location and datum see drawing No. 1

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH
		150 mm asphalt over 150 mm concrete over FILL : clayey silt, mottled reddish brown and black, fine to medium gravel, clay seams, occasional silt layers below 0.75 m., moist.	99.32	0
		CLAYEY SILT: reddish brown becoming brown below 3.0 m., layered silt and clay, fine to medium gravel, moist, firm; becoming stiff with depth	" 97.8	1 2 3 4 5 6 7 8
		GRAVEL : brown, silty, some sand, medium grained, moist.	" 92.0	9
		TERMINATED	91.70	10

N Value: 20 40 60 80 — Shear Strength 0.10 0.20 MPa

Natural Moisture Content and Atterberg Limits % Dry Weight: 10 20 30

Natural Unit Weight kN/m³

NOTES:-

(1) Borehole advanced uncased by solid stem augers to termination at 7.6 m depth, on January 15,1990, by Drilltech

(2) Water Level Record :-

Time Elapsed	Depth to W.L.,m
14 days	7.15

(3) Chemical Analysis of ground water sample from borehole:
pH = 7.62
Sulphate,SO4,content= 105.25 mg/l

(4) Standpipe installed.

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS.

Log of Borehole 4

Trow

Auger Sample ☒ | SPT (N) Value ○○▨ | Dynamic Cone Test ——— | Shelby Tube ● ● ■ | Field Vane Test + s

Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at Overburden Pressure % Strain at Failure | Penetrometer

Project Proposed Storm Sewers — Dwg. No. 10

Region of Hamilton -Wentworth, Main St. at Paisley Ave.

Hamilton, Ontario. — Project No. H01760-G

Hole location and datum see drawing No. 1

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH
		150 mm asphalt over 250 mm concrete over FILL : clayey silt/ silty clay, reddish brown becoming brown below 1.5 m., fine to medium gravel, clay layers, black clay seams in first 0.75 m., moist, firm.	99.07	0
		CLAYEY SILT: brown, layered silt and clay, moist, soft becoming firm below 3.0 m.	" 96.8	2 4 6
		GRAVEL : brown, silty, some sand, medium to coarse grained, moist.	" 92.7	8
		TERMINATED	91.45	8

N Value: 20 40 60 80 — Shear Strength 0.10 0.20 MPa

Natural Moisture Content and Atterberg Limits % Dry Weight: 10 20 30

Natural Unit Weight kN/m³

NOTES:-

(1) Borehole advanced uncased by solid stem augers to termination at 7.6 m depth, on January 15,1990,by Drilltech

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS.

Log of Borehole 5

Trow

Auger Sample ⊠ | Natural Moisture
SPT (N) Value O O ▩ | Plastic and Liquid Limit
Dynamic Cone Test ——— | Undrained Triaxial at Overburden Pressure % Strain at Failure
Shelby Tube • • ■ | Penetrometer
Field Vane Test + s

Project Proposed Storm Sewers Dwg. No. 11
Region of Hamilton -Wentworth, Main St. at Bond St.
Hamilton, Ontario. Project No. H01760-G
Hole location and datum see drawing No. 1

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value: Shear Strength 0.10 – 0.20 MPa (20 40 60 80)	Natural Moisture Content and Atterberg Limits % Dry Weight (10 20 30)	Natural Unit Weight kN/m³
		125 mm asphalt over 125 mm concrete over 25 mm granular over FILL : silty clay, grey, fine to medium gravel, moist.	99.20	0			
		CLAYEY SILT: light brown becoming greyish brown between 5.6 to 5.8 m., moist becoming wet with depth, firm to soft	97.2	2			
		SAND - coarse with fine gravel and silt, moist, dense	92.8	7			
		TERMINATED	91.58				

NOTES:-
(1) Borehole advanced uncased by solid stem augers to termination at 7.6 m depth, on January 16, 1990, by Drilltech
(2) Standpipe installed.
(3) Water Level Record:
Standpipe pinched at 3.0 m, dry to 3.0 m.

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS

Log of Borehole 6

Trow

Auger Sample ⊠ | Natural Moisture
SPT (N) Value O O ▩ | Plastic and Liquid Limit
Dynamic Cone Test ——— | Undrained Triaxial at Overburden Pressure % Strain at Failure
Shelby Tube • • ■ | Penetrometer
Field Vane Test + s

Project Proposed Storm Sewers Dwg. No. 12
Region of Hamilton -Wentworth, Main St. at Longwood Dr.
Hamilton, Ontario. Project No. H01760-G
Hole location and datum see drawing No. 1

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value: Shear Strength 0.10 – 0.20 MPa (20 40 60 80)	Natural Moisture Content and Atterberg Limits % Dry Weight (10 20 30)	Natural Unit Weight kN/m³
		125 mm asphalt over 175 mm concrete over FILL : clayey silt, brown, clay pockets and seams, cohesive, moist, firm to stiff.	99.20	0			
		SILTY CLAY/ CLAYEY SILT : brown, occasional clay seams, silt layers, moist becoming wet below 3.0 m, firm to stiff with depth	97.7	2			
		GRAVEL : brown, some sand, medium grained, moist, dense.	92.6	7			
		TERMINATED	91.58				

NOTES:-
(1) Borehole advanced uncased by solid stem augers to termination at 7.6 m depth, on January 16, 1990, by Drilltech.

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS

Log of Borehole 7

Trow

Auger Sample ☒ | Natural Moisture
SPT (N) Value ○○■ | Plastic and Liquid Limit
Dynamic Cone Test —— | Undrained Triaxial at Overburden Pressure
Shelby Tube ● ● ■ | % Strain at Failure
Field Vane Test + s | Penetrometer

Project Proposed Storm Sewers Dwg. No. 13
Region of Hamilton -Wentworth, Main St. near Paradise Rd.
Hamilton, Ontario. Project No. H01760-G
Hole location and datum see drawing No. 1

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength	Natural Moisture Content and Atterberg Limits % Dry Weight	Natural Unit Weight kN/m³
		125 mm asphalt over 175 mm concrete over FILL : clayey silt, mottled brown and reddish brown, concrete fragments at approximately 400 mm., cohesive, moist, firm.	98.92	0			
		CLAYEY SILT : light brown becoming greyish brown below 5.5 m., occasional clay seams, silt layers, trace fine gravel, cohesive, wet, soft to firm	97.4	1 2 3 4 5 6 7 8 9 10			
		TERMINATED	91.30				

NOTES:-
(1) Borehole advanced uncased by solid stem augers to termination at 7.6 m depth, on January 16, 1990, by Drilltech

(2)Standpipe installed.

(3)Water Level Record:
Standpipe pinched at 2.0 m, dry to 2.0 m.

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS.

Log of Borehole 8

Trow

Auger Sample ☒ | Natural Moisture
SPT (N) Value ○○■ | Plastic and Liquid Limit
Dynamic Cone Test —— | Undrained Triaxial at Overburden Pressure
Shelby Tube ● ● ■ | % Strain at Failure
Field Vane Test + s | Penetrometer

Project Proposed Storm Sewers Dwg. No. 14
Region of Hamilton -Wentworth, Main St. at Paradise Rd.
Hamilton, Ontario. Project No. H01760-G
Hole location and datum see drawing No. 1

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength	Natural Moisture Content and Atterberg Limits % Dry Weight	Natural Unit Weight kN/m³
		125 mm asphalt over 175 mm concrete over FILL : silty clay, reddish brown, fine gravel, weathered shale fragments, clay pockets and seams, moist, firm.	98.79	0			
		CLAYEY SILT : reddish brown becoming light brown below 3.0 m., greyish brown at 5.5 m., clay seams, silt layers, cohesive, wet, firm.	97.3	1 2 3 4 5 6 7 8 9 10			
		TERMINATED	91.17				

NOTES:-
(1) Borehole advanced uncased by solid stem augers to termination at 7.6 m depth, on January 16, 1990, by Drilltech

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS

Log of Borehole 21

Trow

Auger Sample ⊠ | Natural Moisture
SPT (N) Value ○○■ | Plastic and Liquid Limit
Dynamic Cone Test —— | Undrained Triaxial at Overburden Pressure % Strain at Failure
Shelby Tube ● ● ■
Field Vane Test + s | Penetrometer

Project Proposed Sanitary Sewer — Dwg. No. 2
Longwood Road
Hamilton, Ontario — Project No. H02273-G
Hole location and datum see drawing No. 1

GWL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength (0.10–0.20 MPa)	Natural Moisture Content and Atterberg Limits % Dry Weight (10–30)	Natural Unit Weight kN/m³
	FILL: Firm red/ brown silty clay, with occasional rootlets	98.49	0			19.1
	Loose to compact brown, clayey silt with occasional sand layers. Becoming stiff grey silty clay below 3.35 m.	" 97.3	2			18.4
			4			18.6
						19.5
	Dense to very dense grey medium to coarse sand, and fine to medium gravel. Grading into a dense medium to coarse sand below 9.1 m.	" 93.3	6			20.0
	proposed sewer invert		8			
			10			20.2
	Stiff to very stiff brownish grey silty clay interbedded with layers of coarse sand up to 125 mm thick	" 87.8	12			20.6
			14			20.5
			16			21.1
	Compact to dense reddish brown fine to medium sand with occasional layers of grey silty clay	" 81.7	18			20.6
	Continued....	" 78.5	20			

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS.

Log of Borehole 21 con't

Trow

Auger Sample ⊠ | Natural Moisture
SPT (N) Value ○○■ | Plastic and Liquid Limit
Dynamic Cone Test —— | Undrained Triaxial at Overburden Pressure % Strain at Failure
Shelby Tube ● ● ■
Field Vane Test + s | Penetrometer

Project Proposed Sanitary Sewer — Dwg. No. 2A
Longwood Road
Hamilton, Ontario — Project No. H02273-G
Hole location and datum see drawing No. 1

GWL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength (0.10–0.20 MPa)	Natural Moisture Content and Atterberg Limits % Dry Weight (10–30)	Natural Unit Weight kN/m³
	Continued....	78.49	20			21.3
	TERMINATED	" 75.2	22			20.5
			24			21.3
			26			
			28			

NOTES:-
(1) Borehole advanced cased by hollow stem augers to termination at 23.3 m depth, on January 2, 1991, by Drilltech

(2) Water Level Record :-

Time Elapsed	Depth to W.L., m
5 Days	1.9

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS.

JACQUES WHITFORD
ENVIRONMENT LIMITED

BOREHOLE RECORD

MW204

CLIENT Petro-Canada
LOCATION 906 Main Street West (at Longwood Drive), Hamilton, Ontario
DATES: BORING December 13, 2004 WATER LEVEL December 17, 2004

PROJECT No. ONW36136
DATUM Local
TPC ELEV. 100.115

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	VAPOUR CONCENTRATIONS ● %LEL ▲ ppm	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES N-VALUE	WELL CONSTRUCTION
0	100.29				0	● 20 40 60 80 ▲ 100 200 300 400				
	100.1	ASPHALT					NR			50 mm ID solid PVC pipe with bentonite and cement seal
		Brown, SILTY CLAY (FILL), dry					SS	1	23	
1		- brown to grey, some sand, moist					SS	2	11	50 mm ID slotted PVC pipe with silica sand backfill
		- trace gravel					SS	3	19	
3	97.2	Brown, very stiff, SANDY SILT (TILL), some clay, wet					SS	4	11	
4							SS	5	25	
5							SS	6	20	
							SS	7	29	
6	94.2	END OF BOREHOLE at 6.1 m.								

LABORATORY ANALYSES: MW204-3 submitted for BTEX and PH (F1 to F4)
Groundwater submitted for BTEX and PH (F1 to F4)

JACQUES WHITFORD
ENVIRONMENT LIMITED

BOREHOLE RECORD

MW211

CLIENT Petro-Canada
LOCATION 906 Main Street West (at Longwood Drive), Hamilton, Ontario
DATES: BORING December 14, 2004 WATER LEVEL December 17, 2004

PROJECT No. ONW36136
DATUM Local
TPC ELEV. 99.875

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	VAPOUR CONCENTRATIONS ● %LEL ▲ ppm	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES N-VALUE	WELL CONSTRUCTION
0	99.94				0	● 20 40 60 80 ▲ 100 200 300 400				
	99.7	ASPHALT					NR			50 mm ID solid PVC pipe with bentonite and cement seal
		CONCRETE								
		Red to brown, SILTY CLAY (FILL), trace sand, moist					SS	1	20	
1	98.3	Brown, compact, SILTY SAND (TILL), some clay, wet					SS	2	26	50 mm ID slotted PVC pipe with silica sand backfill
3							SS	3	29	
							SS	4	11	
4	96.1	Brown, stiff, SANDY SILT (TILL), wet					SS	5	15	
		- some clay					SS	6	13	
5		- brown to grey					SS	7	26	
6	93.8	END OF BOREHOLE at 6.1 m.								

LABORATORY ANALYSES: MW211-1 submitted for BTEX and PH (F1 to F4)
Groundwater submitted for BTEX and PH (F1 to F4)

HIGHWAY 403 CROSSING

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 180-60 BORE HOLE NO. 4

JOB F59-116 STATION 12+77 (19' Lt.)

DATUM 279.9' COMPILED BY B.K.

BORING DATE Dec. 22/59 CHECKED BY V.K.

LEGEND

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

1/2 UNCONFINED COMPRESSION (Qu)
VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	Ground level	279.9	0
	Granular fill		
	Silty sandy gravel with some clay (traces of garbage)		15
	Medium brown silty clay (with some sand and pebbles)	252.4	30
	Medium grey silty clay.	244.9	45
			60
			75
	Bedrock Queenston shale relatively sound.	189.6	90
	End of borehole	179.6	105
			120

Penetration resistance profile shown obtained by driving a 2" dia. cone from ground level to depth noted with an energy of 350 ft. lb. per blow.

STRENGTH AND PENETRATION RESISTANCE
1000 2000 3000 4000 P.S.F.
25 50 75 100 BLOWS/FT.

Penetration ends at elev. 216.9'

CONSISTENCY
MOIST. CONTENT - % DRY WT.
10 20 30

SAMPLE	NATURAL UNIT WT. P.C.F.
S1	-
S2	-
S3	-
S4	-
S5	-
S6	-
T7	131.0
T8	131.0
T9	-
T10	136.0
T11	133.0
T12	-
RC13	-
RC14	-

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 180-60 BORE HOLE NO. 5

JOB 559-116 STATION 14+20 (19' Rt.)

DATUM 274.8' COMPILED BY B.K.

BORING DATE Dec. 15/59 CHECKED BY V.K.

LEGEND

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

1/2 UNCONFINED COMPRESSION (Qu)
VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	Ground level	274.8	0
	Granular fill Silty sandy gravel with some clay (traces of garbage)		15
	Soft brown silty clay (with some sand and decayed vegetation)	245.8	30
	Medium to stiff grey silty clay.	238.8	45
			60
			75
	Bedrock Queenston shale Weathered - Elev. 187 to 172' Relatively sound-Elev. 172' to 167.8'.	187.0	90
		167.8	105
	End of borehole		120

Penetration resistance profile shown obtained by driving a 2" dia. cone from ground level to depth noted with an energy of 350 ft. lb. per blow.

STRENGTH AND PENETRATION RESISTANCE
1000 2000 3000 4000 P.S.F.
25 50 75 100 BLOWS/FT.

Penetration ends at Elev. 219.8'

CONSISTENCY
MOIST. CONTENT - % DRY WT.
10 20 30

SAMPLE	NATURAL UNIT WT. P.C.F.
S1	-
S2	-
S3	-
S4	-
S5	-
S6	128.0
S7	125.0
T8	127.0
T9	-
T10	136.0
T11	130.0
RC12	-
RC13	-
RC14	-

FORM OB-ML-126 (REV. 1959.)—58-5691

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 231-58-3 BORE HOLE NO. 3

JOB 59-F-125 STATION 17+00 ℄ Ramp H.

DATUM G.S.C. COMPILED BY B.K.

BORING DATE Jan. 25/60 CHECKED BY J.B.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu)
VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Groundlevel	262.0	0
	W.L. ▽	257.0	
	Grey-brown silty clay with decayed organic matter.		10
			20
		232.0	30
	Grey silty clay with layers of sand and gravel.	227.0	
	Stiff grey silty clay.		40
			50
		201.0	60
	Shale, weathered at surface.	195.0	
	End of borehole		70
	Penetration resistance profile obtained by driving a 2" dia. cone from groundlevel to depth noted with an energy of 350 ft. lb. per blow.		80

STRENGTH AND PENETRATION RESISTANCE
1000 2000 3000 4000 P.S.F.
25 50 75 100 BLOWS/FT.

+4.5, +4.8, +3.3, +4.1, +1.4, +4.4, +1.6, +1.4
127, 143, 147
Penetration ends at elev. 202.7'

CONSISTENCY
MOIST. CONTENT - % DRY WT.
15 30 45

SAMPLE	NATURAL UNIT WT. P.C.F.
S1	-
S2	-
S3	-
S4	-
S5	-
S6	-
S7	-
T8	93.5
T9	-
S10	-
S11	-
S12	-

FORM OB-ML-126 (REV. 1959.)—58-5691

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 231-58-3 BORE HOLE NO. 4

JOB 59-F-125 STATION 17+50 ℄ Ramp H.

DATUM G.S.C. COMPILED BY B.K.

BORING DATE Feb. 8/60 CHECKED BY J.B.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu)
VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Groundlevel	263.0	0
	Clayey mixture of sand, gravel and ashes. W.L. ▽	259.0	
		255.0	10
	Soft brown silty clay with decayed organic matter.	251.0	
	Brown sandy clay with decayed organic matter & some ash.	242.0	20
	Brown to grey silty clay with layers of sand & gravel.	236.0	
			30
	Stiff grey silty clay, sandy near bedrock.		40
			50
		201.0	60
	Pink Shale	200.0	
	End of borehole		70
			80

STRENGTH AND PENETRATION RESISTANCE
1000 2000 3000 4000 P.S.F.
25 50 75 100 BLOWS/FT.

+2.8, +2.5, +1.5, +2.4, +1.0

CONSISTENCY
MOIST. CONTENT - % DRY WT.
15 30 45

SAMPLE	NATURAL UNIT WT. P.C.F.
S1	-
S2	-
S3	-
S4	-
S5	-
T6	-
S7	-
T8	124.0
S9	-
S10	-

FORM OB-ML-126 (REV. 1959.)—58-5691

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 231-58-3 BORE HOLE NO. 5

JOB 59-F-125 STATION 18/00 ℄ Ramp H.

DATUM G.S.C. COMPILED BY B.K.

BORING DATE Jan. 28/60 CHECKED BY J.B.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +S
NATURAL MOISTURE AND LIQUIDITY INDEX LI X
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Groundlevel	260.0	0
	Heterogeneous mixture of ashes, gravel & sand. W.L. ▽	256.0	
	Brown sandy clay	251.0	10
	Well graded sand & gravel.	239.0	20
	Stiff grey silty clay with scattered shale fragments.	237.0	30
			40
			50
			60
	End of borehole	193.7	70
			80

Penetration resustance profile shown obtained by driving a 2" dia. cone from groundlevel to depth noted with an energy of 350 ft. lb. per blow.

STRENGTH AND PENETRATION RESISTANCE
1000 2000 3000 4000 P.S.F.
25 50 75 100 BLOWS/FT.

Penetration refusal at elev. 204.5'

CONSISTENCY
MOIST. CONTENT - % DRY WT.
15 30 45

SAMPLE: S1 S2 S3 S4 S5 S6 S7 S8 S9

NATURAL UNIT WT. P.C.F.

FORM OB-ML-126 (REV. 1959.)—58-5691

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 231-58-3 BORE HOLE NO. 7

JOB 59-F-125 STATION 20/00 ℄ Ramp H.

DATUM G.S.C. COMPILED BY B.K.

BORING DATE Feb. 11/60 CHECKED BY J.B.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +S
NATURAL MOISTURE AND LIQUIDITY INDEX LI X
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Groundlevel	274.0	0
	Brown clay with sand, gravel & rubble.	271.0	
	Well graded gravelly sand with rubble.	250.0	10
	Black peaty sand with wood.	248.0	20
	Soft brown sandy clay with decayed vegetation.	241.0	30
			40
			50
			60
	End of borehole		70
			80

STRENGTH AND PENETRATION RESISTANCE
1000 2000 3000 4000 P.S.F.
25 50 75 100 BLOWS/FT.

CONSISTENCY
MOIST. CONTENT - % DRY WT.
15 30 45

SAMPLE: S1 S2 S3 S4 S5 S6 T7

NATURAL UNIT WT. P.C.F.

FORM OB-ML-126 (REV. 1959.)—58-5691

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 231-58-3 BORE HOLE NO. 9 Ramp H.

JOB F 59-125 STATION 436+59 18' Rt. ℄ Chedoke

DATUM G.S.C. COMPILED BY B.K.

BORING DATE Dec. 3/59 CHECKED BY J.B.

LEGEND

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +S
NATURAL MOISTURE AND LIQUIDITY INDEX LI X
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Groundlevel	261.7	0
	Loose sandy mixture of ashes and organic matter also partially decayed wood, etc.	249.7	10
	Soft brown sandy clay with organic matter also ashes and sanitary fill locally.	231.7	30
	Stiff grey silty clay.	198.4	60
	Shale	188.9	70
	End of borehole. Penetration resistance profile shown obtained by driving a 2" dia cone from groundlevel to depth noted with an energy of 350 ft. lb. per blow.		80

STRENGTH AND PENETRATION RESISTANCE
1000 2000 3000 4000 P.S.F.
25 50 75 100 BLOWS/FT.
Penetration ends at Elev. 206.8'

CONSISTENCY
MOIST. CONTENT - % DRY WT.
15 30 45

SAMPLE	NATURAL UNIT WT. P.C.F.
S1	-
S2	-
S3	-
S4	-
S5	-
T6	127.5
T7	119.2
T8	119.3
T9	-
RC10	-

FORM OB-ML-126 (REV. 1959.)—58-5691

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 231-58-3 BORE HOLE NO. 10 Ramp H.

JOB F59-125 STATION 437+19 90' Rt. ℄ Chedoke.

DATUM 258.0' COMPILED BY B.K.

BORING DATE Nov. 28/59 CHECKED BY V.K.

LEGEND

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +S
NATURAL MOISTURE AND LIQUIDITY INDEX LI X
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Groundlevel	258.0	0
	Loose sandy mixture of rubble ashes and sanitary fill.		10
Limits Uncertain.	Soft brown clay with organic matter, sand, etc.	233.0	20
	Grey silty clay		30
		194.7	60
	Bedrock (shale)	184.7	70
	End of borehole Penetration resistance profile shown obtained by driving a 2" Dia. cone from ground level to depth noted with an energy of 350 ft. lb. per blow.		80

STRENGTH AND PENETRATION RESISTANCE
1000 2000 3000 4000 P.S.F.
25 50 75 100 BLOWS/FT.
Penetration ends at elev. 209.0'

CONSISTENCY
MOIST. CONTENT - % DRY WT.
15 30 45

SAMPLE	NATURAL UNIT WT. P.C.F.
S1	-
T2	-
T3	-
S4	-
T5	-
T6	-
T7	-
T8	-
RC 9	-

FORM OB-ML-126 (REV. 1959.)-58-3691 OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 231-58-3 BORE HOLE NO. 12B

JOB 59-F-125 STATION 437+00 ℄

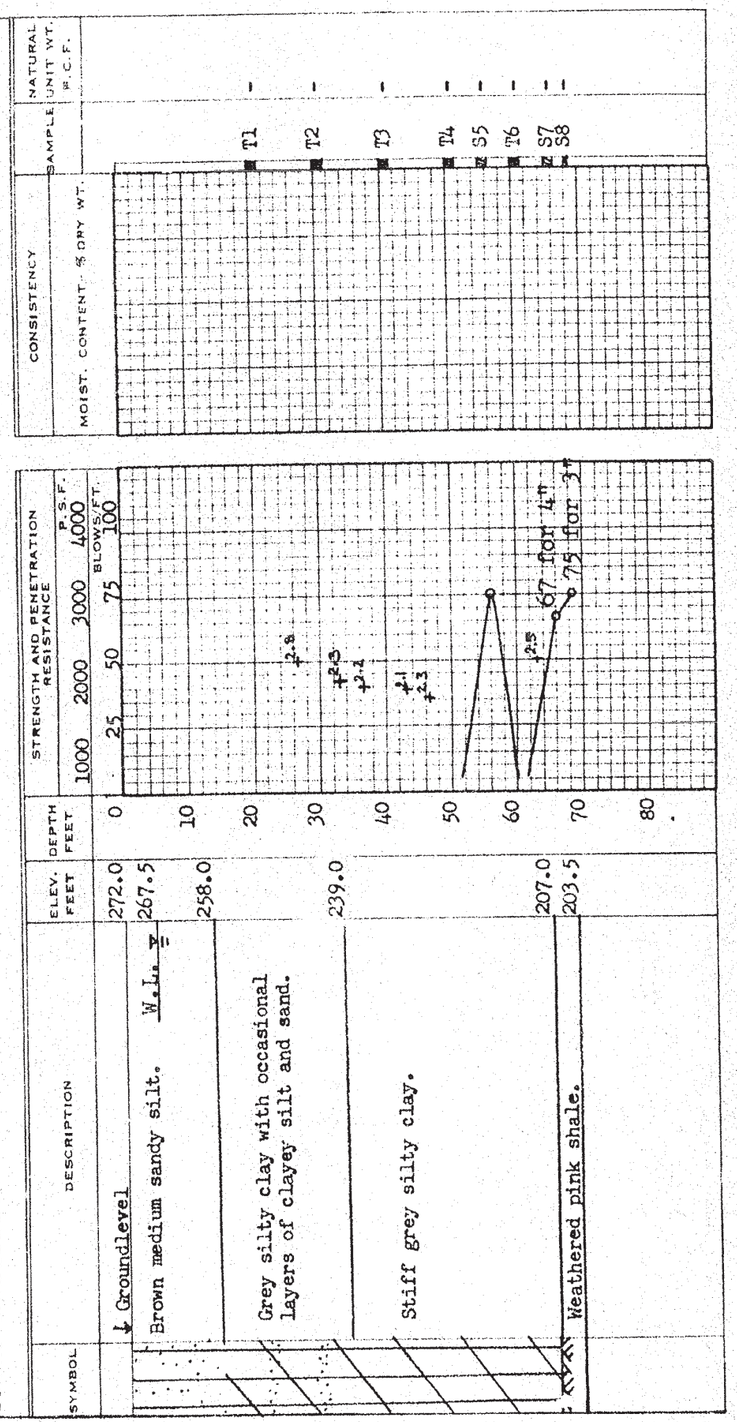
DATUM G. S. C. COMPILED BY B. K.

BORING DATE Jan. 18/60 CHECKED BY J. B.

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) — — O
VANE TEST (C) AND SENSITIVITY (S) — — +S
NATURAL MOISTURE AND LIQUIDITY INDEX — — LI
LIQUID LIMIT — — — — — — — — — — — — X
PLASTIC LIMIT — — — — — — — — — — — — ⊢

2" DIA. SPLIT TUBE — — — — — —
2" SHELBY TUBE — — — — — — —
2" SPLIT TUBE — — — — — — — —
2" DIA. CONE — — — — — — — — —
2" SHELBY — — — — — — — — — —
CASING — — — — — — — — — — —



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LOG OF BOREHOLE NO. 2

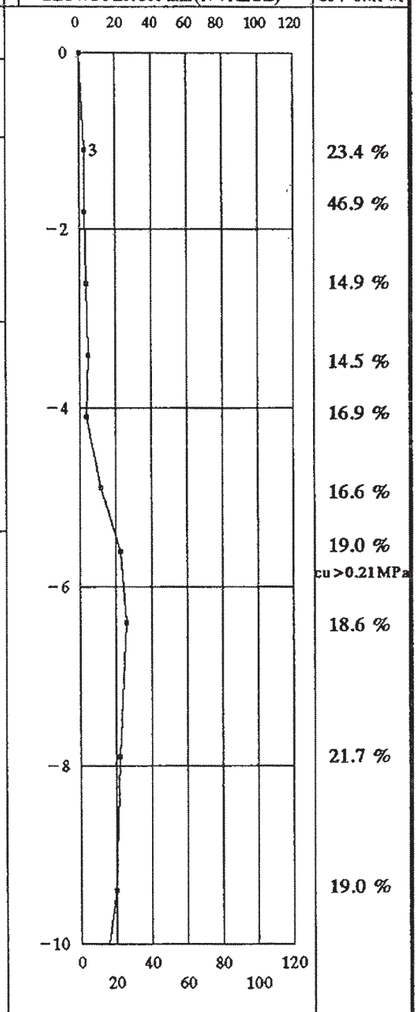
DWG NO. 4

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 10, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH	DRILLING [ ] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED CSO TANK	METHOD: [X] HOLLOW STEM
LOCATION: CATHEDRAL PARK, MAIN ST @ HWY 403, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; MC MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	MC (%) / CU / UNIT WT
85.7	Grass and surficial vegetation			0.0	
84.8	FILL silty clay with silt and sand, dark brown to brown, rootlets and organics, moist			0.9	
	FILL ash, cinders, sand, organics, decayed plant fibres and wood, pieces of porcelain and glass, generally grey to black, moist to very moist,	3	SS	1.1	23.4 %
		3	SS	1.8	46.9 %
	(VERY LOOSE)	4	SS	2.6	14.9 %
82.7	– red brick pieces			3.0	
		5	SS	3.4	14.5 %
	SAND AND SILT fine sand sizes, slightly clayey, greyish brown below 4.7 m, very moist,	4	SS	4.1	16.9 %
	(LOOSE TO COMPACT)	12	SS	4.9	16.6 %
80.4				5.3	
		23	SS	5.6	19.0 % cu > 0.21 MPa
	SILTY CLAY layered with silt and sand seams, vertical fissures, red shale fragments, trace of gravel, oxidized brown to unoxidized grey below 10.9 m, moist to very moist,	26	SS	6.4	18.6 %
	(VERY STIFF TO STIFF)	22	SS	7.9	21.7 %
	– dessicated and oxidized grey-brown becoming unoxidized grey below 10.9 m				
		20	SS	9.4	19.0 %
	BOREHOLE CONTINUED ON NEXT PAGE				

STD PENETRATION TEST
BLOWS PER 300 mm (N VALUE)



BORELOG.FRM May-94

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LOG OF BOREHOLE NO. 2 (CONT'D)

DWG NO. 5

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 10, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING [ ] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED CSO TANK	METHOD: [X] HOLLOW STEM
LOCATION: CATHEDRAL PARK, MAIN ST. @ HWY 403, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; M/C MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	M/C (%) CU / UNIT WT
75.7	Continued from previous page			10.0		
	SILTY CLAY layered with silt and sand seams, vertical fissures, red shale fragments, trace of gravel, oxidized brown to unoxidized grey below 10.9 m, moist to very moist, (VERY STIFF TO STIFF)	9	SS	11		21.4 %
		8	SS	12.5		18.3 %
	– dessicated and oxidized grey–brown becoming unoxidized grey below 10.9 m	6	SS	14		23.8 %
		21	SS	15.5		19.9 %
68.7	**SHALE (Queenston Formation)**					
	layered with grey siltstone seams, weathered, red,	80+	SS	17.0	/80 mm	
68.5	moist, (HARD)			17.2		19.5 %
	BOREHOLE TERMINATED					

NOTES:
1. BOREHOLE OPEN TO 16.3 m ON COMPLETION.
2. WATER LEVEL AT 5.2 m ON COMPLETION.

BORELOG.FRM May–94

MOUNTAINVIEW GEOTECHNICAL LTD.
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LOG OF BOREHOLE NO. 3

DWG NO. 6

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 10, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING [ ] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED CSO TANK	METHOD: [X] HOLLOW STEM
LOCATION: CATHEDRAL PARK, MAIN ST @ HWY 403, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; M/C MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	M/C (%) CU / UNIT WT
87.2	Grass and surficial vegetation			0.0		
	FILL					
86.4	silty clay with silt and sand, dark brown to brown, rootlets and organics, moist			0.8		
	FILL	5	SS	1.1		18.2 %
85.9	ash, cinders, sand, organics, decayed plant fibres and wood, pieces of porcelain and glass, generally grey to black (LOOSE TO VERY LOOSE)			1.5		
		15	SS	1.8		11.6 %
		14	SS	2.6		16.1 %
	SAND AND SILT fine sand sizes, slightly clayey, oxidized brown, clay seams @ 4.0 m (COMPACT)	10	SS	3.4		20.9 %
		17	SS	4.1		7.4 %
82.3		16	SS	4.9		11.5 %
	SILTY CLAY layered with silt and sand seams, vertical fissures, red shale fragments, trace of gravel, oxidized brown to unoxidized grey below 6.1 m, moist to very moist (FIRM TO STIFF)	23	SS	5.6		15.9 %
		28	SS	6.4		15.8 %
		15	SS	7.9		15.3 %
		13	SS	9.4		20.7 %

BOREHOLE CONTINUED ON NEXT PAGE

BORELOG.FRM Jun–94

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LOG OF BOREHOLE NO. 3
(CONT'D)

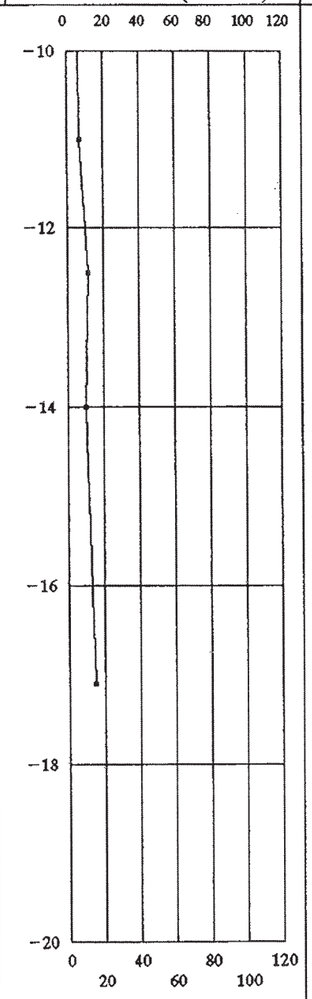
DWG NO. 7

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 10, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING METHOD: [ ] SOLID STEM CONTINUOUS FLIGHT [X] HOLLOW STEM [ ] DIAMOND DRILL; [ ] NX or [ ] BX
PROJECT NAME: PROPOSED CSO TANK	
LOCATION: CATHEDRAL PARK, MAIN ST. @ HWY 403, HAMILTON	
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; MC MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	MC (%) CU / UNIT WT
77.2	Continued from previous page			10.0		
	SILTY CLAY layered with silt and sand seams, vertical fissures, red shale fragments, trace of gravel, oxidized brown to unoxidized grey below 6.1 m, moist to very moist (FIRM TO STIFF)	7	SS	11		14.9 %
		12	SS	12.5		21.7 %
		10	SS	14		21.3 %
		15	SS	17.1		20.9 %
	SHALE (Queenston Formation) layered with grey siltstone seams, weathered, red,					
67.1	moist (HARD)			20.4		
67.2	BOREHOLE TERMINATED			20.5		

NOTES:
1) BOREHOLE OPEN TO 20.5 m ON COMPLETION.
2) BOREHOLE WAS DRY UPON COMPLETION.



BORELOG.FRM May–94

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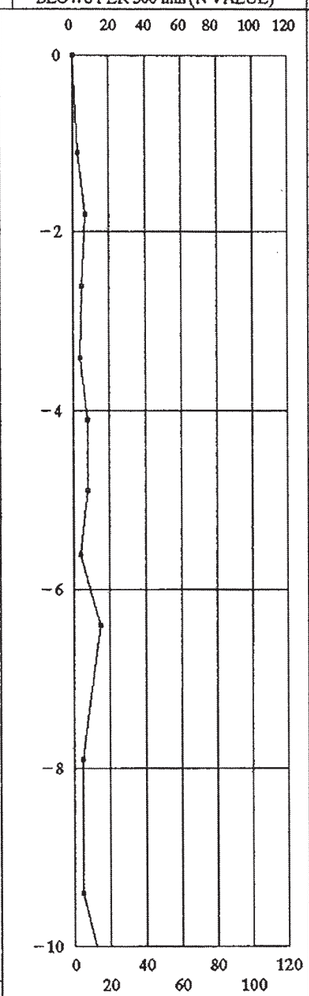
LOG OF BOREHOLE NO. 4

DWG NO. 8

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 10, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING METHOD: [X] SOLID STEM CONTINUOUS FLIGHT [ ] HOLLOW STEM [ ] DIAMOND DRILL; [ ] NX or [ ] BX
PROJECT NAME: PROPOSED CSO TANK	
LOCATION: CATHEDRAL PARK, MAIN ST @ HWY 403, HAMILTON	
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; MC MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	MC (%) CU / UNIT WT
88.2	Grass and surficial vegetation			0.0		
	FILL silty clay with silt and sand, dark brown to brown,					
87.5	rootlets and organics, moist			0.7		
		3	SS	1.1		33.0 %
		7	SS	1.8		31.2 %
		5	SS	2.6		30.4 %
	FILL ash, cinders, sand, organics, decayed plant fibres and wood, pieces of porcelain and glass, generally grey to black, possible asphalt shingles @ 5m, black cemented foundry sand @ 6 m, wet below 7 m (LOOSE TO VERY LOOSE)	4	SS	3.4		29.0 %
		8	SS	4.1		37.6 %
		8	SS	4.9		33.7 %
		4	SS	5.6		34.4 %
		15	SS	6.4		19.5 %
		5	SS	7.9		61.2 %
		5	SS	9.4		16.6 %
	SILTY CLAY layered with silt and sand seams, vertical fissures,					
78.1	red shale fragments, trace of gravel, oxidized brown, moist to very moist (HARD)			10.1		
	BOREHOLE CONTINUED ON NEXT PAGE					



BORELOG.FRM May–94

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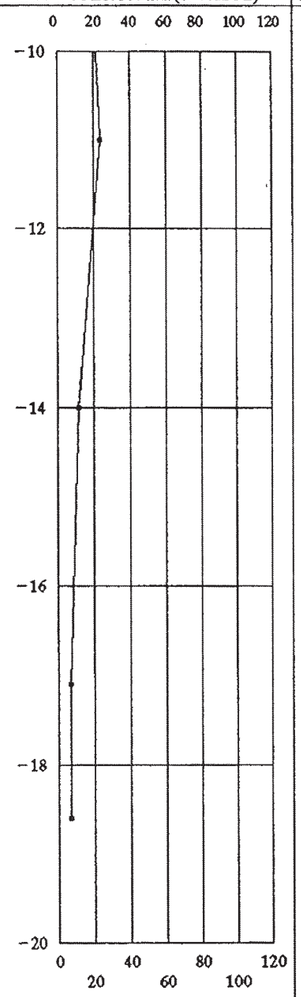
LOG OF BOREHOLE NO. 4 (CONT'D)

DWG NO. 9

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 10, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING [X] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED CSO TANK	METHOD: [ ] HOLLOW STEM
LOCATION: CATHEDRAL PARK, MAIN ST. @ HWY 403, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; MC MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	MC (%) CU / UNIT WT
78.2	Continued from previous page			10.0		
	SILTY CLAY layered with silt and sand seams, vertical fissures, red shale fragments, trace gravel, oxidized brown, unoxidized grey below 11.6 m, moist to very moist (HARD)	24	SS	11		19.5 %
		12	SS	14		18.1 %
		7	SS	17.1		24.2 %
		7	SS	18.6		23.1 %
65.0	**SHALE (Queenston Formation)** layered with grey siltstone seams, weathered, red, moist (HARD)			23.2		
63.8	BOREHOLE TERMINATED ON PRACTICAL AUGER REFUSAL			24.4		



BOREHOLOG.FRM May–94

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CONSULTING ENGINEERS

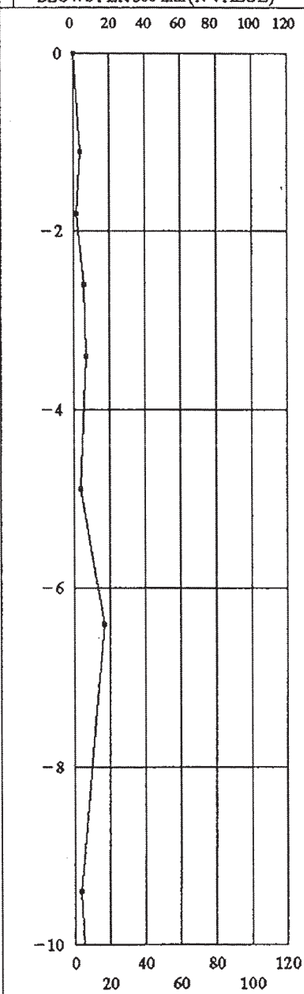
LOG OF BOREHOLE NO. 5

DWG NO. 10

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 16, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING [ ] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED CSO TANK	METHOD: [X] HOLLOW STEM
LOCATION: CATHEDRAL PARK, MAIN ST @ HWY 403, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; MC MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	MC (%) CU / UNIT WT
89.8	Grass and surficial vegetation			0.0		
89.2	**FILL** silty clay with silt and sand, dark brown to brown, rootlets and organics, moist			0.6		
		4	SS	1.1		39.5 %
		2	SS	1.8		45.6 %
		6	SS	2.6		36.5 %
		7	SS	3.4		34.6 %
	FILL ash, cinders, sand, organics, decayed plant fibres and wood, pieces of porcelain and glass, generally grey to black, wet below 9.4 m	4	SS	4.9		21.2 %
		17	SS	6.4		45.5 %
		4	SS	9.4		26.8 %
	BOREHOLE CONTINUED ON NEXT PAGE					



BOREHOLOG.FRM May–94

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LOG OF BOREHOLE NO. 5
(CONT'D)

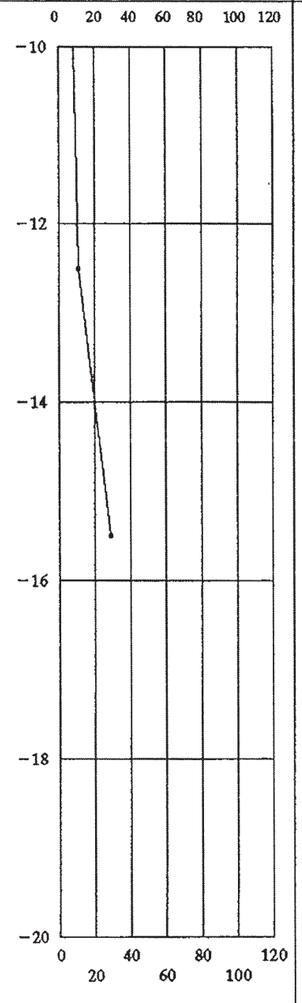
DWG NO. 11

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 16, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING METHOD: [ ] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED CSO TANK	[X] HOLLOW STEM
LOCATION: CATHEDRAL PARK, MAIN ST. @ HWY 403, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; MC MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	M/C (%) CU / UNIT WT
79.8	Continued from previous page			10.0		
	FILL ash, cinders, sand, organics, decayed plant fibres and wood, pieces of porcelain and glass, generally					
78.2	grey to black, wet (LOOSE TO VERY LOOSE)			11.6		
	SILTY CLAY layered with silt and sand seams, vertical fissures, red shale fragments, trace of gravel, oxidized brown to grey, beamy unoxidized grey below 17 m, moist to very moist (FIRM TO STIFF)	11	SS	12.5		19.8 %
		29	SS	15.9		14.0 %
66.3	SHALE (Queenston Formation) layered with grey siltstone seams, weathered, red,			23.5		
	moist (HARD)			23.8		
	BOREHOLE TERMINATED ON AUGER REFUSAL					

NOTES:
1) WET CAVE TO 8.2 m. WATER LEVEL @ 6.7 m.



BORELOG.FRM Jun–94

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CONSULTING ENGINEERS

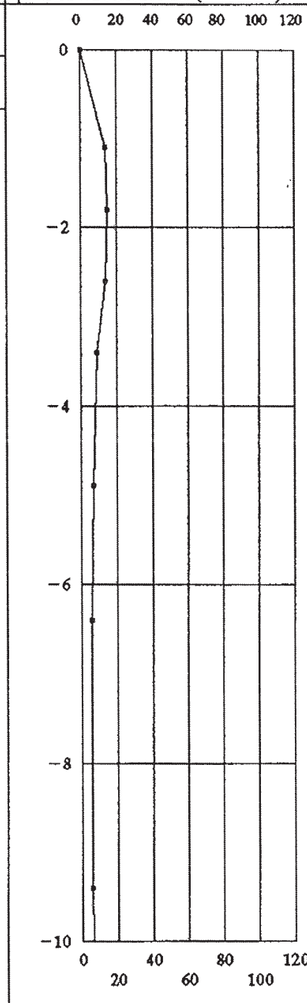
LOG OF BOREHOLE NO. 20

DWG NO. 40

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 12, 13, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING METHOD: [ ] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED CSO TANK	[X] HOLLOW STEM
LOCATION: CATHEDRAL PARK, MAIN ST @ HWY 403, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; MC MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	M/C (%) CU / UNIT WT
84.1	Grass and surficial vegetation			0.0		
83.2	FILL silty clay with silt and sand, dark brown to brown, rootlets and organics, moist			0.9		
		14	SS	1.1		19.0 %
	SILTY CLAY layered with silt and sand seams, vertical fissures, red shale fragments, trace of gravel, dessicated and oxidized brown becoming unoxidized grey below 2.4 m (STIFF TO FIRM)	15	SS	1.8		19.1 %
		14	SS	2.6		17.3 %
		9	SS	3.4		21.5 %
		7	SS	4.9		24.2 %
		6	SS	6.4		31.6 %
		6	SS	9.4		17.5 %
	BOREHOLE CONTINUED ON NEXT PAGE					



BORELOG.FRM May–94

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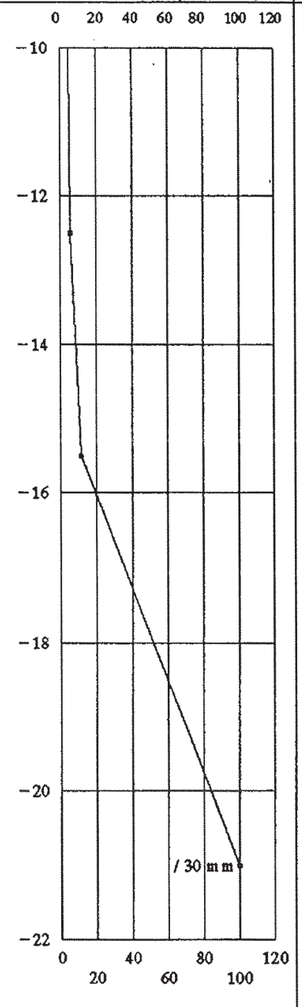
LOG OF BOREHOLE NO. 20
(CONT'D)

DWG NO. 41

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 13, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING METHOD: [ ] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED CSO TANK	[X] HOLLOW STEM
LOCATION: CATHEDRAL PARK, MAIN ST. @ HWY 403, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; M/C MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	M/C (%) CU / UNIT WT
74.1	Continued from previous page			10.0		
	SILTY CLAY layered with silt and sand seams, vertical fissures, red shale fragments, trace of gravel, desiccated and oxidized brown becoming unoxidized grey below 2.4 m, (STIFF TO FIRM)	6	SS	12.5		12.1 %
		12	SS	15.5		23.4 %
	SHALE (Queenston Formation)					
63.4	layered with grey siltstone seams, weathered, red	100+	SS	20.7		
	BOREHOLE TERMINATED					



NOTES:
1) BOREHOLE OPEN TO 20.1 m ON COMPLETION
2) WATER LEVEL AT 19.5 m ON COMPLETION

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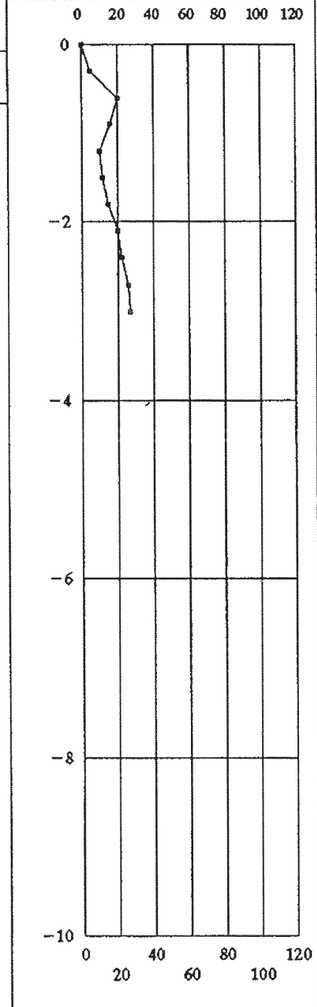
DYNAMIC CONE PENETRATION TEST NEAR BOREHOLE NO. 20

DWG NO. 41A

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 12, 13, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING METHOD: [ ] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED CSO TANK	[X] HOLLOW STEM
LOCATION: CATHEDRAL PARK, MAIN ST @ HWY 403, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; M/C MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	M/C (%) CU / UNIT WT
84.1	Grass and surficial vegetation			0.0		
83.2	**FILL** silty clay with silt and sand, dark brown to brown, rootlets and organics, moist			0.9		
	SILTY CLAY layered with silt and sand seams, vertical fissures, red shale fragments, trace of gravel, dessicated and oxidized brown becoming unoxidized grey below 2.4 m (STIFF TO FIRM)					



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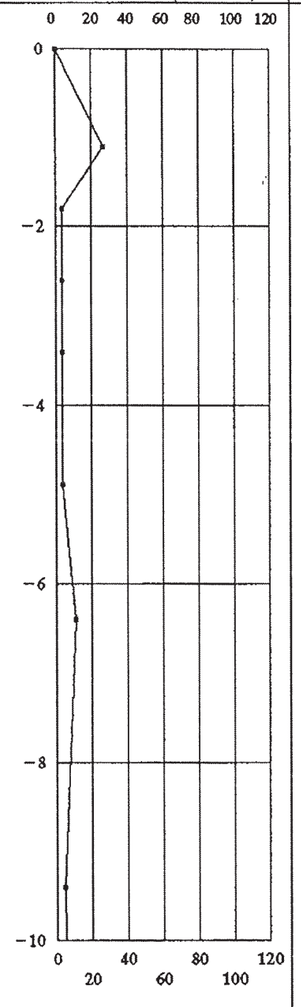
LOG OF BOREHOLE NO. 21

DWG NO. 42

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 12, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING [X] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED CSO TANK	METHOD: [ ] HOLLOW STEM
LOCATION: CATHEDRAL PARK, MAIN ST @ HWY 403, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; M/C MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	M/C (%) CU / UNIT WT
91.4	Grass and surficial vegetation			0.0		
90.9	**FILL** silty clay with silt and sand, dark brown to brown, rootlets and organics, moist			0.5		
	FILL ash, cinders, sand @ 1.2 m, foundry sand @ 6 m, organics, decayed plant fibres and wood, pieces of porcelain and glass, generally grey to black, wet @ 6 m (LOOSE TO VERY LOOSE)	27	SS	1.1		14.3 %
		4	SS	1.8		34.3 %
		4	SS	2.6		28.0 %
		4	SS	3.4		34.5 %
		4	SS	4.9		42.6 %
		11	SS	6.4		5.9 %
82.0		5	SS	9.4		20.0 %
	SAND AND SILT fine sand sizes, slightly clayey, greyish brown, decayed plant fibres, gravel sizes, very moist (LOOSE TO COMPACT)					
	BOREHOLE CONTINUED ON NEXT PAGE					



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LOG OF BOREHOLE NO. 21 (CONT'D)

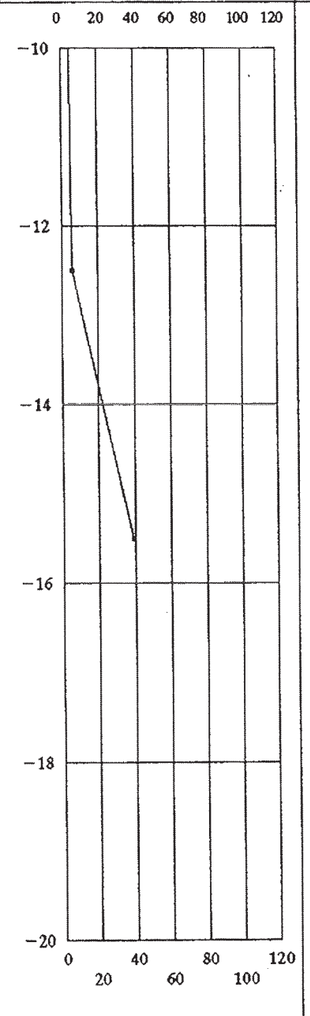
DWG NO. 43

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 12, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING [X] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED CSO TANK	METHOD: [ ] HOLLOW STEM
LOCATION: CATHEDRAL PARK, MAIN ST. @ HWY 403, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; M/C MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	M/C (%) CU / UNIT WT
81.4	Continued from previous page			10.0		
80.4	**SAND AND SILT** fine sand sizes, slightly clayey, greyish brown, decayed plant fibres, gravel sizes, very moist (LOOSE TO COMPACT)			11.0		
	SILTY CLAY layered with silt and sand seams, vertical fissures, red shale fragments, trace of gravel, unoxidized grey, moist to very moist (FIRM TO STIFF)	6	SS	12.5		29.2 %
		39	SS	15.5		17.3 %
75.2				16.2		
	SHALE (Queenston Formation) layered with grey siltstone seams, weathered, red, moist (HARD)					
71.4				20.0		
	BOREHOLE TERMINATED ON PRACTICAL AUGER REFUSAL					

NOTES:
1) BOREHOLE OPEN TO 19.2 m ON COMPLETION
2) WATER LEVEL AT 11.6 m ON COMPLETION



BORELOG.FRM Jun–94

KING STREET WEST

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Interceptor Trunk Sanitary Sewer
Client: The Corporation of the City of Hamilton
Elevation: Geodetic 324.9
Job No.: 62220
Casing: Auger 4-1/2" and 6"
Compiled By: A. A.M.
Borehole No.: 2
Boring Date: Dec. 27, 1962 - Jan. 11/63
Checked By: P. L.

SAMPLE CONDITION
UNDISTURBED
FAIR
DISTURBED
LOST

SAMPLE TYPE
A.S. AUGER SAMPLE
C.S. CASING SAMPLE
S.S. 2" STANDARD SPLIT TUBE SAMPLE
S.L. SPLIT BARREL WITH LINERS
S.T. THIN-WALLED SHELBY TUBE SAMPLE
W.S. WASH SAMPLE
R.C. ROCK CORE

ABBREVIATIONS
V.T. IN SITU VANE SHEAR TEST
M. MOIST
W.L. WATER LEVEL IN CASING
W.T. GROUND WATER TABLE IN SOIL
W.T.P.L. WETTER THAN PLASTIC LIMIT
D.T.P.L. DRIER THAN PLASTIC LIMIT
A.P.L. ABOUT PLASTIC LIMIT

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth (Elevation)	Legend	Sample No. and Condition	Sample Type	No. of Blows per ft.	Water Content %	WATER LEVELS & REMARKS
Ground surface			0'0"						
Topsoil to 12"	Black & Brown								
Silty, sandy loam	Yellowish brown								
Silty, sandy clay, sandy silt seams & fissures	Reddish brown	Stiff to very stiff			1	SS	17	27.0	D. T. P. L. and moist.
Med. to fine sand & silty clay interlayered	Brownish red		4'6"						
Silty clay, some grits and pebbles sandy silt seams	Brownish grey	Loose to Compact	6'0"		2 3	SS	9	28.5	Wet and W. T. P. L. W. T. P. L.
									Slight water seepage at 9'6"
Silty clay, some g. & p. layers, of sandy silt	Reddish brown	Stiff to very stiff			4	SS	15	25.0	W. T. P. L. and Saturated.
			14'0"						
Silty clay, some g. & p.	Grey with red tint	Firm			5	SS	7	26.3	W. T. P. L.
Sandy silty clay, grits and pebbles	Yellowish brown	Very	18'0"		6	2"S.L.			
		Hard	19'0"				48/6"		
Coarse to fine gravel, boulder pieces, some sand		Extremely dense	22'6"		7	SS	100/3"	2.7	Dry
Layer of coarse to med. sand	Grey & brown		23'0"						
Coarse to fine gravel, some sand		Ditto			8	SS	100/6"	2.6	Dry
Coarse to medium sand, some fine gravel	Light brown				9	CS			Slightly moist.
Coarse to fine gravel and sand	Grey and brown	Ditto			10	SS	100/3"		Dry
			32'10"						
Coarse to fine sand	Brown	Dense			11	SS	39	14.7	Wet
			37'6"						
								22.8	Water sample #1 (38'-40')
			40'0"						Sand backing up into casing. Quiet.
Sandy silt pockets of fine sand	Brown	Very dense			12	SS	63	14.7	
			45'0"						
Clayey silt with pockets of silty fine sand	Grey-brown	Hard			13	SS	37	19.9	D. T. P. L.
			51'3"		14	SS	18	23.0	W. T. P. L.
Silty clay, with pockets of reddish-brown sand	Grey-brown	Very stiff							
			55'0"						
Silty clay with grits and pebbles	Grey	Very stiff to hard			15	SS	31	18.4	D. T. P. L.
			57'6"						Started using wash water
Fine to medium sand pebbles,					16	W. S.			Layer of fine to medium sand, pebbles (57'6"-59'6")
			59'6"						
Silty clay, grits and pebbles fragments of shale	Grey	Firm to Stiff			17	SS	8	24.1	M. W. T. P. L.
As above	As above changing to grey-brown	Very hard			18 19	SS	56	17.2	D. T. P. L. Getting less plastic (increasing silt content with depth).
Clayey silt, fragments of shale	Grey-brown	Very hard			20	SS	50	20.1	Slightly plastic
			72'10"						
									Water seepage at 73'6"
									Water sample #2 73'-75'
Weathered shale (Queenston shale)	Red-brown	Very hard			21	SS	144/9"	10.8	Slightly moist.
			77'10"						Refusal at 77'10"

Test Hole Terminated at 77'10".

PETO MacCALLUM LTD.

CONSULTING GEOTECHNICAL ENGINEERS

LOG OF BOREHOLE No. 1 & 2

JOB NAME: PROPOSED SEWER CONSTRUCTION — JOB No.: 77 F 25
LOCATION: King Street, Hamilton — BORING DATE: Feb. 17, 1977 — ENGINEER: J.F.W.
BORING METHOD: 4" ϕ Solid Stem, Continuous Flight Augers — TECHNICIAN: P.W.

DEPTH	SOIL PROFILE: DESCRIPTION	LEGEND	ELEVATION	SAMPLES: NUMBER	TYPE	BLOWS/FOOT N-VALUES	SHEAR STRENGTH C_u ▲ / DYNAMIC CONE PENETRATION ▪ / STANDARD PENETRATION TEST ● — BLOWS/FOOT 20 40 60 80	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W — W_P W W_L — WATER CONTENT % 10 20 30	GROUNDWATER OBSERVATIONS AND REMARKS
	Borehole No. 1 GROUND ELEVATION: 327.5								
	SAND: Compact to loose reddish brown silty fine sand.		325	1	SS	11			
5	With clayey silt layers.			2	AS	-			
				3	SS	6			
			320						
				4	SS	14			
10	Becoming brown.			5	SS	19			
			315						
				6	SS	10			
15	Becoming dense reddish brown silty fine sand.								
18'0"			310	7	SS	61/11"			
	Borehole terminated at 18'0".								Upon completion of augering no water no cave.
	Borehole No. 2 Ground Elevation: 329.9								
0	8½" CONCRETE								
	SAND: Compact reddish brown silty fine sand with gravel sizes.			1	SS	22			
	Becoming very loose.		325	2	AS	-			
5				3	SS	4			
	Becoming brown fine to medium sand.		320	4	SS	3			
10	Becoming compact reddish brown.			5	SS	18			
	Becoming silty with gravel sizes.			6	SS	16			
15			315						
	Becoming very dense and dark brown.								
18'0"				7	SS	52			
	Borehole terminated at 18'0".		310						Upon completion of augering no water no cave.

NOTES:

CHECKED BY EC

PML/504

MEMBER OF THE ASSOCIATION OF CONSULTING ENGINEERS OF CANADA

PETO MacCALLUM LTD.
CONSULTING GEOTECHNICAL ENGINEERS

LOG OF BOREHOLE No. 3 & 4

JOB NAME: PROPOSED SEWER CONSTRUCTION — JOB No.: 77 F 25
LOCATION: King Street, Hamilton — BORING DATE: Feb. 17, 1977 — ENGINEER: J.F.W.
BORING METHOD: 4" ϕ Solid Stem, Continuous Flight Augers — TECHNICIAN: P.W.

Borehole No. 3
GROUND ELEVATION: 340.2

DEPTH	DESCRIPTION	ELEVATION	NUMBER	TYPE	BLOWS/FOOT N-VALUES
	SAND: Compact brown silty fine sand.		1	SS	28
5	Becoming loose.	335	2	AS	-
			3	SS	8
			4	SS	8
10	Becoming dense reddish brown silty fine to medium sand.	330	5	SS	37
			6	SS	66
15		325			
18'0"	Becoming compact.		7	SS	12
20	Borehole terminated at 18'0".				

Upon completion of augering no water no cave.

Borehole No. 4
Ground Elevation: 361.6

DEPTH	DESCRIPTION	ELEVATION	NUMBER	TYPE	BLOWS/FOOT N-VALUES
0'5"	CONCRETE				
	SAND: Compact brown silty fine to coarse sand and gravel.	360	1	SS	17
5	Becoming very loose dark brown silty fine to coarse sand.	355	2	SS	2
9'6"	Becoming compact.		3	SS	17
10	SAND AND GRAVEL: Very dense brown fine to coarse sand and gravel.	350	4	SS	68
			5	SS	96
15		345	6	SS	62/11"
17'5"	Borehole terminated at 17'5".				
20					

Upon completion of augering no water no cave.

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT W_L
PLASTIC LIMIT W_P
WATER CONTENT W
W_P W W_L
WATER CONTENT % 10 20 30

NOTES:

CHECKED BY: KK

PME/504 — MEMBER OF THE ASSOCIATION OF CONSULTING ENGINEERS OF CANADA

PETO MacCALLUM LTD.
CONSULTING GEOTECHNICAL ENGINEERS

LOG OF BOREHOLE No. 5 & 6

JOB NAME: PROPOSED SEWER CONSTRUCTION — JOB No.: 77 F 25
LOCATION: King Street, Hamilton — BORING DATE: Feb. 17, 1977 — ENGINEER: J.F.W.
BORING METHOD: 4" ϕ Solid Ste[illegible], Continuous Flight Augers — TECHNICIAN: P.W.

Borehole No. 5
GROUND ELEVATION: 355.0

DEPTH	DESCRIPTION	ELEVATION	NUMBER	TYPE	BLOWS/FOOT N-VALUES
	SAND: Loose light brown fine sand.		1	SS	6
5		350	2	AS	-
6'6"			3	SS	5
	SAND AND GRAVEL: Dense to very dense dark brown coarse sand with gravel sizes.		4	SS	31
10		345	5	SS	35
	Becoming silty fine to coarse sand with gravel sizes.		6	AS	-
15		340	7	SS	65
18'0"	Less silty.		8	SS	40
20	Borehole terminated at 18'0".				

Upon completion of augering no water no cave.

Borehole No. 6
Ground Elevation: 352.6

DEPTH	DESCRIPTION	ELEVATION	NUMBER	TYPE	BLOWS/FOOT N-VALUES
	SAND: Loose light brown silty fine sand.	350	1	SS	5
5			2	AS	-
			3	SS	7
8'0"		345			
	SAND AND GRAVEL: Very dense brown silty fine to coarse sand and gravel.		4	SS	52
10			5	SS	106
	Becoming dark brown fine to medium sand and gravel.	340	6	AS	-
15			7	SS	85
18'0"		335	8	SS	60
20	Borehole terminated at 18'0".				

Upon completion of augering no water no cave.

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT W_L
PLASTIC LIMIT W_P
WATER CONTENT W
W_P W W_L
WATER CONTENT % 10 20 30

NOTES:

CHECKED BY: KK

PME/504 — MEMBER OF THE ASSOCIATION OF CONSULTING ENGINEERS OF CANADA

PETO MacCALLUM LTD.
CONSULTING GEOTECHNICAL ENGINEERS

LOG OF BOREHOLE No. 7 & 8

JOB NAME: PROPOSED SEWER CONSTRUCTION — JOB No. 77 F 25
LOCATION: King Street, Hamilton — BORING DATE: 17 Feb. 1977 — ENGINEER: J.F.W.
BORING METHOD: 4" ϕ Solid Stem, Continuous Flight Augers — TECHNICIAN: P.W.

DEPTH	DESCRIPTION	ELEVATION	NUMBER	TYPE	BLOWS/FOOT N-VALUES
	Borehole No. 7				
	GROUND ELEVATION: 346.5				
0'3"	CONCRETE				
	SAND: Compact reddish brown silty fine sand.	345			
			1	SS	83
			2	AS	-
	Becoming brown fine to medium sand.		3	SS	20
		340			
			4	SS	25
			5	SS	26
		335			
			6	AS	-
			7	SS	23
		330			
18'0"			8	SS	20
	Borehole terminated at 18'0".				
	Borehole No. 8				
	Ground Elevation: 336.8				
	CLAYEY SILT: Stiff reddish brown clayey silt.	335			
			1	SS	9
5'0"±			2	AS	-
	SAND: Loose brown silty fine to medium sand.	330	3	SS	5
			4	SS	4
	Becoming dark brown fine to medium sand.		5	SS	4
		325			
			6	SS	5
15'6"±					
	CLAYEY SILT: Hard brown clayey silt.	320	7	SS	30
22'0"±		315			
24'5"	SAND: Very dense brown medium to coarse sand.		8	SS	79/11"
	Borehole terminated at 24'5".				

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT ——— W_L
PLASTIC LIMIT ——— W_P
WATER CONTENT ——— W
W_P W W_L
WATER CONTENT % 10 20 30

GROUNDWATER OBSERVATIONS AND REMARKS:
Upon completion of augering no water no cave.
Upon completion of augering no water cave at 21'6".

NOTES:

CHECKED BY KC

PML/504 — MEMBER OF THE ASSOCIATION OF CONSULTING ENGINEERS OF CANADA

PETO MacCALLUM LTD.
CONSULTING GEOTECHNICAL ENGINEERS

LOG OF BOREHOLE No. 9

JOB NAME: PROPOSED SEWER CONSTRUCTION — JOB No. 77 F 25
LOCATION: King Street, Hamilton — BORING DATE: Feb. 17, 1977 — ENGINEER: J.F.W.
BORING METHOD: 4" ϕ Solid Stem, Continuous Flight Augers — TECHNICIAN: P.W.

DEPTH	DESCRIPTION	ELEVATION	NUMBER	TYPE	BLOWS/FOOT N-VALUES
	GROUND ELEVATION: 328.8				
	SAND: Loose brown fine sandy silt to silty fine sand.	325	1	SS	4
4'6"			2	AS	-
	CLAYEY SILT: Stiff reddish brown silty clay to clayey silt, becoming brown clayey fine sandy silt.		3	SS	15
		320	4	SS	13
			5	SS	11
13'0"					
	SAND AND GRAVEL: Compact brown coarse sand with fine gravel sizes.	315	6	SS	18
			7	SS	10
	Becoming dense silty fine to coarse sand and gravel.	310			
		305			
25'0"	Borehole terminated at 25'0".		8	SS	47

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT ——— W_L
PLASTIC LIMIT ——— W_P
WATER CONTENT ——— W
W_P W W_L
WATER CONTENT % 10 20 30

GROUNDWATER OBSERVATIONS AND REMARKS:
Upon completion of augering no water cave at 19'6".

NOTES:

CHECKED BY KC

PML/504 — MEMBER OF THE ASSOCIATION OF CONSULTING ENGINEERS OF CANADA

MOUNTAINVIEW GEOTECHNICAL LTD.
CONSULTING ENGINEERS

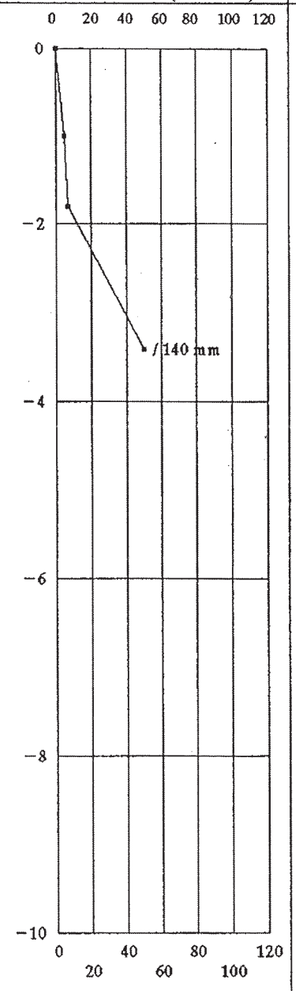
LOG OF BOREHOLE NO. 20

DWG NO. 21

MGL PROJECT NO.: S0858	DRILLING DATE: OCTOBER 25, 1995
CLIENT: THE REGION OF HAMILTON–WENTWORTH	DRILLING METHOD: [X] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED WATERMAIN & SEWER INSTALLATION	[ ] HOLLOW STEM
LOCATION: MARKET STREET, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; M/C MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	M/C (%) CU / UNIT WT
108.5				0.0		
	75 mm Asphalt over 150 mm crushed limestone					
	FILL sand with some silt, medium to coarse grained, clayey, brown, moist,	5	SS	1.0		14.0 %
	(LOOSE)	7	SS	1.8		19.2 %
106.5				2.0		
	SAND AND GRAVEL medium to coarse grained sand, meduim gravel sizes, brown, moist,					
	(DENSE)					
105.0		>50	SS	3.4	140 mm	5.0 %
	BOREHOLE TERMINATED			3.5		



NOTES:
1. BOREHOLE OPEN TO 2.9 m ON COMPLETION.
2. BOREHOLE WAS DRY ON COMPLETION.

GEO DISK # 25 Nov–95

MOUNTAINVIEW GEOTECHNICAL LTD.
CONSULTING ENGINEERS

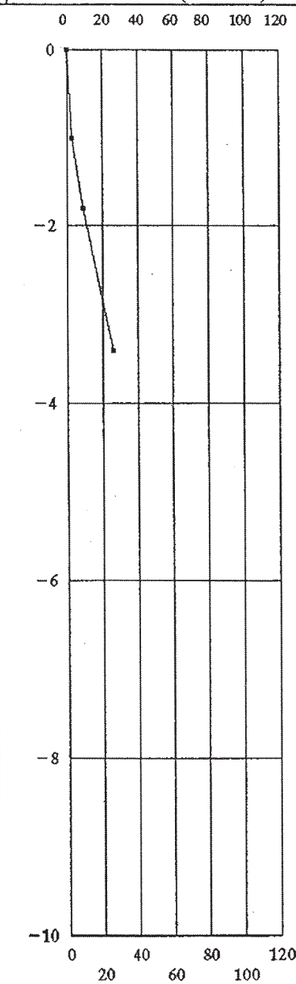
LOG OF BOREHOLE NO. 21

DWG NO. 22

MGL PROJECT NO.: S0858	DRILLING DATE: OCTOBER 25, 1995
CLIENT: THE REGION OF HAMILTON–WENTWORTH	DRILLING METHOD: [X] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED WATERMAIN & SEWER INSTALLATION	[ ] HOLLOW STEM
LOCATION: MARKET STREET, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; M/C MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	M/C (%) CU / UNIT WT
103.0				0.0		
	100 mm Asphalt over 175 mm crushed limestone					
	FILL sand with some silt, medium to coarse grained, clayey, brown, moist,	3	SS	1.0		11.9 %
101.2	(LOOSE)	9	SS	1.8		15.2 %
	SAND AND GRAVEL medium to coarse grained sand, meduim gravel sizes, brown, moist,					
	(COMPACT)					
99.5		26	SS	3.4		6.0 %
	BOREHOLE TERMINATED			3.5		



NOTES:
1. BOREHOLE OPEN TO 2.7 m ON COMPLETION.
2. BOREHOLE WAS DRY ON COMPLETION.

GEO DISK # 25 Nov–95

PETO ASSOCIATES LTD. — CONSULTING SOIL ENGINEERS

RECORD OF BOREHOLE NO. 4 P

JOB NO. 73 F 48 — JOB NAME Parking Garage - Main Street, Hamilton — TECHNICIAN W.J.

BORING DATE Mar. 13/73 — CLIENT Corporation of the City of Hamilton — ENGINEER GDP/APJ

GROUND ELEV. 324.3 — BOREHOLE TYPE Hollow Stem Augers — TYPED BY jnc

DEPTH ELEV.	SOIL PROFILE DESCRIPTION	LEGEND	SAMPLES NUMBER	TYPE	BLOWS/FOOT	REMARKS
0'0"						
1'0"	CINDER FILL					
	MIXED FILL: Dark brown sandy silt fill, some gravel.		1	SS	4	#4A augered 10' north of #4. Fill to 16'. Boulders to 25'.
	Mainly loose sandy fill.		2	SS	2	
	Ashes and bricks fill. Moist.		3	SS	2	
14'6"±						
309.8	SAND: Brown fine to medium sand with gravel and boulders. Dense.		4	SS	43	After sample #4, hole dry.
20'0"±						
304.3	SANDY TILL: Hard, dry.		5	SS	30/0"	
22'0"±						
302.	SAND: Fine to coarse sand, wet below 25' ±, compact to dense, saturated.		6	SS	56	P1 E = 505 bars PL = not determined
			7	SS	27	
	Becoming grey brown, pockets of sandy till.		8	SS	185	After sample #8 - W.L. @ 26' ±
32'6"±						
	SILTY CLAY: Grey silty clay. W.T.P.L. Odd pebble, till like, stiff.		9	SS	32	P2 E = 68 bars PL = 16 bars
			10	SS	19	
	Reddish brown pockets of silt.		11	TW	Push	
			12	SS	27	P3 E = 58 bars PL = 11 bars
			13	SS	32	
			14	TW	Push	
	Firm to stiff clayey silt/silty clay.		15	SS	20	P4 E = 59 bars PL = 12 bars
	Mainly silty clay. W.T.P.L.		16	SS	29	
			17	TW	Push	
	Interbedded clayey silt and sandy silt layers.		18	SS	13	P5 E = 48 bars PL = 10.5 bars
			19	SS	18	
71'0"±						
253.3	CLAYEY SILT TILL: Reddish brown to grey silt till. Hard. A.P.L. Variable gravel content.		20	SS	17	
			21	SS	77	P6 E = 102 bars PL = 23 bars
			22	SS	90	
			23	SS	40	
97'0"±						
227.3	SILTY CLAY: Grey clayey silt to silty clay. W.T.P.L. Silt pockets and seams red and grey. Stiff.		24	SS	34	P7 E = 139 bars PL = not determined
			25	SS	28	
			26	TW	Push	
97'0"±	Borehole terminated at 97'0"					

Hollow augers at 95', W.L. - 25'1" Pulled augers W.L. - 25' ± Cave - 35' Installed piezometer - 30' - 35'

May 15/73: W.L. 27'5"

PAL/504

PETO ASSOCIATES LTD. — CONSULTING SOIL ENGINEERS

RECORD OF BOREHOLE NO. 5

JOB NO. 73 F 48 — JOB NAME Parking Garage - Main Street, Hamilton — TECHNICIAN W.J.

BORING DATE Mar. 9/73 — CLIENT corporation of the City of Hamilton — ENGINEER GDP/APJ

GROUND ELEV. 322.8± — BOREHOLE TYPE Hollow Stem Augers — TYPED BY jnc

DEPTH ELEV.	SOIL PROFILE DESCRIPTION	LEGEND	SAMPLES NUMBER	TYPE	BLOWS/FOOT	REMARKS
0'0"						
1'6"±	CRUSHED STONE AND FINES.					
321.3	MIXED FILL: Mixed sand and gravel fill. Bricks, concrete slabs, etc.		1	SS	13	
			2	SS	10	
			3	SS	15	
9'6"±	CONCRETE SLAB					
10'0"						
312.8	Clayey sandy silt fill, wet.		4	SS	6	
12'0"±						
310.8	SAND: Brown fine to medium sand, moist, loose.		5	SS	4	
15'0"±						
16'6"±	SANDY TILL: Brown		6	SS	39	
306.3	SAND: Brown fine to coarse, gravel layers. Boulders. Very moist, compact.		7	SS	37	Hole dry to 22'. W.L. 23'8"
	Becoming dark brown fine to medium sand.		8	SS	19	Hole at 25' water - 23'8"
	Fine to coarse sand. Saturated, dense.		9	SS	62	Hole at 30' water - 24'
33'0"±						
289.8	SILTY CLAY: Grey silty clay, stiff, A.P.L. Stiff, grit content, till like.		10	SS	32	
	Silt seams and pockets.		11	SS	26	
	Becoming W.T.P.L.		12	SS	24	After pulling augers, cave - 9'
	Seams of sandy silt.		13	SS	16	
51'6"±						
271.3	Borehole terminated at 51'6" 1					

PAL/504

PETO ASSOCIATES LTD.

RECORD OF BOREHOLE NO. 6P

CONSULTING SOIL ENGINEERS

JOB NO. 73 F 48 | JOB NAME Parking Garage - Main Street, Hamilton | TECHNICIAN W.J.

BORING DATE Mar. 9/73 | CLIENT Corporation of the City of Hamilton | ENGINEER GDP/APJ

GROUND ELEV. 322.6± | BOREHOLE TYPE Hollow Stem Augers | TYPED BY jnc

DEPTH ELEV.	SOIL PROFILE: DESCRIPTION	LEGEND	SAMPLES: NUMBER	TYPE	BLOWS/FOOT	STANDARD PENETRATION TEST BLOWS/FOOT (10 20 30 40 50) / SHEAR STRENGTH C_u LB/SQ.FT. (1000 2000 3000 4000 5000)	LIQUID LIMIT W_L / PLASTIC LIMIT W_p / WATER CONTENT W (W_p W W_L; WATER CONTENT % 10 20 30)	REMARKS
0'0"	CRUSHED STONE							
0'6"	MIXED FILL: Sandy fill to 2 feet below. Mixed sand and gravel fill. Bricks, wood, concrete slabs. Very moist. Odd boulder.		1	SS	25			Hole #6A augered 10' East. After 16 feet of drilling, W.L. - 13'1"
			2	SS	7			After 5 mins. 13'1" cave - 15'1"
			3	SS	18			After 22 feet W.L. - 22'
9'9"	BASEMENT FLOOR LEVEL							After 5 mins. 21'8"
312.4	SAND: Brown fine to medium sand. Compact. Moist. Some fine gravel.		4	SS	15			On pulling augers, W.L. and cave 9'6".
			5	SS	33			BH. #6B
18'0"±								20'0" Water running into hole.
304.6	SANDY TILL: Clayey sandy till, brown							
20'0"±								
302.6	SAND: Brown fine to coarse sand. Wet.		6B1	SS	95	95	E=61 bars PL=40 bars	P1 22'0"
	Boulders.		6B2	SS	75	75 W.L. 24'8"		Hole #6B augered 5' East of #6. After 25' augering, moist at bottom.
	Becoming saturated.		6B3	SS	35			29'0" After 10 mins. W.L. - 24'8"
	Layers of gravel.						E=287 bars	P
			7	SS	23/6"		PL=>40 bars	31'0"
33'0"±								BH. #6P
289.6	SILTY CLAY: Grey silty clay. Stiff. Grits and pebbles. Till like. W.T.P.L.		8	SS	22	▲ 3590 PSF		35'6" BH.#6P P1 E = 61 bars PL = 10.5 "
			9	SS	26	▲ 2300 PSF		37'6"
			10	SS	28			41'0" P2 E = 66 bars
			11	SS	35			28 43'0" P2 PL = 13 bars
			12	SS	22			46'0" P3 E = 78 bars
	Gravel sizes present.		13	SS	32	▲ 1550 PSF		22 48'0" P3 PL = 12 bars
	Soft mainly silty clay. Clayey silt/ silty clay. Reddish brown silty sand seams.		14	SS	8			56'0" P4 E = 55 bars
			15	SS	17			P4 58'0" PL = 9.5 "
	Interbedded							
	Silty clay							
66'6"±								
256.1	CLAYEY SILT TILL: Reddish brown to grey clayey silt till. Hard. Silt seams and pockets.		16	SS	14			66'0" P5 E = 71 bars
			17	SS	48	▲ 4180 PSF		P5 68'0" PL = 12 bars
	Variable gravel content.		18	SS	42			
			19	SS	70	70		81'0" P6 E = 127 bars
			20	SS	51			P6 83'0" PL ~ 28 bars
87'0"±								
245.6	SILTY CLAY: Grey clayey silt to silty clay. W.T.P.L. Silt pockets and seams. Red and grey. Stiff.		21	SS	15			
			22	SS	16			96'0" P7 E = 58 bars
98'0"±			23	SS	31	20		31 P7 PL = 17 bars
224.6	Borehole terminated at 98'0"							98'0"

PAL/504

PETO ASSOCIATES LTD.

RECORD OF BOREHOLE NO. 7

CONSULTING SOIL ENGINEERS

JOB NO. 73 F 48 | JOB NAME Parking Garage - Main Street, Hamilton | TECHNICIAN W.J.

BORING DATE Mar. 19/73 | CLIENT Corporation of the City of Hamilton | ENGINEER GDP/APJ

GROUND ELEV. 321.8± | BOREHOLE TYPE Hollow Stem Augers | TYPED BY jnc

DEPTH ELEV.	SOIL PROFILE: DESCRIPTION	LEGEND	SAMPLES: NUMBER	TYPE	BLOWS/FOOT	DYNAMIC CONE PENETRATION BLOWS/FOOT / STANDARD PENETRATION TEST BLOWS/FOOT (10 20 30 40 50) / SHEAR STRENGTH C_u LB/SQ.FT.	LIQUID LIMIT W_L / PLASTIC LIMIT W_p / WATER CONTENT W (W_p W W_L; WATER CONTENT % 10 20 30)	REMARKS
0'0"	MIXED FILL: Mixed sand, silt, bricks, etc., loose, moist to wet. Sandy fill.		1	SS	5			
9'6"								
10'9"±	OLD BASEMENT FLOOR LEVEL							
311.5	SAND: Brown, fine to medium sand. Compact to dense, odd pebble. Moist.		2	SS	14			
			3	SS	62			No free water to 24'. Hole at 25' W.L. @ 23'8"
21'0"±								
300.8	SAND: Grey brown fine to coarse sand, wet. Compact to dense. Saturated.		4	SS	57			Hole at 31' W.L. @ 23'8". Took water sample. pH = 6.8 SO_3 = 480 ppm
			5	SS	35	W.L. 23'4"		Mildly aggressive.
31'2"								29'3"
290.6	SILTY CLAY: Grey brown to grey silty clay. A.P.L. Very stiff.		6	SS	47			31'0" Hole at 31' augers at 30'. Sand backed to 28'.
			7	SS	24			Bailed to 26'10".
	Odd pebble.		8	SS	21	17 27		2 mins. later 26'2". 6 mins. later 25'3".
	Becoming W.T.P.L.							10 mins. later 24'8".
	Reddish grey.		9	TW	Push			Stopped checking.
	Sandy silt to silty sand layers.		10	SS	20			On completion installed piezometer 29' to 31' W.L.-23'3" initially.
50'0"								
271.8	Borehole terminated at 50'0"							May 16/73: W.L. 23'4"

PAL/504

Order No. S3831/H551 Enclosure No. 5

RACEY, MacCALLUM & BLUTEAU LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: (3) King St.W.

Project: Proposed Sanitary & Storm Sewers
Location: King St.W., Hamilton, Ont.
Hole Location: See Drawing No. 1
Hole Elevation and Datum: 320.8
Start Date: March 11/71 Prep.: P.H.
End Date: " " Checked: D.B.

LEGEND
- Split spoon
- Wash sample
- Shelby Tube
- Core sample

Shear Strength (C)
Unconfined compression
Vane test and sensitivity (S) ⊕ +S
Penetration Resistance (P)
2" Split tube
2" Dia. Cone
Casing

Symbol	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE C P.S.F. P BLOWS/FT. 20 40 60 80	Sample No.	Recovery
		320.8	0			
	Asphalt & Concr.Base	319				
	Sand-dense to very dense; silty; fine to medium; reddish brown to grey; moist becoming wet below approx. 24 ft.depth.		10		SS1 SS2 SS3	
	Conglomorate layer at approx. 20 ft. depth*		20	6"	SS4 SS5	
	W.L	297				
	End of Borehole	289.3	30		SS6	

Notes:
1. Borehole advanced using flight auger equipment.
2. On completion, hole open to approx. 23 ft. depth.
3. *Layer of conglomorate gravel encountered at 20 ft. depth; difficult to penetrate by auger.

Order No. S3831/H551 Enclosure No. 7

RACEY, MacCALLUM & BLUTEAU LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: (5) King St.W.

Project: Proposed Sanitary & Storm Sewers
Location: King St.W., Hamilton, Ont.
Hole Location: See Drawing No. 1
Hole Elevation and Datum: 323.4
Start Date: March 12/71 Prep.: P.H.
End Date: " " Checked: D.B.

LEGEND
- Split spoon
- Wash sample
- Shelby Tube
- Core sample

Shear Strength (C)
Unconfined compression
Vane test and sensitivity (S) ⊕ +S
Penetration Resistance (P)
2" Split tube
2" Dia. Cone
Casing

Symbol	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE C P.S.F. P BLOWS/FT. 20 40 60 80	Sample No.	Recovery
		323.4	0			
	Asphalt & Concr.Base	322				
	Sand-loose, fine to medium; reddish brown; moist; (probably fill to approx. 16 ft.depth)		10		SS1 SS2 SS3	
	Refusal on conglomorate layer of sand and gravel.	304	20			
			30			

Notes:
1. Borehole advanced to 19'6" using flight auger equipment.
2. Refusal to augering encountered at approx. 19'6" depth.

Order No. S3831/H551 Enclosure No. 8

RACEY, MacCALLUM & BLUTEAU LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: (6) King St.W.

Project: Proposed Sanitary & Storm Sewers

Location: King St.W., Hamilton, Ont.

Hole Location: See Drawing No. 1

Hole Elevation and Datum: 325.4

Start Date: March 15/71 Prep.: P.H.

End Date: " " Checked: D.B.

LEGEND

- Split spoon
- Wash sample
- Shelby Tube
- Core sample

Shear Strength (C)
Unconfined compression
Vane test and sensitivity (S) ⊕ +S

Penetration Resistance (P)
2" Split tube
2" Dia. Cone
Casing

Symbol	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE C P.S.F. P BLOWS/FT. 20 40 60 80	Sample No.	Recovery
		325.4	0			
	Asphalt & Concr. Base	324				
	Sand-loose; fine to medium; reddish brown; moist (probably fill).	317			SS1	
	Sand-dense; fine to medium; reddish brown; moist		10		SS2	
R	Layer of conglomorate sand and gravel; approx. 9" thick at 17 ft. depth; underlain by sand & gravel.			Refusal	SS3	
	End of Borehole	302	20		SS4	
			30			

Notes:

1. Borehole advanced to 17 ft. depth using flight auger equipment together with conventional wash boring technique for breaking through the conglomorate layer.
2. On completion, hole dry and open to 21 ft. depth.

KING STREET WEST

Log of Borehole 1

Project No. HAGE-0060496-A Drawing No. 4

Project: Geotechnical Investigation - Proposed Sewer and Watermain Construction Sheet No. 1 of 1

Location: James Street (King Street to Wilson Street), Hamilton, Ontario

Date Drilled: May 12, 2001

Drill Type: Truck Mount

Datum:

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S) | Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH m	N Value (20 40 60 80) Shear Strength 0.1 0.2 MPa	Combustible Vapour Reading (ppm) 250 500 750; Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30	SAMPLES	Natural Unit Weight kN/m³
		ASPHALT: ~ 290 mm thick	96.14	0				
		FILL: Sand and gravel, brown, moist, ~ 150 mm thick	95.85					
		FILL: Silty sand, reddish brown, fine grained, some clay, moist, very loose to loose	95.70	1				
		SAND: Light brown, fine grained, layered, silty sand seams, moist, compact to dense	93.84	2				
		BOREHOLE TERMINATED	92.64	3				

Notes:

1. Borehole was advanced by solid stem auger equipment to a termination depth of 3.5 m on May 12, 2001.

2. Upon completion of drilling, no cave, no water.

3. In hole methane reading using MSA explosimeter: 0% methane.

4. Upon completion of drilling, 19 mm (3/4 in.) diameter P.V.C. standpipe installed to 3.5 m depth, screened portion 2.6 to 3.5 m depth, bentonite seal 0.2 to 1.1 m depth and asphalt patch from 0 to 0.2 m depth.

LAGWGL02 BHLOG.GPJ NEW.GDT 6/21/01

Trow Consulting Engineers Ltd.
428 Millen Road
Stoney Creek, Ontario, L8E 3N9
Telephone: 905-664-3300
Fax: 905-662-4144
E-Mail: hamilton@trow.com

Time	Water Level (m)	Depth to Cave (m)
June 1, 2001	3.50	

Borehole Log

Trow Ltd

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test +S | Lab Vane Test t | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at Overburden Pressure % Strain at Failure (0, 5, 10, 15) | Penetrometer

Project: Proposed Amphitheatre Dwg. No. 2

Gore Park Borehole No. 1

Hamilton, Ontario Project No. H4596-G

Hole location and datum see drawing No. 1

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH m	N Value (ASTM) D1586-CSA A119.1 (20 40 60 80) Shear Strength 0.1 0.2 MPa	Natural Moisture Content and Atterberg Limits % Dry Weight (10 20 30)	Natural Unit Weight kN/m³
		0.3 m TOPSOIL	99.83	0			
		SAND-reddish brown to brown, stratified frequently silty, occ. wet seams, loose		1			
		SAND & GRAVEL-brown, very dense	95.8	2			
		SILTY CLAY TILL-grey, with traces of sand & gravel, very stiff	91.3	3			
		TERMINATED	90.2	4			
		NOTES: See attached sheet		5			
				6			
				7			
				8			
				9			
				10			

TL101rD

Log of Borehole BH16

Project No. SPB481-3 — Drawing No. 3

Project: Geo-environmental Investigation — Sheet No. 1 of 1

Location: Hughson St. N., King St. E. to King William St., City of Hamilton, Ontario

Date Drilled: Sept.2, 2004

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ☒
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✦
Sensitivity S
Piezometric Water Level ▼

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit |—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH m	N Value: Shear Strength (Blows/0.3m; 20 40 60 80; kPa 0.1 0.2)	Combustible Vapour Reading (ppm) 250 500 750; Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30	SAMPLES	Natural Unit Weight kN/m³
		ASPHALTIC CONCRETE: 150 mm CONCRETE: 200 mm GRANULAR BASE: 50 mm, crusher run limestone FILL: silty sand to sandy silt, brown, moist, compact	96.16	0	○	×		
				1	○	×		
				2	○	×		
		SAND: coarse to medium grained, some silt seams, brown, moist, very dense	93.86	3	○	×		
		End of Borehole	92.66					

S & P Shaheen & Peaker Consulting Engineers

Borehole BH16

Time	Water Level (m)	Depth to Cave (m)
on completion	dry	3.0

PROJECT: 941-6037 — **RECORD OF BOREHOLE BH-C** — SHEET 1 OF 1

LOCATION: SEE PLAN FIGURE 1 — BORING DATE: 11/10/94 — DATUM: GEODETIC

DIP: — SAMPLER HAMMER, 63.5 kg; DROP, 760 mm

BORING METHOD: CME 55 TRUCKMOUNTED AUGER, 114mm HOLLOW STEM AUGERS

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION (ppm) ⊕ / % LEL □	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT Wp W Wl (10 20 30 40)	INSTALLATIONS (1 2 3)
-1	GROUND SURFACE		96.34								
0	80mm PAVING STONE.		96.20								
	SAND and GRAVEL. (FILL)		96.14	1A							
	Dense, brown, SANDY SILT; trace brick fragments, cinders. (FILL)		0.20	1B	SS	50/0.0	50				
1	Loose, brown, SILTY SAND; trace topsoil, occasional gravel. (possibly FILL)		95.74 0.60	2	SS	50/0.0	5				NOTE: Borehole dry during drilling.
2				3	SS	50/0.0	6				
	Loose, reddish-brown, SANDY SILT; trace clay with sand layers.		94.19 2.15	4	SS	50/0.0	7				
3				5	SS	50/0.0	6				
	Compact, brown, fine to medium SAND; trace silt, occasional gravel.		92.69 3.65	6	SS	50/0.0	24				
4				7	SS	50/0.0	29				
5	Compact, brown, SAND and GRAVEL.		91.16 5.18	8	SS	50/0.0	27				
6	END OF BOREHOLE		90.55 5.79								
7											
8											
9											

DATA INPUT: D.Popovich 11/14/94

DEPTH SCALE (ALONG HOLE) 1 to 50

Golder Associates

LOGGED: K.G.

CHECKED: J.G.M.

PROJECT: 941-6037

LOCATION: SEE PLAN FIGURE 1

DIP:

RECORD OF BOREHOLE BH-D

BORING DATE: 10/27/94

SHEET 1 OF 1

DATUM: LOCAL

SAMPLER HAMMER, 63.5kg; DROP, 760 mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION (ppm)	HYDRAULIC CONDUCTIVITY, k, cm/s	WATER CONTENT, PERCENT Wp W Wl	INSTALLATIONS
0	CME 55 TRUCKMOUNTED AUGER 114mm HOLLOW STEM AUGERS	GROUND SURFACE		96.15						% LEL		10 20 30 40	1 2 3
		80mm PAVING STONE.		96.06									
		Sand and Gravel. (FILL)		0.09 95.85									
		Dense, brown, sandy silt. (FILL)		0.30	1	SS	37						
				95.39									
1		Loose to compact, brown, SILTY SAND; some gravel. (possibly FILL)		0.76	2	SS	10						NOTE: Borehole dry during and following drilling.
					3	SS	6						
2				94.00									
		Loose, reddish brown, SANDY SILT; with sand seams and layers.		2.15	4	SS	9						
				93.40									
3		Loose, brown, fine to medium SILTY SAND.		2.75	5	SS	8						
				92.50									
4		Compact, brown, fine to medium SAND; trace silt, occasional gravel.		3.65	6	SS	27						
					7	SS	29						
5				90.97									
		Dense, brown, SAND and GRAVEL.		5.16	8	SS	47						
6		END OF BOREHOLE		90.36 5.79									
7													
8													
9													

DATA INPUT: D.Popovich 11/13/94

DEPTH SCALE (ALONG HOLE)

1 to 50

Golder Associates

LOGGED: K.G.

CHECKED: J.G.M.

SITEST ENGINEERING

DATA SHEET FOR BOREHOLE 5

DRAWING 10 (SHEET ___ OF ___)

8614

Project No. PROPOSED SEWERS (Your No. ___)

Project CATHARINE ST. (HAMILTON)

Location REGION OF HAMILTON-WENTWORTH

SEE DRAWING NO: 2

Hole Location APRIL 18, 1988 VERTICAL

Date Drilled 100 mm SOLID STEM AUGER

Drilled by GEODETIC (BOREHOLE ELEV. = (94.567m))

Datum

Field: 3" OD Split Tube; 3", 3"ID Shelby Tube; Rotary Core Sample; Auger or Wash Sample; 3" Dia Cone; Field Vane; Pressure Meter; Sample Pushed (pressure); Water Table (definite, apparent)

Laboratory: Natural Moisture; Plastic & Liquid Limit; Lab Vane Test; Torvane; Unconfined Compression; Undrained Triaxial at Overburden Pressure; Strain at Failure; Sensitivity

Symbol	Description / Classification	Elevation (metres)	Depth (metres)	Penetration Resistance N, 350 ft lbs blows/ft (10 20 30 40); Shear Strength	Natural Water Content & Atterberg Limits (10 % dry weight 20 30); Sensitivity	Sample Type & Number	Recovery %
	PAVEMENT	94.47	0.10				
	FILL, sandy gravel	94.17	0.40				
	SAND, some silt loose, reddish-brown, wet occasional coarse sand seams		1	10		1	100
			2				
			3	8		2	100
	GRAVELLY SAND, some silt cobbles and boulders very dense	90.46	4.11	62/275mm		3	100
	▽	89.57	5.00				
	SILTY SAND, layered, wet brown, very dense	88.63	5.94	53		4	100
	BOREHOLE TERMINATED	88.02	6.55				

Notes
1. Free water encountered @ 6.5m. Level observed @ 5.0 m on completion.
2. Borehole was backfilled on completion of the fieldwork.

Borehole #: A

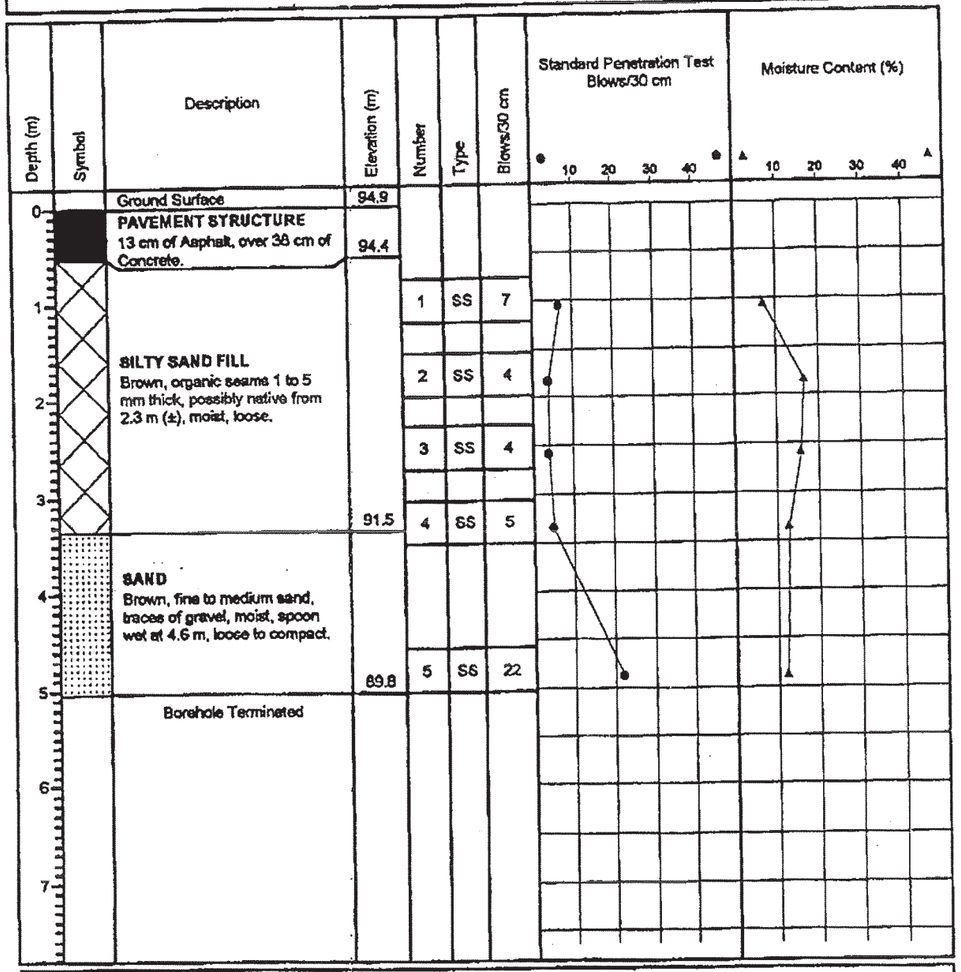
Project No: TB99002G

Project: Storm Sewer Construction

Client: Reg. Mun. of Hamilton-Wentworth

Location: King & Walnut St., Hamilton

Prepared By: M. Leitch



Drilled by: Elite Drilling

Drill Method: Solid Stem Augers

Upon Completion: Caved and wet at 4.9 m.

AGRA Earth and Environmental
505 Woodward Avenue
Hamilton, Ontario
L8H 6N6

Hole Size: 150 mm

Datum: Geodetic

Drill Date: 99 02 04

Borehole #: B

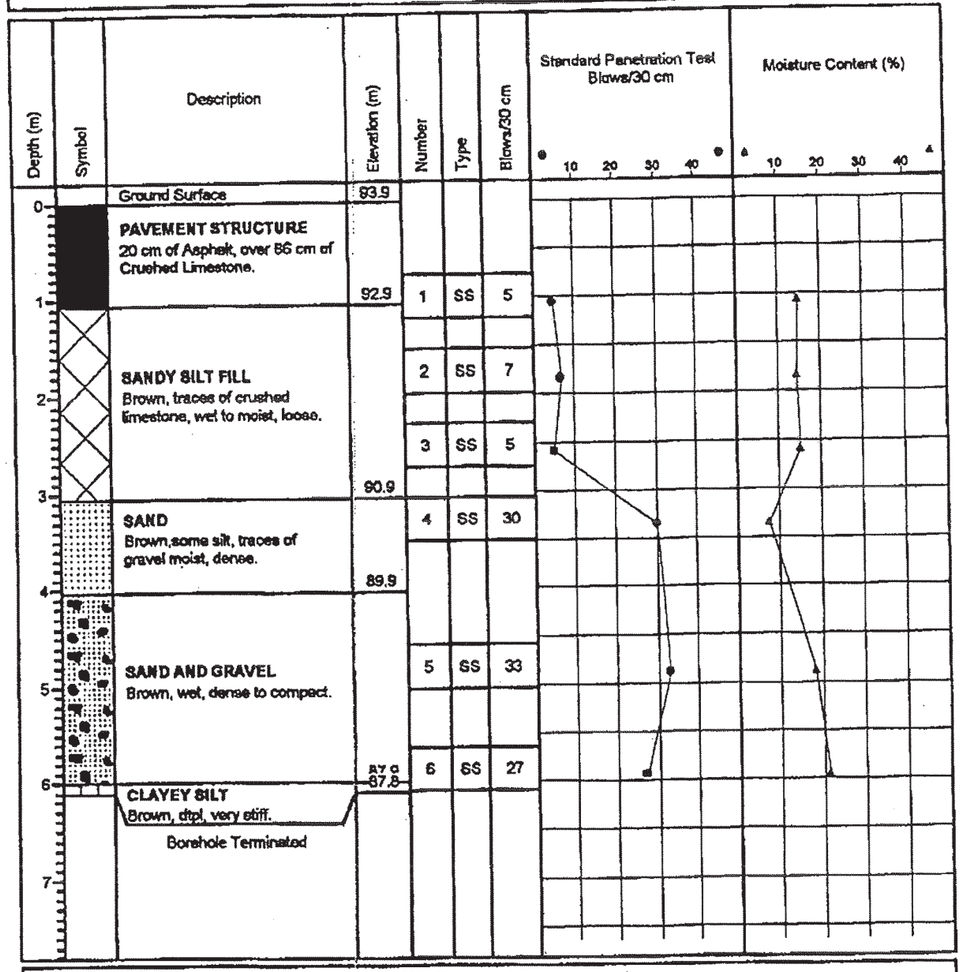
Project No: TB99002G

Project: Storm Sewer Construction

Client: Reg. Mun. of Hamilton-Wentworth

Location: King & Walnut St., Hamilton

Prepared By: M. Leitch



Drilled by: Elite Drilling

Drill Method: Solid Stem Augers

Upon Completion: Caved and wet at 4.4 m.

AGRA Earth and Environmental
505 Woodward Avenue
Hamilton, Ontario
L8H 6N6

Hole Size: 150 mm

Datum: Geodetic

Drill Date: 99 02 04

Terraprobe

LOG OF BOREHOLE 3

PROJECT No: 7-02-0137-2
CLIENT: City of Hamilton
LOCATION: Walnut St. Hamilton, Ontario

BORING DATE: November 26, 2002
ELEVATION DATUM: Geodetic
SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD	DEPTH SCALE IN METRES	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (20 40 60 80)	WATER CONTENT (%) (P, x, L; 10 20 30)	INSTALLATION INFORMATION
CME 55 TRUCKMOUNT	0	GROUND SURFACE		94.87						
		125mm Asphalt		0.0						
		CONCRETE		0.13						
		(FILL) Granular Base/Subbase		0.33						
		Firm, reddish brown; CLAYEY SILT		0.48						
	1			93.87	1	SS	8	o	o	
				1.00						
	2	Loose to compact, reddish brown; SANDY SILT, with seams and layers of fine sand			2	SS	9	o	o	
					3	SS	16	o	o	
	3				4	SS	21	o	o	
		END OF BOREHOLE		91.36 3.51						
	4									
	5									
	6									
	7									
	8									
	9									

NOTES:
Borehole dry upon completion of drilling.

SHEET 1 OF 1

A. CUMMINGS
7-02-0137-2-3.DWG

LOG OF BOREHOLE 1

Trow

Auger Sample
SPT(N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Natural Moisture
Plastic and Liquid Limit
Penetrometer

Project: Geotechnical Investigation
Proposed Watermain Construction
King Street East (Mary Street to Wellington Street)
Hamilton, Ontario

Dwg. No: 3
Project No: H0 4362-A/G
Ground Elevation : m

Borehole location and datum see Drawing No. 2

Water Level	Elev. Scale (m)	Soil Description	Depth Scale m	Depth Scale ft	N Value	N Value / Shear Strength kPa (20 40 60 80; 100; 200)	Natural Moisture Content % Dry Weight (10 20 30)	Sample	Unit Weight (Kn/m³)
	93.70	Asphaltic Concrete - 200 mm thick							
		FILL: Sand and gravel, some slag, grey, damp	0.5	2			X		
	92.9	- silty sand, reddish brown, trace of gravel, occasional concrete fragments, moist	1	4	40	o	X		
	92.3	SILTY SAND: Reddish brown, trace of clay and gravel, moist, loose to dense	1.5	6	9	o	X		
			2						
			2.5	8	31	o	X		
			3	10					
		- becoming brown from 3.3 to 3.5m depth.			24	o	X		
	90.2	BOREHOLE TERMINATED	3.5	12					
			4	14					
			4.5	16					
			5						
			6.5	18					

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS.

1. Borehole advanced by solid stem augers to a termination depth of 3.5 m on March 16, 1998 by Landtest Drilling Ltd.
2. Upon completion of drilling, no cave, no free water.
3. Borehole backfilled and patched upon completion of drilling.

LOG OF BOREHOLE 2

Trow

Auger Sample
SPT(N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test + S
Natural Moisture X
Plastic and Liquid Limit
Penetrometer

Project: Geotechnical Investigation
Proposed Watermain Construction
King Street East (Mary Street to Wellington Street)
Hamilton, Ontario

Dwg. No: 4
Project No: H0 4362-A/G
Ground Elevation : m

Borehole location and datum see Drawing No. 2

Water Level	Elev. Scale (m)	Soil Description	Depth Scale m	Depth Scale ft	N Value	Sample	Unit Weight (Kn/m³)
	92.53	Asphaltic Concrete - 150 mm thick					
		FILL: Sand and gravel, some slag, grey, moist	0.5	2	22		
	91.7	SILTY SAND: Reddish brown, trace of clay and gravel, moist, compact to dense	1	4	35		
			1.5	6	24		
			2				
			2.5	8	18		
		- becoming brown from 3.2 to 3.5m depth	3	10	35		
	89.0	BOREHOLE TERMINATED	3.5	12			
			4	14			
			4.5	16			
			5				
			6.5	18			

N Value: 20 40 60 80 — Shear Strength 100 kPa 200
Natural Moisture Content % Dry Weight: 10 20 30

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS.

1. Borehole advanced by solid stem augers to a termination depth of 3.5 m on March 16, 1998 by Landtest Drilling Ltd.
2. Upon completion of drilling, no cave, no free water.
3. Borehole backfilled and patched upon completion of drilling.

LOG OF BOREHOLE 3

Trow

Auger Sample
SPT(N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test + S
Natural Moisture X
Plastic and Liquid Limit
Penetrometer

Project: Geotechnical Investigation
Proposed Watermain Construction
King Street East (Mary Street to Wellington Street)
Hamilton, Ontario

Dwg. No: 5
Project No: H0 4362-A/G
Ground Elevation : m

Borehole location and datum see Drawing No. 2

Water Level	Elev. Scale (m)	Soil Description	Depth Scale m	Depth Scale ft	N Value	Sample	Unit Weight (Kn/m³)
	91.67	Asphaltic Concrete - 200mm thick					
		FILL: Sand and gravel, some slag, brown, damp	0.5	2	20		
	90.8	SILTY SAND: Reddish Brown, trace of clay and gravel, moist, compact to dense	1	4	12		
		- with trace rootlets from 1.5 to 2.0m depth	1.5	6	14		
			2				
			2.5	8	12		
			3	10	35		
	88.2	- brown cemented sand seams from 3.4 to 3.5 m depth	3.5	12			
		BOREHOLE TERMINATED	4	14			
			4.5	16			
			5				
			6.5	18			

N Value: 20 40 60 80 — Shear Strength 100 kPa 200
Natural Moisture Content % Dry Weight: 10 20 30

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS.

1. Borehole advanced by solid stem augers to a termination depth of 3.5 m on March 16, 1998 by Landtest Drilling Ltd.
2. Upon completion of drilling, no caving, no free water.
3. Standpipe monitoring well installed to a 3.0 m depth (slotted from 0.3 to 3.0 m depth), March 25, 1995 - Water Level: Dry.
4. Borehole backfilled, sealed and patched upon completion of drilling.

RECORD OF BOREHOLE 7

PROJECT: 951-6031 | SHEET 1 OF 1

LOCATION: SEE PLAN FIGURE 1 | BORING DATE: 06/05/95 | DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm | PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (netV - +, rem.V - ⊕) (Q - ●, U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT, PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		91.37							
0	CME 75 TRUCKMOUNTED DRILLING 146mm SOLID STEM AUGERS	ASPHALT 91.27 CONCRETE 91.09 SAND and GRAVEL : (FILL) 90.99		0.38	1	SS	14				
1		Loose, brown, SILTY SAND to SANDY SILT; occasional gravel. (FILL)			2	SS	4				
					3	SS	15				
2				89.22							
		Very loose, brown, fine to medium, SAND; with silt layers.		2.15	4	SS	2				GROUND WATER ENCOUNTERED DURING DRILLING AT ELEVN 87.72m
3				88.32							
		Compact, brown, fine to medium, SAND.		3.05	5	SS	12				
4					6	SS	4				06/05/95
		Loose, brown, SILT.		87.20							
		END OF BOREHOLE		87.10 4.27							
5											
6											
7											
8											
9											

DATA INPUT: B.MCLEAN 06/06/95

DEPTH SCALE 1 to 50

LOGGED: K.G.

CHECKED: J.G.M.

Golder Associates

Project No: SM 031428-G

Log of Borehole No. 6-1

Project: Proposed Road Reconstruction - Phase II

Location: Hamilton, Ontario

Borehole Location: Wellington St. N, N of King St. E : 14m N, 2m W of wood hydro pole #8396

Client: Sutton & Associates

Project Manager: Ian Shaw, B.Eng., E.I.T.

Soil-Mat

SUBSURFACE PROFILE: Depth (ft / m)	Symbol	Description	Elevation	SAMPLE: Type	Number	Blows/300mm	PP (kgf/cm2)	U.Wt.(kN/m3)	Recovery	Moisture Content w% (10 20 30 40) / Standard Penetration Test blows/300mm (20 40 60 80)
0 / 0		Ground Surface	91.29							
		Asphaltic Concrete Approximately 75mm	91.02							
2		***Portland Cement Concrete*** Approximately 200mm		SS	1	18				
4		***Granular Base*** Approximately 150mm	89.89	SS	2	10				
6 / 2		***Silty Sand Fill*** Brown, trace of fine gravel, moist, compact.		SS	3	17				
8		***Sand*** Brown, medium to fine grained, trace of to some silt, occasional thin layering, moist, compact.		SS	4	7				
10				SS	5	21				
12 / 4			87.29							
14		***Silty Clay*** Grey, trace fine gravel, moist, very stiff.								
16				SS	6	27			4.0-4.5	
18 / 6			86.09							
20		End of Borehole								
22		NOTES: 1. Borehole advanced using solid stem continuous flight auger equipment on October 23, 2003 to a depth of 5.2 metres. 2. No free groundwater present at completion. Borehole backfilled with auger cuttings and topped with portland cement concrete. 3. Soil samples will be discarded after three months unless otherwise directed by the client.								
24										
26 / 8										
28										

Drill Method: Solid Stem Auger

Drill Date: October 23, 2003

Hole Size: 150mm

SOIL-MAT ENGINEERS & CONSULTANTS LTD.
130 Lancing Drive, Hamilton, ON L8W 3A1
Phone: (905) 318-7440 Fax: (905) 318-7455
e-mail: info@soil-mat.on.ca

Datum: Geodetic

Checked by: IS

Sheet: 1 of 1

this margin reserved for binding

PETO ASSOCIATES LTD.

RECORD OF BOREHOLE NO. 2

CONSULTING SOIL ENGINEERS

JOB NO. 69F66 | JOB NAME West Avenue Storm Sewer | TECHNICIAN BG

BORING DATE Mar. 18/69 | CLIENT Corporation of the City of Hamilton, c/o Proctor and Redfern Ltd. | ENGINEER JH

GROUND ELEV. 300.± | BOREHOLE TYPE Auger | TYPED BY JC

DEPTH ELEV.	SOIL PROFILE DESCRIPTION	LEGEND	SAMPLES NUMBER	TYPE	BLOWS/FOOT
	3" Black Pavement				
1'0"	PAVEMENT & CRUSHED STONE				
	FILL. Dark brown sandy silt fill moist		1	SS	4
6'2"	Loose		2	SS	8
	SILT/SAND. Brown interbedded sandy and silty sand, moist compact		3	SS	11
11'0"	SAND. Grey fine to medium sand, wet		4	SS	12
			5	SS	15
			6	SS	21
18'0"	Compact TILL. Grey clayey silt till		7	SS	21
			8	SS	18
	Wet		9	SS	15
			10	TW	Push
36'6"	Compact		11	SS	11
	Terminated at 36'6"				

DYNAMIC CONE PENETRATION BLOWS/FOOT
STANDARD PENETRATION TEST BLOWS/FOOT
10 20 30 40 50
SHEAR STRENGTH C_u LB/SQ.FT.

LIQUID LIMIT ——— W_L
PLASTIC LIMIT ——— W_p
WATER CONTENT ——— W
W_p W W_L
WATER CONTENT % 10 20 30

REMARKS

SITEST ENGINEERING DATA SHEET FOR BOREHOLE 3 DRAWING 4

Project No: 8916
Project: Proposed Sewers
Location: Steven Street, Hamilton, Ontario
Hole Location: See Drawing No: 1
Date Drilled: July 6, 1989
Drilled By: Solid Stem Auger (125 mm O.D.)
Datum: Geodetic Borehole Elevation 88.598 M

FIELD TESTS
50 mm O.D. Split Tube
50 mm I.D. Shelby Tube
Auger Sample
Core Sample
Cone Test ....
Vane Test +
Water Level

LABORATORY TESTS
Natural Moisture X
Plastic & Liquid Limits
Lab Vane Test
Torvane
Penetrometer 0
Unconfined Compression

SYMBOL	DESCRIPTION/CLASSIFICATION	ELEV M	DEPTH M	PENETRATION RESISTANCE 'N' blows/300mm 10 20 30 40 50 60 70	WATER CONTENT % 10 20 30	SAMPLE Type No:	REC %
	ASPHALT	88.51	0.09				
	CONCRETE	88.42	0.18				
	SILTY SAND, trace of gravel, brown, loose to compact, moist, layered		1	6	X	1	100
			2				
		86.00	2.60				
	SILTY CLAY TILL, trace of embedded sand and gravel, grey, moist, very stiff		3	17	X	2	100
	sand and gravel decreasing with depth		4	22	X	3	100
	some large gravel		5				
	—	83.11	5.49				
	BOREHOLE TERMINATED		6				

NOTES:
1. Borehole was moist and open to 4.1 metres on completion.
2. Borehole was backfilled on completion of the fieldwork.

Log of Borehole 1

Project No. HAGE-0060494-A Drawing No. 4

Project: Geotechnical Investigation - Proposed Sewer and Watermain Construction Sheet No. 1 of 1

Location: Wentworth Street (King Street to Barton Street), Hamilton, Ontario

Date Drilled: April 29, 2001

Drill Type: Truck Mount

Datum:

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m
		ASPHALT: ~ 90 mm thick	88.33
		CONCRETE (possible slag): ~ 190 mm thick	88.24
		FILL: Silty sand, brown, fine grained, moist, compact	88.05
		-reddish brown from 0.6 to 1.2 m	
		SILTY SAND: Light brown to dark brown, oxidized stains, damp to moist, dense	85.93
		SILTY CLAY TILL: Grey, moist	84.93
		BOREHOLE TERMINATED	84.83

N Value: Shear Strength 20 40 60 80 MPa 0.1 0.2

Combustible Vapour Reading (ppm): 250 500 750

Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

DEPTH 0 1 2 3

SAMPLES

Natural Unit Weight kN/m³

Notes:

1. Borehole advanced by solid stem auger equipment to a termination depth of 3.5 m on April 29, 2001.

2. Upon completion of drilling, cave at 3.4 m depth, no water.

3. In hole methane reading using MSA explosimeter: 0% methane.

4. Upon completion of drilling, 19 mm (3/4 in.) diameter P.V.C. standpipe installed to 3.4 m depth, screened portion 2.1 to 3.4 m depth, bentonite seal 0.2 to 1.1 m depth and asphalt patch from 0 to 0.2 m depth.

LAGWGL02 BHLOGS.GPJ NEW.GDT 5/14/01

Trow Consulting Engineers Ltd.
428 Millen Road
Stoney Creek, Ontario, L8E 3N9
Telephone: 905-664-3300
Fax: 905-662-4144
E-Mail: hamilton@trow.com

Time	Water Level (m)	Depth to Cave (m)
April 29, 2001		3.4
May 7, 2001	3.30	

PETO MacCALLUM LTD.
CONSULTING GEOTECHNICAL ENGINEERS

LOG OF BOREHOLE No. 1

JOB NAME Proposed Sanitary Sewers - Vineland and Vicinity JOB No. 76 F 153

LOCATION Hamilton, Ontario BORING DATE July 9/76 ENGINEER T.R.

BORING METHOD 4½" Auger (soil) TECHNICIAN H.K.

DEPTH	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS FOOT N - VALUES
0'0"	GROUND ELEVATION: 278.0					
0'9"	2" ASPHALT 7" CRUSHED STONE					
	SILTY SAND: gravelly fill, reddish brown, compact, uniform, wet		275			
3'8"	SILTY CLAY (TILL): brown to grey brown, very stiff, W.P.L., some multicoloured silt pockets			1	SS	15
			270	2	SS	22
12'0"±	becoming grey, stiff, W.T.P.L.		265	3	SS	15
16'0"	Borehole terminated at 16'0"			4	SS	11

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION ▪ STANDARD PENETRATION TEST ●
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT W_L
PLASTIC LIMIT W_P
WATER CONTENT W
W_P W W_L
WATER CONTENT % 10 20 30

GROUNDWATER OBSERVATIONS AND REMARKS

#1 Borehole dry and open at completion

NOTES:

CHECKED BY: KK

PML/304

MEMBER OF THE ASSOCIATION OF CONSULTING ENGINEERS OF CANADA

PETO MacCALLUM LTD.
CONSULTING GEOTECHNICAL ENGINEERS

LOG OF BOREHOLE No. 4

JOB NAME Proposed Sanitary Sewers - Vineland and Vicinity — JOB No. 76 F 153
LOCATION Hamilton, Ontario — BORING DATE July 13/76 — ENGINEER T.R.
BORING METHOD 4½" flight auge. — TECHNICIAN T.R.

DEPTH	DESCRIPTION	LEGEND	ELEVATION	SAMPLES NUMBER	SAMPLES TYPE	BLOWS FOOT N - VALUES
	GROUND ELEVATION: 286.4					
0'8"	2" ASPHALT& 6" CONCRETE BASE					
	SILTY SAND: fill, probably roadbase material, loose to compact, saturated		285	1	SS	9
			280	2	SS	12
9'3"	SILTY CLAY (TILL): grey, stiff to very stiff in siltier zones, W.T.P.L., quite gritty		275	3	SS	13
				4	SS	16
16'6"	Borehole terminated at 16'6"		270	5	SS	12

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION x
STANDARD PENETRATION TEST •
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT W_L
PLASTIC LIMIT W_P
WATER CONTENT W
W_P W W_L
WATER CONTENT % 10 20 30

GROUNDWATER OBSERVATIONS AND REMARKS

After Sad cave 7'
Water 6'8"
(perched in sand fill)

Cave 14'6"
Water 11'6"
(mostly saturated sands)

Note: Borehole moved 60' west of anticipated location due to parked cars.

NOTES:

CHECKED BY: KK

PML/504 — MEMBER OF THE ASSOCIATION OF CONSULTING ENGINEERS OF CANADA

PETO MacCALLUM LTD.
CONSULTING GEOTECHNICAL ENGINEERS

LOG OF BOREHOLE No. 6

JOB NAME Proposed Sanitary Sewer - Vineland and Vicinity — JOB No. 76 F 153
LOCATION Hamilton, Ontario — BORING DATE July 13/76 — ENGINEER T.R.
BORING METHOD 4½" flight auger — TECHNICIAN T.R.

DEPTH	DESCRIPTION	LEGEND	ELEVATION	SAMPLES NUMBER	SAMPLES TYPE	BLOWS FOOT N - VALUES
0'0"	GROUND ELEVATION: 283.2					
0'8"	2"ASPHALT 6" CONCRETE BASE					
2'0"	CRUSHED STONE:					
2'6"	SILTY SAND: fill					
	SILTY CLAY (TILL): brown to grey brown, very stiff, O.T.P.L., quite gritty, numerous multicoloured silt seams and pockets.		280	1	SS	22
				2	SS	28
10'7"			275			
	becoming grey, stiff, A.P.L. some silt pockets, shale fragments, gritty to depth.			3	SS	11
			270	4	SS	11
16'6"	Borehole terminated at 16'6"			5	SS	10
			265			

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION x
STANDARD PENETRATION TEST •
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT W_L
PLASTIC LIMIT W_P
WATER CONTENT W
W_P W W_L
WATER CONTENT % 10 20 30

GROUNDWATER OBSERVATIONS AND REMARKS

Upon completion hole open and dry.

Note: Borehole located 20' south of anticipated location due to overhead wires.

NOTES:

CHECKED BY: KK

PML/504 — MEMBER OF THE ASSOCIATION OF CONSULTING ENGINEERS OF CANADA

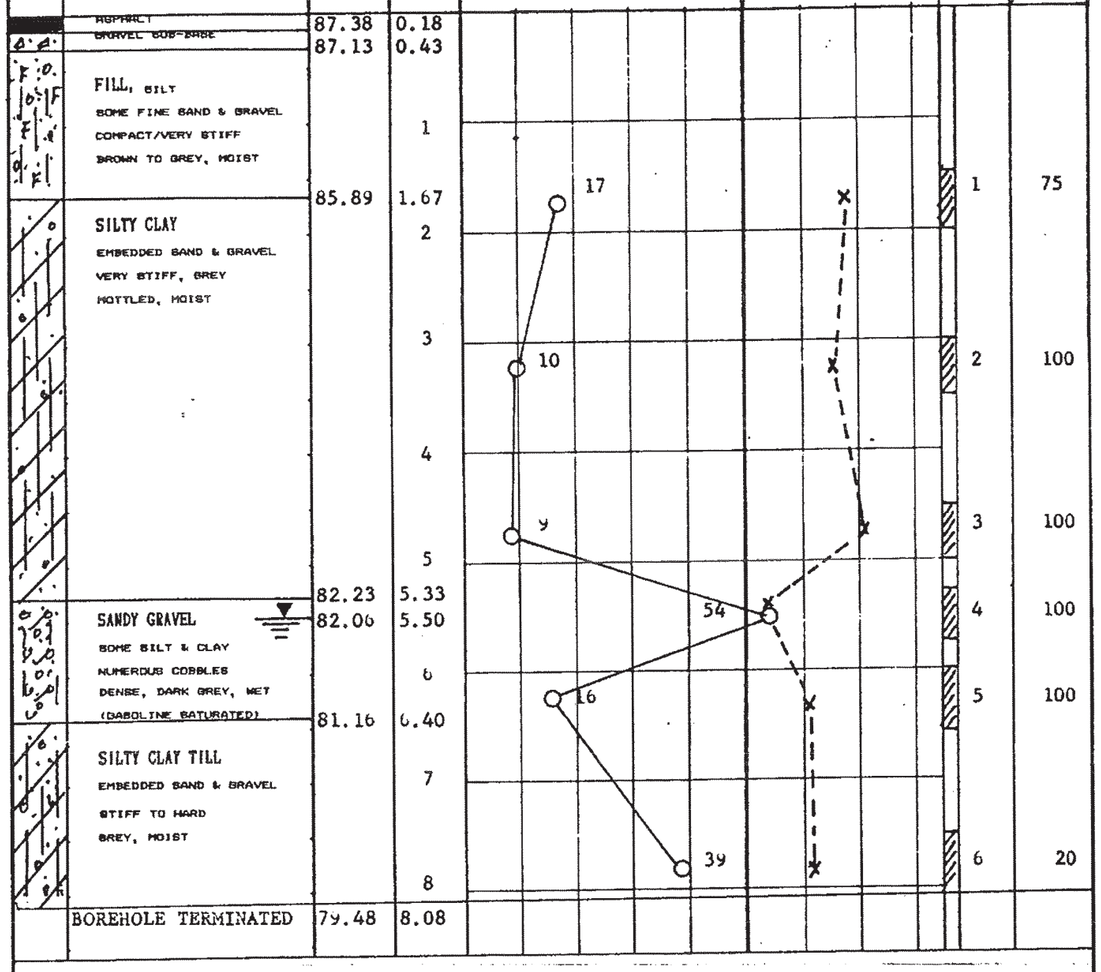
SITEST ENGINEERING — DATA SHEET FOR BOREHOLE 1 — DRAWING ____ (SHEET ____ OF ____)

Project No. 8903 (Your No. ____)
Project PROPOSED SEWERS
Location KING STREET @ GAGE
HAMILTON, ONTARIO
Hole Location SEE DRAWING NO: 1
Date Drilled APR 07, 1989 Hole VERTICAL
Drilled by SOLID STEM AUGER (165 MM O.D.)
Datum GEODETIC 87.564 METRES

Field: 3" O.D. Split Tube; 3", 3" I.D. Shelby Tube; Rotary Core Sample; Auger or Wash Sample; 3" Dia. Cone; Field Vane; Pressure Meter; Sampler Pushed (pressure); Water Table (definite, apparent); P( )
Laboratory: Natural Moisture; Plastic & Liquid Limit; Lab Vane Test; Torvane; Unconfined Compression; Undrained Triaxial at Overburden Pressure; Stress at Failure; Sensitivity

Symbol	Description / Classification	Elevation (metres)	Depth (metres)	Sample Type & Number	Unit weight / Recovery %
	ASPHALT	87.38	0.18		
	GRAVEL SUB-BASE	87.13	0.43		
	FILL, SILT SOME FINE SAND & GRAVEL COMPACT/VERY STIFF BROWN TO GREY, MOIST			1	75
	SILTY CLAY EMBEDDED SAND & GRAVEL VERY STIFF, GREY MOTTLED, MOIST	85.89	1.67	2	100
	SANDY GRAVEL SOME SILT & CLAY NUMEROUS COBBLES DENSE, DARK GREY, WET (DABOLINE SATURATED)	82.23 82.06	5.33 5.50	3 4	100 100
	SILTY CLAY TILL EMBEDDED SAND & GRAVEL STIFF TO HARD GREY, MOIST	81.16	6.40	5 6	100 20
	BOREHOLE TERMINATED	79.48	8.08		

Penetration Resistance, N, 350 ft.lbs. blows/ft. (10 20 30 40; Shear Strength 50 100 150 200 kPa)
Natural Water Content & Atterberg Limits (% dry weight) (10 20 30; Sensitivity)



Notes
1. WATER LEVEL OBSERVED AT 5.5 METRES 1/2 HOUR AFTER COMPLETION OF BOREHOLE.
2. BOREHOLE WAS BACKFILLED ON COMPLETION.
3. BOREHLOE WAS RELOCATED TO THE SOUTHEAST CORNER OF KING/GAGE.
4. ACTUAL ELEVATIONS ARE SLIGHTLY LOWER THAN SHOWN.

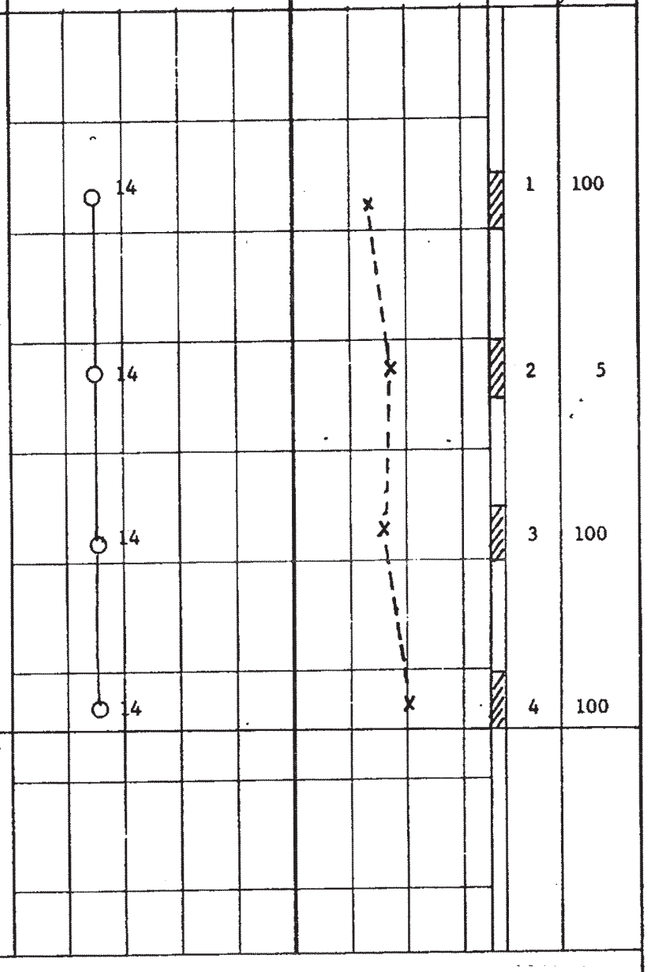
SITEST ENGINEERING — DATA SHEET FOR BOREHOLE 2 — DRAWING ____ (SHEET ____ OF ____)

Project No. 8903 (Your No. ____)
Project PROPOSED SEWERS
Location KING STREET @ EASTBEND
HAMILTON, ONTARIO
Hole Location SEE DRAWING NO: 1
Date Drilled APR 07, 1989 Hole VERTICAL
Drilled by SOLID STEM AUGER (165 MM O.D.)
Datum GEODETIC 89.432 METRES

Field: 3" O.D. Split Tube; 3", 3" I.D. Shelby Tube; Rotary Core Sample; Auger or Wash Sample; 3" Dia. Cone; Field Vane; Pressure Meter; Sampler Pushed (pressure); Water Table (definite, apparent); P( )
Laboratory: Natural Moisture; Plastic & Liquid Limit; Lab Vane Test; Torvane; Unconfined Compression; Undrained Triaxial at Overburden Pressure; Stress at Failure; Sensitivity

Symbol	Description / Classification	Elevation (metres)	Depth (metres)	Sample Type & Number	Unit weight / Recovery %
	ASPHALT	89.28	0.15		
	CONCRETE	89.08	0.35		
	SILT SOME SAND AND CLAY MOTTLED BROWN/GREY MULTI-COLOURED, REDDISH BROWN COMPACT, MOIST			1	100
	SILTY CLAY TILL EMBEDDED SAND & GRAVEL THIN WET SILT SEAMS STIFF, GREY, MOIST	86.23	3.20	2 3 4	5 100 100
	BOREHOLE TERMINATED	82.88	6.55		

Penetration Resistance, N, 350 ft.lbs. blows/ft. (10 20 30 40; Shear Strength 50 100 150 200 kPa)
Natural Water Content & Atterberg Limits (% dry weight) (10 20 30; Sensitivity)



Notes
1. BOREHOLE WAS MOIST AND OPEN TO 6.0 METRES ON COMPLETION OF BOREHOLE.
2. BOREHOLE WAS BACKFILLED ON COMPLETION.
3. BOREHLOE WAS RELOCATED TO THE SOUTHWEST CORNER OF KING/EASTBEND.
4. ACTUAL ELEVATIONS ARE SLIGHTLY LOWER THAN SHOWN.

SITEST ENGINEERING DATA SHEET FOR BOREHOLE 3 DRAWING ____ (SHEET ____ OF ____)

Project No. 8903 (Your No. ____)
Project PROPOSED SEWERS
Location KING STREET @ GLENDALE
HAMILTON, ONTARIO
Hole Location SEE DRAWING NO: 1
Date Drilled APR 07, 1989 Hole VERTICAL
Drilled by SOLID STEM AUGER (165 MM O.D.)
Datum GEODETIC 90.078 METRES

Field
3" O.D. Split Tube
3", 3" I.D. Shelby Tube
Rotary Core Sample
Auger or Wash Sample
3" Dia. Cone
Field Vane
Pressure Meter
Sampler Pushed (pressure) P( )
Water Table (date/hrs. elapsed)

Laboratory
Natural Moisture
Plastic & Liquid Limit
Lab Vane Test
Torvane
Unconfined Compression
Undrained Triaxial at Overburden Pressure
Direct or Fixture
Sensitivity

Symbol	Description / Classification	Elevation (metres)	Depth (metres)	Penetration Resistance, N, 350 ft lbs blows/ft. (10 20 30 40) Shear Strength (kPa) 50 100 150 200	Natural Water Content & Atterberg Limits (% dry weight) 10 20 30 Sensitivity	Sample Type & Number	Unit weight / Recovery %
	ASPHALT	89.98	0.10				
	CONCRETE	89.83	0.25				
	SILTY CLAY MOTTLED BROWN/GREY STIFF, MOIST		1	12		1	100
		88.68	1.40				
	SILTY CLAY TILL EMBEDDED SAND & GRAVEL THIN WET SILT SEAMS BROWN GREY		2	26		2	75
			3	15		3	100
			4				
	GRAVELLY CLAY	85.13	4.95	15		4	100
	BOREHOLE TERMINATED	85.05	5.03				

Notes
1. BOREHOLE WAS MOIST AND OPEN TO 4.5 METRES ON COMPLETION OF BOREHOLE.
2. BOREHOLE WAS BACKFILLED ON COMPLETION.
3. BOREHLOE WAS RELOCATED TO THE SOUTHWEST CORNER OF KING/GLENDALE.
4. ACTUAL ELEVATIONS ARE SLIGHTLY LOWER THAN SHOWN

MAIN STREET EAST

APPENDIX B

RECORD OF BOREHOLE SHEETS

MAIN STREET WEST

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 1

PROJECT Watermain, Sewer and Road Reconstruction — *OUR PROJECT NO.* 02HF051
LOCATION London St. N. (Dunsmure Rd. to Roxborough Ave.) — *BORING DATE* 2002 07 20 — *ENGINEER* P. Cullen
BORING METHOD Continuous Flight Solid Stem Augers — *TECHNICIAN* M. Rapsey

DEPTH in METRES	DESCRIPTION (GROUND ELEVATION 90.60)	LEGEND	ELEVATION	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/0.3m N - VALUES	GROUND WATER OBSERVATIONS AND REMARKS
0.25	PAVEMENT STRUCTURE: 130 mm asphaltic concrete over 110 mm granular "A" crushed limestone		90	1	SS	5	
1.5 1.65	SILT: Loose, brown, fine sandy silt, damp		89	2	SS	24	
2.40	CLAY TILL: Very stiff, brown, silty clay, some sand and gravel, low to medium plastic, D.T.P.L. becoming grey, A.P.L.		88				
3.0				3	SS	17	
3.60	BOREHOLE TERMINATED AT 3.60 m		87				Upon completion of augering, no water, no cave

SHEAR STRENGTH C_u kPa (50 100 150 200) ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3M (20 40 60 80)
LIQUID LIMIT W_L — PLASTIC LIMIT W_P — WATER CONTENT W
WATER CONTENT % (10 20 30)

NOTES

CHECKED BY

BHLOG WITH PML LOGO 02HF051D.GPJ PETOMAC.GDT 2002 06 12

Terraprobe

PROJECT No: 7-03-0122-6
CLIENT: The City of Hamilton
LOCATION: Edgemont Street

LOG OF BOREHOLE 1

BORING DATE: September 24, 2003
ELEVATION DATUM: Geodetic
SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD	DEPTH SCALE IN METRES	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUE
CME 75 TRUCKMOUNT	0	GROUND SURFACE		90.68			
		100mm Asphalt		0.0	1	AS	
		150mm Concrete					
		(FILL) Granular Road Base		0.30	2	SS	11
	1	(FILL)			3	SS	6
		Firm, brown and grey; CLAYEY SILT to silty clay, trace topsoil, some sand and gravel with pieces of shale			4	SS	4
	2			88.08	5	SS	12
		Stiff to very stiff, brown and grey; SILTY CLAY, trace sand and ocassional gravel (TILL)		2.60			
	3			87.17	6	SS	16
		END OF BOREHOLE		3.51			
	4						
	5						
	6						
	7						
	8						
	9						

PENETRATION RESISTANCE PLOT (20 40 60 80) SHEAR STRENGTH kPa (20 40 60 80)
WATER CONTENT (%) (W_P — W — W_L) (10 20 30)
INSTALLATION INFORMATION

NOTES:
Borehole dry upon completion of drilling.

SHEET 1 OF 1

A. CUMMINGS
7-03-0122-6-1.DWG

SITEST ENGINEERING DATA SHEET FOR BOREHOLE 1 DRAWING 2 (SHEET OF)

Project No. 8732 (Your No.)
Project PARK ROW SEWERS
Location PARK ROW STREET
HAMILTON, ONTARIO
Hole Location SEE DRAWING NO: 1
Date Drilled JULY 13, 1987 Hole VERTICAL
Drilled by HOLLOW STEM AUGER 80 mm I.D.
Datum GEODETIC

Field: 3" O.D Split Tube; 3", 2" I.D Shelby Tube; Rotary Core Sample; Auger or Wash Sample; 2" Dia. Cone; Field Vane; Pressure Meter; Sampler Pushed (pressure) P( ); Water Table (definite, apparent)

Laboratory: Natural Moisture; Plastic & Liquid Limit; Lab Vane Test; Torvane; Unconfined Compression; Undrained Triaxial at Overburden Pressure; Strain at Failure; Sensitivity

Symbol	Description / Classification	Elevation metres	Depth metres	Penetration Resistance, N, 350 ft lbs blows/ft. 10 20 30 40 — Shear Strength	Natural Water Content & Atterberg Limits (% dry weight) 10 20 30 — Sensitivity	Sample Type & Number	Unit weight / Recovery %
	ASPHALT		0.10				
	CONCRETE		0.25				
	SILTY CLAY TILL embedded sand and gravel occasional cobbles brownish grey very stiff to hard		1	20		1	90
	occasional red shale inclusions		2	33		2	100
	grey @ 1.8 m		3				
			4	23		3	100
				22		4	100
	BOREHOLE TERMINATED		5.03				

Notes 1. Borehole was moist and open to 5 metres on completion.
2. Borehole was backfilled on completion of the fieldwork.

Borehole Log

Trow Ltd

Auger Sample; SPT (N) Value; Dynamic Cone Test; Shelby Tube; Field Vane Test +s; Lab Vane Test
Natural Moisture; Plastic and Liquid Limit; Undrained Triaxial at Overburden Pressure % Strain at Failure; Penetrometer

Project Sewer Construction Dwg. No. 2
Wexford and Monterey Avenues Borehole No. 1
Hamilton, Ontario Project No H4462-G
Hole location and datum see drawing No. 1

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH m
	F	90 mm ASPHALT 460 mm GRANULAR BASE CRUSHER-RUN LIMESTONE FILL-silty clay,wet,firm	92.8 (304.5)	0
		SILTY CLAY-brownish grey,with traces of sand and fine gravel, very stiff	90.8 (297.9)	2
		SILTY CLAY-grey,moist, firm	88.8 (291.4)	4
		TERMINATED	87.78 (288.0)	5

N Value (ASTM) D1586-CSA A119.1: 20 40 60 80 — Shear Strength MPa

Natural Moisture Content and Atterberg Limits % Dry Weight: 10 20 30

Natural Unit Weight kN/m³ (pcf): 20.3 (128.8); 20.0 (127.1)

NOTES:
1. Borehole put down uncased with continuous flight auger equipment on September 28, 1982.
2. Water level at 1 m depth on completion.

TL10fr0

BOREHOLE LOG

PROJECT No. H2397 BOREHOLE No. 1 DRAWING No. 2

PROJECT Proposed Sewer Installation
LOCATION 3 Intersections
Hamilton, Ontario
HOLE LOCATION AND DATUM SEE DRAWING No. 1

AUGER SAMPLE
2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
2" DIA. CONE
PUSHED
VANE TEST AND SENSITIVITY (S)
NATURAL MOISTURE
PLASTIC AND LIQUID LIMIT
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
% STRAIN AT FAILURE

SOIL DESCRIPTION	ELEV. FEET	DEPTH FT.
2" ASPHALT	305.4	0
7" CONCRETE	304.7	
SAND: fine to med., silty, occ. gravel sizes, red-brown to brown, wet to moist, (compact)	299.9	5
SILTY CLAY TILL: sand and gravel sizes, horizontally layered, some silt pockets, grey, moist to very moist, (very stiff)		10
		15
		20
		25
		30
		35
		40
		45
		50
TERMINATED	283.9	

PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80
SHEAR STRENGTH K.S.F.
NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT 10 20 30
NATURAL UNIT WEIGHT P.C.F.

NOTES:

1 Borehole advanced uncased by continuous flight auger equipment to termination at 21½ feet depth on Sept.7/86 by S.O.I.L.

2. Water Level Records:

ELAPSED TIME	DEPTH TO W.L.(ft)	HOLE OPEN TO (ft)
on completion	dry	19.5

William Trow Associates (Hamilton) Ltd.

BORING LOG

Warnock Hersey

PROJECT THE REGIONAL MUNICIPALITY OF ~~HAMILTON-WENTWORTH~~
PROPOSED SEWERS, GROUP 3
PARKDALE AVE.S., AT QUEENSTON RD.,
CONTRACT NO. 050319-C700-435600 ~~HAMILTON~~
DATUM GEODETIC

BORING BH 1-5
PAGE 1 OF 1
BORING DATE None
CASING H.S.A.

SAMPLE CONDITION: DISTURBED, GOOD, LOST
SAMPLE TYPES: SS SPLIT SPOON; ST THIN WALLED OPEN (SHELBY); PS PISTON SAMPLER; WS WASH SAMPLE; RC ROCK CORE
ABBREVIATIONS: GS GRAIN SIZE ANALYSIS; γ WET UNIT WEIGHT - kN/m³; C CONSOLIDATION; K PERMEABILITY - cm/s; DS DIRECT SHEAR; Q TRIAXIAL QUICK

DEPTH m	ELEVATION - m DEPTH	DESCRIPTION	SYMBOL	WATER LEVEL	OTHER TESTS	CONDITION	TYPE AND NUMBER	RECOVERY %	STANDARD PENETRATION - N BLOWS/0.3m
	99.24	GROUND SURFACE ASPHALT 90							
		CONCRETE 150 SAND AND GRAVEL 370							
1	0.61	VERY STIFF TO HARD BROWN TO GREY BROWN SILTY CLAY TRACE SAND AND GRAVEL					SS1	22	21
2							SS2	72	71
3	96.61				SO_4		SS3	83	75
4	3.23	HARD RED BROWN, AND GREY SILT LAYERED TRACE SAND AND GRAVEL							
5							AS4	-	175
6									
7	92.59 6.65	END OF BOREHOLE BOREHOLE DRY UPON COMPLETION					SS5	100	100 for 100 mm

TESTS: UNDRAINED SHEAR STRENGTH - kPa; Q TEST; FIELD VANE: INTACT, REMOULDED; FALL CONE: INTACT, REMOULDED; WATER CONTENT - W_n%; LIQUID LIMIT - W_L%; PLASTIC LIMIT - W_p%; DYNAMIC PENETRATION TEST - BLOWS/0.3 m; SAMPLES

QUEENSTON ROAD

LANDTEK LIMITED

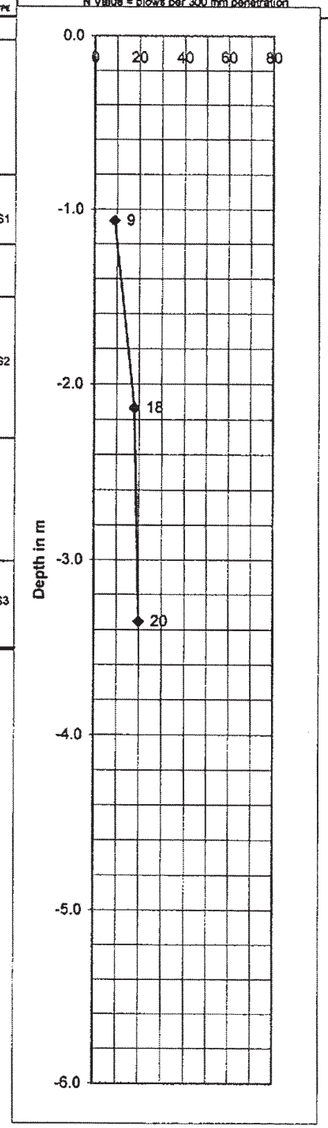
Consulting Engineers

LOG OF BOREHOLE NO. 2

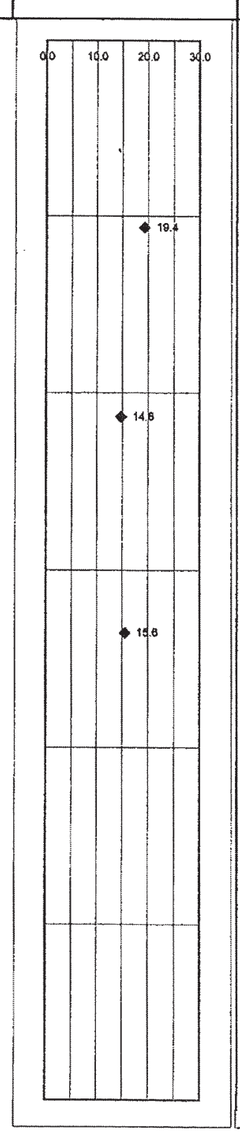
Project #	99075	Drilling Date	20-Jul-99	Drawing No. 3
Client:	Region of Hamilton-Wentworth	Drilling Method	[x] solid stem continuous flight	
Project:	Proposed Watermain Construction		[ ] hollow stem	
Location:	Bell Avenue, Hamilton		[ ] diamond drill	
Bench Mark:	Geodetic	Contract Drilling Co.	Geo-Environmental Drilling	

SOIL DESCRIPTION	WATER LEVEL	STRATA ELEV. / DEPTH	SAMPLE TYPE
		95.0	
75 mm of Asphalt over 125 mm Concrete 25 mm of Granular		0.0	
TILL (Halton Formation) silty clay, gravel sizes, brown, red shale fragments, grey fractures, red-brown, moist (Stiff to Very Stiff)			SS1
			SS2
			SS3
		91.5	
BOREHOLE TERMINATED		3.5	

STANDARD PENETRATION TEST
N Value = blows per 300 mm penetration



SOIL MOISTURE PROFILE



DATA & COMMENTS

Notes: 1. Borehole was dry and open to 3.0 m on completion.

MOUNTAINVIEW GEOTECHNICAL LTD.

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Lab Vane Test
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at Overburden Pressure
% Strain at Failure
Penetrometer

Project Proposed Storm Sewer — Dwg. No. 2
Queenston Road — Borehole No. 1
Hamilton — Project No S0145

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH m
		89mm Asphalt 165mm Concrete 203 mm Sand and Gravel	99.1	0
		Fill - silty clay, gravel sizes, cobbles & Boulders, Shale fragments, organic Pockets, Reddish-Brown, moist, (soft to firm)	98.6	1
		Shale - weathered changing to sound Shale at 4.9m, Siltstone layers, red, (hard)	94.9	4
		End of Borehole	94.1	5
		Notes: 1) Borehole advanced on April 2/91 using continuous Flight Solid Auger Equipment 2) Borehole open to full depth and dry on completion.		6

N Value (ASTM) D1586-CSA A119.1)
20 40 60 80
Shear Strength MPa

Natural Moisture Content and Atterberg Limits % Dry Weight
10 20 30

Natural Unit Weight kN/m³

MOUNTAINVIEW GEOTECHNICAL LTD.

Auger Sample ⊠ | Natural Moisture ×
SPT (N) Value ○ ○ ▨ | Plastic and Liquid Limit ⊢○
Dynamic Cone Test ——— | Undrained Triaxial at Overburden Pressure
Shelby Tube ● ● ■ | % Strain at Failure 0 15 5 10
Field Vane Test +s | Penetrometer ▲
Lab Vane Test t

Project: Proposed Storm Sewer — Dwg. No: 3
Queenston Road — Borehole No: 2
Hamilton — Project No: S0145

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH m	N Value (ASTM) D1586-CSA A119 1) 20 40 60 80 Shear Strength MPa	Natural Moisture Content and Atterberg Limits % Dry Weight 10 20 30	Natural Unit Weight kN/m³
		76mm Asphalt	99.5	0			
		230mm Concrete	99.2				
		Shale - weathered to clay consistency, gravel size, Siltstone cobbles, moist changing to sound Shale at 3.4m, Red, (hard)		1			
				2			
		End of Borehole	96.0	3			
				4			
		Notes: 1) Borehole advanced on April 2/91 using continuous Flight Solid Stem Auger Equipment 2) Borehole open to full depth and dry on completion.		5			
				6			
				7			
				8			
				9			
				10			

MOUNTAINVIEW GEOTECHNICAL LTD.

Auger Sample ⊠ | Natural Moisture ×
SPT (N) Value ○ ○ ▨ | Plastic and Liquid Limit ⊢○
Dynamic Cone Test ——— | Undrained Triaxial at Overburden Pressure
Shelby Tube ● ● ■ | % Strain at Failure 0 15 5 10
Field Vane Test +s | Penetrometer ▲
Lab Vane Test t

Project: Proposed Storm Sewer — Dwg. No: 4
Queenston Road — Borehole No: 3
Hamilton — Project No: S0145

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH m	N Value (ASTM) D1586-CSA A119 1) 20 40 60 80 Shear Strength MPa	Natural Moisture Content and Atterberg Limits % Dry Weight 10 20 30	Natural Unit Weight kN/m³
		100mm Asphalt	99.3	0			
		255mm Concrete					
		255mm Sand & Gravel	98.7				
		Silty Clay Till - gravel Sizes, Limestone boulders, Red Shale and siltstone fragments, moist, reddish-brown (hard)		1			
				2			
		Silt Till- occasional gravel sizes, red shale fragments, oxidized olive-brown, moist, (hard)	96.1	3			
		Shale - siltstone layers red, (hard)	95.4	4			
		End of Borehole	94.7				
				5			
		Notes: 1) Borehole advanced on April 2/91 using continuous Flight Solid Auger Equipment 2) Borehole open to full depth and dry on completion.		6			
				7			
				8			
				9			
				10			

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SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Redhill Creek Sewer | Job No.: 61182/1 | Borehole No.: 22

Client: City of Hamilton | Casing: BX | Boring Date: Jan. 10 - 11 , 1962

Elevation: 269.8 | Compiled By: J. F. G. | Checked By: S. B.

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

A.S. AUGER SAMPLE
C.S. CASING SAMPLE
S.S. 2" STANDARD SPLIT TUBE SAMPLE
S.L. SPLIT BARREL WITH LINERS
S.T. THIN-WALLED SHELBY TUBE SAMPLE
W.S. WASH SAMPLE
R.C. ROCK CORE

ABBREVIATIONS

V.T. IN SITU VANE SHEAR TEST
C. SOIL SHEAR STRENGTH LBS/SQ.FT.
W.L. WATER LEVEL IN CASING
W.T. GROUND WATER TABLE IN SOIL
W.T.P.L. WETTER THAN PLASTIC LIMIT
D.T.P.L. DRIER THAN PLASTIC LIMIT

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth / Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per Ft	Natural Moisture Content	WATER LEVELS & REMARKS
			GROUND SURFACE						
Silty fine sand - organic	Red brown		1'0"		1	C.S.			Very moist.
Clayey silt	Red brown				2	C.S.			Very moist.
Clayey silt - fine sand content	Red brown	Loose to Compact			3	S.S.	6	27.3	Very moist
River Gravel	Red brown		4'3" / 4'9"		4	C.S.			Saturated.
Highly weathered shale	Red brown	Extremely Dense	6'6" / 7'8"		5	S.S.	93	9.3	Moist.
Queenston shale	Red & blue		13'0"			R.C.			Rust pocket at 9 feet. Recovery 95% Odd broken seam
Thin gypsum seam			15'9"						
Queenston shale	Red & blue		18'0"			R.C.			Recovery 100%
Fissure at 22'10"			22'10"						
Queenston shale	Red & blue					R.C.			Recovery 100%
Soft seam or fissure at 25'6"			25'6"						
			28'2"						
			Boring Terminated at 28'2"						Note: Arrows denote soft seams.

WATER CONDITIONS.

Date	Time	Depth Casing	Depth Hole	Depth Water	Remarks
Jan. 10/62		0'	4'4"	3'7"	Hole should be at 6 ft. seepage from 4'3" to 4'9'
Jan. 11/62	10:30 a.m.	8'	18'	6'2"	Unable to lower W.L. below 6'2' by bailing.
	10:31 a.m.	8'	18'	3'7"	
	10:36 a.m.	8'	18'	3'7"	
	12:30 p.m.	8'	18'	3'7"	

RECORD OF BOREHOLE 304

SHEET 1 of 2

LOCATION SEE FIGURE 2 | BORING DATE AUGUST 29,1989 | DATUM GEODETIC

SAMPLER HAMMER, 63.5kg, DROP, 760mm | PENETRATION TEST HAMMER, 63.5kg, DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (M)	SAMPLES: NUMBER	TYPE	BLOWS/0.3M	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: SHEAR STRENGTH Cu, kPa (nat.V.- + O.- ● rem.V.- ⊕ U.- O)	HYDRAULIC CONDUCTIVITY, k, CM/SEC: WATER CONTENT, PERCENT (Wp, W, WL; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	CME-65 POWER AUGER BORING 165mm DIA. SOLID STEM AUGERS	GROUND SURFACE		92.00 / 0.00							Backfill
1		Granular road base. FILL.		91.20 / 0.80	1	50 DO	8			MH	
2		Firm to stiff, grey silty clay, trace to some sand and gravel, trace organics (wood and peat) FILL.			2	50 DO	6				
3					3	50 DO	8				
4					4	50 DO	10				
5					5	50 DO	12				
6		Red-brown sand, some gravel. FILL.		87.40 / 4.80	6	50 DO	8				
7		Firm to stiff, brown to grey clayey silt, some sand, trace gravel, some sandy silt pockets/layers, occ. organics. FILL. Topsoil layer (about 200mm thick) at 6m depth.		86.70 / 5.30	7	50 DO	7				
8					8	50 DO	18				
9					9	50 DO	19				
10		CONTINUED ON SHEET 2		82.00 / 10.00							

0 / 15 / 10 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE 1 : 50

Golder Associates

LOGGED RF

CHECKED ASP

RECORD OF BOREHOLE 304

SHEET 2 of 3

LOCATION SEE FIGURE 2
SAMPLER HAMMER, 63.5kg, DROP, 760mm
BORING DATE AUGUST 29,1989
PENETRATION TEST HAMMER, 63.5kg, DROP, 760mm
DATUM GEODETIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3M	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat.V.- + Q.- ●, rem.V.- ⊕ U.- ○)	HYDRAULIC CONDUCTIVITY, k, CM/SEC; WATER CONTENT, PERCENT (Wp, W, WL; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10		CONTINUED FROM SHEET 1		82.00							Backfill
		SEE DESCRIPTION ON PREVIOUS PAGE.		10.00							
				81.40							
		Possible boulder (inferred from auger resistance).									
11		Stiff, mottled brown and grey CLAYEY SILT with sand and gravel, occ. sand seams.		10.80	10	60 DO	13				
				80.10							
12		Red-brown completely weathered calcareous mudstone.		11.90	11	50 DO	82/.5				
				79.68							
				12.42							
13		FOR BEDROCK CORING INFORMATION REFER TO SHEET 3.									Water level in borehole open to 12.4m depth, at Elev. 81.3m on completion of overburden drilling.
14											
15	CME-55 POWER AUGER BORING 165mm DIA. HOLLOW STEM AUGERS										
16											
17											
18											
		END OF HOLE		73.38 18.84							
19											
20											

D
18 ⊕ 6 PERCENT AXIAL STRAIN AT FAILURE
19

DEPTH SCALE
1 : 50

Golder Associates

LOGGED RF
CHECKED ASP

RECORD OF BOREHOLE 304

SHEET 3 of 3

LOCATION SEE FIGURE 2
INCLINATION AZIMUTH
DRILLING DATE AUGUST 29,1989
DRILL RIG CME-55 POWER AUGER BORING
DRILLING CONTRACTOR NX CORING
DATUM GEODETIC

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	RUN No.	PENETRATION RATE (M/MIN)	% RETURN COLOUR FLUSH	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.3M	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY k, cm/sec	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
		FR-FRACTURE CL-CLEAVAGE SH-SHEAR VN-VEIN						F-FAULT J-JOINT P-POLISHED S-SLICKENSIDED					SM-SMOOTH R -ROUGH ST-STEPPED PL-PLANAR		FL-FLEXURED UE-UNEVEN W -WAVY C -CURVED	
10		FOR SOILS INFORMATION REFER TO SHEET 2		82.00												
				10.00												
11																
12	NQ RC	Red-brown completely weathered calcareous mudstone. (QUEENSTON SHALE)		80.10												
				11.90												
				79.58												
13	NQ RC			12.42	12	09	80%						BROKEN CORE SEAMS			Backfill
					13	.06	80%						BROKEN CORE SEAMS			
14													BROKEN CORE SEAMS			
15	DRILLING NQ RC	Red-brown, moderately to slightly weathered, fine grained, thinly bedded, calcareous mudstone. (QUEENSTON SHALE)			14	.05	30-60%						BROKEN CORE SEAMS			
16	ROTARY NQ RC				15								BROKEN CORE SEAMS			Bentonite Seal
17																Granular Filter
18	NQ RC				16	.04	30-60%						BROKEN CORE SEAMS			
				73.36									BROKEN CORE SEAMS			
		END OF HOLE		18.64												Water level in piezometer at Elev. 81.6m on Oct. 4, 1989.
19																
20																

DEPTH SCALE
1 : 50

Golder Associates

LOGGED RF
DATE AUG. 29,1989
CHECKED ASP

RECORD OF BOREHOLE 308

SHEET 1 of 2

LOCATION SEE FIGURE 2

BORING DATE SEPT. 5,1989

DATUM GEODETIC

SAMPLER HAMMER, 63.5kg, DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg, DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	SAMPLES: NUMBER	TYPE	BLOWS/0.3M	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat.V.- +Q.- ● rem.V.- ⊕ U.- ○)	HYDRAULIC CONDUCTIVITY, k, CM/SEC; WATER CONTENT, PERCENT (Wp W Wl, 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	CME-55 POWER AUGER BORING 165mm DIA. SOLID STEM AUGERS	GROUND SURFACE		92.09							
		Compact, grey sand and gravel (granular road base). FILL.		0.00							
1				90.92	1	50 DO	10				
				1.17							
2		Stiff, grey-brown silty clay, trace to some sand, trace gravel, occ. organics, topsoil seam at 2.5m depth. FILL.			2	50 DO	9			MH	
					3	50 DO	16				
3					4	50 DO	9				
4				88.09	5	50 DO	8				
				4.00							
5		Stiff to very stiff, red-brown clayey silt, some gravel, weathered shale/residual soil. FILL.			6	50 DO	9				
6					7	50 DO	22				
7				84.59							
				7.50							
8		Mixture of very stiff red-brown clayey silt, trace to some sand and gravel; and dense brown silty sand, trace clay; occ. organics, occ. asphalt fragments. FILL.			8	50 DO	30				
9					9	50 DO	18				
10		CONTINUED ON SHEET 2		82.09							
				10.00							

0 10 ⊕ 6 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE 1 : 50

Golder Associates

LOGGED RF

CHECKED ASP

RECORD OF BOREHOLE 308

SHEET 2 of 2

LOCATION SEE FIGURE 2

BORING DATE SEPT. 6,1989

DATUM GEODETIC

SAMPLER HAMMER, 63.5kg, DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg, DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (M)	SAMPLES: NUMBER	TYPE	BLOWS/0.3M	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat.V.- +Q.- ● rem.V.- ⊕ U.- ○)	HYDRAULIC CONDUCTIVITY, k, CM/SEC; WATER CONTENT, PERCENT (Wp W Wl, 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10	CME-55 POWER AUGER BORING 165mm DIA. SOLID STEM AUGERS	CONTINUED FROM SHEET 1		82.09							
		SEE DESCRIPTION ON SHEET 1		10.00							
				81.79							
		Loose, brown SAND AND GRAVEL.		10.30							
11				81.29	10	50 DO	48				
		Very stiff, mottled brown CLAYEY SILT, some sand, trace gravel.		10.80							
				80.69							
		Highly weathered, red-brown calcareous mudstone. (QUEENSTON SHALE)		11.40							
12				80.24							
		END OF HOLE		11.85							Water level in open borehole at Elev. 82.6m on completion of drilling.
13											
14											
15											
16											
17											
18											
19											
20											

0 10 ⊕ 6 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE 1 : 50

Golder Associates

LOGGED RF

CHECKED ASP

PetoMacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. Q5 & Q6

PROJECT NORTH-SOUTH SECTION OF FREEWAY PROJECT — OUR PROJECT 97HF098
LOCATION Glen Castle Drive to Barton Street, Hamilton, Ontario — BORING DATE March 31, 1998 — ENGINEER M. Anderson
BORING METHOD Continuous Flight Hollow Stem Augers — TECHNICIAN L. Watson

DEPTH in METERS	DESCRIPTION	LEGEND	ELEVATION	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/0.3m N-VALUES	SHEAR STRENGTH C_u / DYNAMIC CONE PENETRATION x / STANDARD PENETRATION TEST • BLOWS/0.3M (20 40 60 80)	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W — W_P W W_L WATER CONTENT % (10 20 30)	GROUNDWATER OBSERVATIONS AND REMARKS
	BOREHOLE Q5								
	GROUND ELEVATION 83.45								
0									
0.30	TOPSOIL : Dark brown sandy silt, trace of clay, low organic		83						
1.35	SILT : Soft reddish brown clayey silt, some sand and gravel, slightly plastic, W.T.P.L		82	1	SS	11	•	⊕	
1.5	becoming sandy, gravelly, wet, trace of decayed organics, numerous shale particles, mottled black and grey								
2.45			81						
2.60	SHALE : Weathered red shale								
3.0	BOREHOLE TERMINATED AT 2.60m		80						Upon completion of augering, no free water, no cave.
	BOREHOLE Q6								
	GROUND ELEVATION 82.03								
0									
0.30	TOPSOIL : Dark brown sandy silt, trace of clay, low organic								
0.90	SAND : Reddish brown silty sand, trace of clay, wet		81						
1.35	SILT : Layered grey and reddish brown sandy and clayey silts, wet								
1.5	BOREHOLE TERMINATED UPON REFUSAL TO AUGER AT 1.35m BEDROCK ASSUMED		80						Upon completion of augering, no free water, no cave.

NOTES:
1. Refer to Drawing 1d for location.

CHECKED BY:

PETO ASSOCIATES LTD. — CONSULTING SOIL ENGINEERS

RECORD OF BOREHOLE NO. 1

JOB NO. 70F154 — JOB NAME Watermain - Nash Road, Hamilton, Ontario — TECHNICIAN B.P.
BORING DATE Dec. 21/70 — CLIENT Corporation of the City of Hamilton — ENGINEER GDP/PK
GROUND ELEV. Not Recorded — BOREHOLE TYPE 4" Flight Auger — TYPED BY V.S.

DEPTH ELEV.	DESCRIPTION	LEGEND	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/FOOT	DYNAMIC CONE PENETRATION BLOWS/FOOT / STANDARD PENETRATION TEST BLOWS/FOOT / SHEAR STRENGTH C_u LB/SQ.FT.	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W — W_P W W_L WATER CONTENT % (10 20 30)	REMARKS
0'0"	FILL-Clayey, high in organic content, very moist, dark brown							
3'4"±	CLAYEY SILT TILL-Brown fine, moist, mainly fine gravel with occasional medium gravel							
14'0"	BH terminated at 14'0"							At completion BH open and dry 1 hr. later same

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e.m.peto associates ltd. — Consulting soil engineers

RECORD OF BOREHOLE NO. 5-B

JOB NO. 65329 | JOB NAME King Street West Relocation | TECHNICIAN JF
BORING DATE Jan.7/66 | CLIENT Corporation of the City of Hamilton | ENGINEER JH
GROUND ELEV. 325.86 | BOREHOLE TYPE Standard Rig | TYPED BY HF

DEPTH ELEV.	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS/FOOT
0'0"					
0'6"	TOPSOIL				
	CLAY, reddish brn. fine sandy clay V. Wet		1	SS	19
	COMPACT TO LOOSE		2	SS	6
7'0"					
	SAND, reddish brown clayey fine sand Saturated		3	SS	12
	COMPACT		4	SS	26
12'0"					
	SAND, reddish brn. silty clayey very fine sand		5	SS	36
			6	SS	36
	SATURATED				
	DENSE		7	SS	38
23'0"					
	SILT, brown very fine sandy silt Some sand and clay seams		8	SS	38
	SATURATED				
	DENSE		9	SS	33
31'6"					
	Hole terminated at 31'6"				

DYNAMIC CONE PENETRATION BLOWS/FOOT
STANDARD PENETRATION TEST BLOWS/FOOT ——
10 20 30 40 50
SHEAR STRENGTH C_u LB/SQ.FT.

LIQUID LIMIT ——— W_L
PLASTIC LIMIT ——— W_p
WATER CONTENT ——— W
W_p W W_L
WATER CONTENT %
10 15 20 25

18.9 33.4
17.0 17.2
16.9 29.4

REMARKS

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e.m.peto associates ltd. — Consulting soil engineers

RECORD OF BOREHOLE NO. 6-B

JOB NO. 65329 | JOB NAME King Street West Relocation | TECHNICIAN JF
BORING DATE Jan.10/66 | CLIENT Corporation of the City of Hamilton | ENGINEER JH
GROUND ELEV. 326.86 | BOREHOLE TYPE Standard Rig | TYPED BY HF

DEPTH ELEV.	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS/FOOT
0'0"					
0'6"	TOPSOIL				
	CLAY, reddish brn. sandy clay		1	SS	9
	V. WET TO MOIST		2	SS	9
			3	SS	31
	LOOSE TO DENSE				
10'0"					
	SAND, reddish brown clayey sand		4	SS	28
	Some pockets of grey and black silt		5	SS	55
15'0"					
	SILT, brown fine sandy silt with some fine sand seams		6	SS	32
	VERY WET				
			7	SS	31
	DENSE		8	SS	36
26'6"					
	CLAY, brown silty clay, DRY				
	V. STIFF		9	SS	66
31'6"					
	Hole terminated at 31'6"				

DYNAMIC CONE PENETRATION BLOWS/FOOT
STANDARD PENETRATION TEST BLOWS/FOOT — —
10 20 30 40 50
SHEAR STRENGTH C_u LB/SQ.FT.

LIQUID LIMIT ——— W_L
PLASTIC LIMIT ——— W_p
WATER CONTENT ——— W
W_p W W_L
WATER CONTENT %
10 15 20

14.2 20.0
18.7 39.2

REMARKS

Project No: SM 041546-G

Project: Watermain Replacement

Location: Main Street West, Hamilton

Client: Sutton & Associates

Log of Borehole No. 1

Borehole Location: See Drawing No. 1

Project Manager: Ian Shaw, B. Eng., EIT

Soil-Mat

SUBSURFACE PROFILE				SAMPLE						Moisture Content w% 10 20 30 40 / Standard Penetration Test • blows/300mm • 20 40 60 80
Depth (ft / m)	Symbol	Description	Elevation	Type	Number	Blows/300mm	PP (kgf/cm2)	U.Wt.(kN/m3)	Recovery	
0 / 0		Ground Surface	0.00							
		Asphaltic Concrete Approximately 40 millimetres	-0.24							
		Granular Base Approximately 200 millimetres								
2		***Sand and Gravel Fill*** Brown, medium to coarse grained, compact	-1.00	SS	1	22				
4		***Silty Sand/Sandy Silt*** Brown, layered/stratified, loose		SS	2	9				
6 / 2				SS	3	7				
			-2.30							
8		End of Borehole								
10		NOTES: 1. Borehole advanced using solid stem continuous flight auger equipment on February 11, 2004 to a depth of 2.3 metres. 2. No free groundwater present at the completion of drilling. Borehole backfilled with auger cuttings. 3. Soil samples will be discarded after three months unless otherwise directed by the client.								
12										
14 / 4										
16										
18										

Drill Method: Solid Stem Auger

Drill Date: Feb 11, 2004

Hole Size: 100mm

SOIL-MAT ENGINEERS & CONSULTANTS LTD.
130 Lancing Drive, Hamilton, ON L8W 3A1
Phone: (905) 318-7440 Fax: (905) 318-7455
e-mail: info@soil-mat.on.ca

Datum: Ground Surface

Checked by: IS

Sheet: 1 of 1

Project No: SM 041546-G

Project: Watermain Replacement

Location: Main Street West, Hamilton

Client: Sutton & Associates

Log of Borehole No. 4

Borehole Location: See Drawing No. 1

Project Manager: Ian Shaw, B. Eng., EIT

Soil-Mat

SUBSURFACE PROFILE				SAMPLE						Moisture Content w% 10 20 30 40 / Standard Penetration Test • blows/300mm • 20 40 60 80
Depth (ft / m)	Symbol	Description	Elevation	Type	Number	Blows/300mm	PP (kgf/cm2)	U.Wt.(kN/m3)	Recovery	
0 / 0		Ground Surface	0.00							
		Topsoil Approximately 50 millimetres	-0.30							
		Silty Sand and Gravel Fill Brown, medium to coarse grained, compact		SS	1	12				
2		***Silty Sand/Sandy Silt*** Brown, layered/stratified, occasional layers of medium sand, compact to loose		SS	2	17				
4										
6 / 2				AS	3					
			-2.30							
8		End of Borehole								
10		NOTES: 1. Borehole advanced using solid stem continuous flight auger equipment on February 11, 2004 to a depth of 2.3 metres. 2. No free groundwater present at the completion of drilling. Borehole backfilled with auger cuttings. 3. Soil samples will be discarded after three months unless otherwise directed by the client.								
12										
14 / 4										
16										
18										

Drill Method: Solid Stem Auger

Drill Date: Feb 11, 2004

Hole Size: 100mm

SOIL-MAT ENGINEERS & CONSULTANTS LTD.
130 Lancing Drive, Hamilton, ON L8W 3A1
Phone: (905) 318-7440 Fax: (905) 318-7455
e-mail: info@soil-mat.on.ca

Datum: Ground Surface

Checked by: IS

Sheet: 1 of 1

Project No: SM 041546-G

Project: Watermain Replacement

Location: Main Street West, Hamilton

Client: Sutton & Associates

Log of Borehole No. 5

Borehole Location: See Drawing No. 1

Project Manager: Ian Shaw, B. Eng., EIT

Soil-Mat

SUBSURFACE PROFILE				SAMPLE						Moisture Content w% 10 20 30 40 / Standard Penetration Test • blows/300mm • 20 40 60 80
Depth (ft / m)	Symbol	Description	Elevation	Type	Number	Blows/300mm	PP (kgf/cm2)	U.Wt.(kN/m3)	Recovery	
0 / 0		Ground Surface	0.00							
		Topsoil Approximately 50 millimetres								
2		***Silty Sand Fill*** Brown, traces of medium to coarse gravel, compact	-1.10	SS	1	17				
4		***Silty Sand/Sandy Silt*** Brown, layered/stratified, occasional layers of medium sand, compact to loose		SS	2	12				
6 / 2				SS	3	6				
8		End of Borehole	-2.30							
10		NOTES: 1. Borehole advanced using solid stem continuous flight auger equipment on February 11, 2004 to a depth of 2.3 metres. 2. No free groundwater present at the completion of drilling. Borehole backfilled with auger cuttings. 3. Soil samples will be discarded after three months unless otherwise directed by the client.								
12										
14 / 4										
16										
18										

Drill Method: Solid Stem Auger

Drill Date: Feb 11, 2004

Hole Size: 100mm

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Datum: Ground Surface

Checked by: IS

Sheet: 1 of 1

Project No: SM 041546-G

Project: Watermain Replacement

Location: Main Street West, Hamilton

Client: Sutton & Associates

Log of Borehole No. 7

Borehole Location: See Drawing No. 1

Project Manager: Ian Shaw, B. Eng., EIT

Soil-Mat

SUBSURFACE PROFILE				SAMPLE						Moisture Content w% 10 20 30 40 / Standard Penetration Test • blows/300mm • 20 40 60 80
Depth (ft / m)	Symbol	Description	Elevation	Type	Number	Blows/300mm	PP (kgf/cm2)	U.Wt.(kN/m3)	Recovery	
0 / 0		Ground Surface	0.00							
		Asphaltic Concrete Approximately 40 millimetres	-0.35							
		Granular Base Approximately 300 millimetres								
2		***Silty Sand and Gravel Fill*** Brown, medium to coarse grained, compact	-1.10	SS	1	21				
4		***Silty Sand/Sandy Silt*** Brown, layered/stratified, occasional layers of medium sand, compact to loose		SS	2	10				
6 / 2				SS	3	11				
8		End of Borehole	-2.30							
10		NOTES: 1. Borehole advanced using solid stem continuous flight auger equipment on February 11, 2004 to a depth of 2.3 metres. 2. No free groundwater present at the completion of drilling. Borehole backfilled with auger cuttings. 3. Soil samples will be discarded after three months unless otherwise directed by the client.								
12										
14 / 4										
16										
18										

Drill Method: Solid Stem Auger

Drill Date: Feb 11, 2004

Hole Size: 100mm

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Datum: Ground Surface

Checked by: IS

Sheet: 1 of 1

Project No: SM 041546-G

Project: Watermain Replacement

Location: Main Street West, Hamilton

Client: Sutton & Associates

Log of Borehole No. 8

Borehole Location: See Drawing No. 1

Project Manager: Ian Shaw, B. Eng., EIT

Soil-Mat

SUBSURFACE PROFILE				SAMPLE						Moisture Content w% 10 20 30 40 / Standard Penetration Test blows/300mm 20 40 60 80
Depth (ft / m)	Symbol	Description	Elevation	Type	Number	Blows/300mm	PP (kgf/cm2)	U.Wt.(kN/m3)	Recovery	
0 / 0		Ground Surface	0.00							
		Asphaltic Concrete Approximately 40 millimetres								
2		***Sand and Gravel Fill*** Brown, medium to coarse grained, compact	-1.10	SS	1	17				
4		***Silty Sand/Sandy Silt*** Brown, layered/stratified, occasional layers of medium sand, compact to loose		SS	2	16				
6 / 2			-2.30	SS	3	9				
8		End of Borehole								
10		NOTES: 1. Borehole advanced using solid stem continuous flight auger equipment on February 11, 2004 to a depth of 2.3 metres. 2. No free groundwater present at the completion of drilling. Borehole backfilled with auger cuttings. 3. Soil samples will be discarded after three months unless otherwise directed by the client.								
12 / 4										
14										
16										
18										

Drill Method: Solid Stem Auger

Drill Date: Feb 11, 2004

Hole Size: 100mm

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Datum: Ground Surface

Checked by: IS

Sheet: 1 of 1

LANDTEK LIMITED — LOG OF BOREHOLE NO. 1

Project No.:	05161	Drill Date:	December 2, 2005
Project:	GTR-1153; Watermain & Roads Reconstruction Projects	Drill Method:	[x] solid stem [ ] hollow stem [ ] vibratory
Location:	Traymore Avenue, Hamilton	Datum:	Geodetic

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	SPT "N" Value (Scale m)	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Surface		98.0			0 25 50 75 100	0 25 50			
100 mm Asphalt 150 mm Concrete 75 mm Granular		0.0			0.0				
FILL sandy silt, organics, brown to dark brown, moist to very moist (VERY LOOSE)		96.5	1	SS	-0.5 -1.0 -1.5 (1)	◆ 28.2			
SILT with fine sand, iron staining, brown, moist (LOOSE)		95.4	2	SS	-2.0 -2.5 (8)	◆ 22.9			
BOREHOLE TERMINATED		2.6			-3.0 -3.5 -4.0 -4.5 -5.0 -5.5 -6.0 -6.5 -7.0 -7.5 -8.0				

Notes: 1. On completion, borehole open to 2.6 m and dry.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

LANDTEK LIMITED
205 Nebo Road, Unit 3
Hamilton, Ontario, Canada, L8W 2E1
Ph: (905) 383-3733 Fax: (905) 383-8433
www.landteklimited.com

LANDTEK

LANDTEK LIMITED — LOG OF BOREHOLE NO. 2

Project No.:	05161	Drill Date:	December 2, 2005
Project:	GTR-1153; Watermain & Roads Reconstruction Projects	Drill Method:	[x] solid stem [ ] hollow stem [ ] vibratory
Location:	Traymore Avenue, Hamilton	Datum:	Geodetic

Material Description	Symbol	Elev. Depth	Samples No.	Samples Type	SPT "N" Value (Scale (m))	Soil Moisture (%)	GWL	Monitor Details	Test Data
Ground Surface		98.9							
50 mm Asphalt 100 mm Concrete 75 mm Granular		0.0							
SILT with traces of fine sand and clay, fractured, iron stains, brown, moist (VERY LOOSE TO COMPACT)			1	SS	3	24.9			
					15	22.6			
			2	SS					
		96.3							
BOREHOLE TERMINATED		2.6							

SPT "N" Value: 0 25 50 75 100 — Soil Moisture (%): 0 25 50

Scale (m): 0.0, -0.5, -1.0, -1.5, -2.0, -2.5, -3.0, -3.5, -4.0, -4.5, -5.0, -5.5, -6.0, -6.5, -7.0, -7.5, -8.0

Notes: 1. On completion, borehole open to 2.6 m and dry.

PP = pocket penetrometer TCV = total combustible vapour BRD = bulk relative density
PL = plastic limit LL = liquid limit PI = plasticity index FV = field vane LV = lab vane VS = vane sensitivity

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NATURAL

Wiwnock Hersey — BORING LOG

PROJECT: The Regional Municipality of Hamilton-Wentworth Proposed Storm Sewers Haddon Avenue, Hamilton, Ontario — BORING: RH1-B — PAGE: 1 OF 1
CONTRACT NO.: L03784-50319-C7-424600 — BORING DATE: 91.02.18
DATUM: Geodetic (Supplied) — CASING: None

SAMPLE CONDITION: DISTURBED, GOOD, LOST
SAMPLE TYPES: SS - SPLIT SPOON; ST - THIN WALLED OPEN (SHELBY); PS - PISTON SAMPLER; WS - WASH SAMPLE; RC - ROCK CORE
ABBREVIATIONS: GS - GRAIN SIZE ANALYSIS; γ - WET UNIT WEIGHT - kN/m³; C - CONSOLIDATION; k - PERMEABILITY - cm/s; DS - DIRECT SHEAR; Q - TRIAXIAL QUICK

DEPTH - m	ELEVATION - m / DEPTH - m	DESCRIPTION	SYMBOL	WATER LEVEL	UNDRAINED SHEAR STRENGTH - kPa (● TEST; FIELD VANE: ◇ INTACT, ◆ REMOULDED; FALL CONE: ▽ INTACT, ▼ REMOULDED; WATER CONTENT - W%; LIQUID LIMIT - W_L%; PLASTIC LIMIT - W_P%; DYNAMIC PENETRATION TEST - BLOWS/0.3 m)	OTHER TESTS	SAMPLES: CONDITION	TYPE AND NUMBER	RECOVERY %	STANDARD PENETRATION - N BLOWS/0.3m
	99.12	Road Surface								
	98.82	Asphalt 75mm								
	0.30	Concrete 225mm								
1		Loose to Compact Brown Sandy Silt Traces of Clay, Gravel, Organics Occasional Layer Brown Silty Sand						SS1	56	6
2								SS2	100	4
3								SS3	100	12
4								SS4	83	21
5								SS5	100	17
6								SS6	83	17
	93.34									
	5.79	END OF BOREHOLE								
		Borehole Dry at Completion								

Log of Borehole 1

Trow

Auger Sample ☒ | SPT (N) Value ○○■ | Dynamic Cone Test ——— | Shelby Tube ●●■ | Field Vane Test +s

Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at Overburden Pressure % Strain at Failure | Penetrometer

Project Proposed Storm Sewers — Dwg. No. 7

Region of Hamilton -Wentworth Main St. at Dow St.

Hamilton, Ontario. — Project No. H01760-G

Hole location and datum see drawing No. 1

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH
		250 mm asphalt over 200 mm granular material over FILL : clayey silt, brown, mottled light and dark brown in first 0.75 m, fine to medium gravel, occasional clay seams, below 1.5 m., moist, soft	99.55	0
		CLAYEY SILT: brown, occasional clay seams, silty fine sand layers below 3.0 m., less clay with depth, cohesive, trace fine gravel below 4.6 m., moist becoming wet below 3.8m soft	97.3	1
		TERMINATED	94.06	10

N Value (20 40 60 80) — Shear Strength 0.10 0.20 MPa

Natural Moisture Content and Atterberg Limits % Dry Weight (10 20 30)

Natural Unit Weight kN/m³

NOTES:-

(1) Borehole advanced uncased by solid stem augers to termination at 5.5 m depth, on January 15,1990, by Drilltech

(2) Water Level Record :-

Time Elapsed	Depth to W.L.,m
10 days	4.7

(3) Standpipe installed.

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS

Log of Borehole 2

Trow

Auger Sample ☒ | SPT (N) Value ○○■ | Dynamic Cone Test ——— | Shelby Tube ●●■ | Field Vane Test +s

Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at Overburden Pressure % Strain at Failure | Penetrometer

Project Proposed Storm Sewers — Dwg. No. 8

Region of Hamilton -Wentworth, Main St. at Newton Ave.

Hamilton, Ontario. — Project No. H01760-G

Hole location and datum see drawing No. 1

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH
		150 mm asphalt over 200 mm concrete over 150 mm granular material FILL : clayey silt, greyish brown to 0.75 m then mottled reddish brown and black, some fine gravel, silt seams,clay seams, cohesive, moist.	99.37	0
		CLAYEY SILT: brown, trace fine to medium gravel, increased clay between 3.0 to 3.8 m., layered silt and clay moist, becoming wet below 3.8 m., firm becoming soft below 3.8 m.	97.8	1
		TERMINATED	93.27	10

N Value (20 40 60 80) — Shear Strength 0.10 0.20 MPa

Natural Moisture Content and Atterberg Limits % Dry Weight (10 20 30)

Natural Unit Weight kN/m³

NOTES:-

(1) Borehole advanced uncased by solid stem augers to termination at 6.1 m depth, on January 15,1990, by Drilltech

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS

Log of Borehole 3

Trow

Auger Sample ☒ | SPT (N) Value ○○▨ | Dynamic Cone Test ——— | Shelby Tube ● ● ■ | Field Vane Test + s

Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at Overburden Pressure % Strain at Failure | Penetrometer

Project Proposed Storm Sewers — Dwg. No. 9

Region of Hamilton -Wentworth, Main St. at Paisley Ave.

Hamilton, Ontario. — Project No. H01760-G

Hole location and datum see drawing No. 1

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH
		150 mm asphalt over 150 mm concrete over FILL : clayey silt, mottled reddish brown and black, fine to medium gravel, clay seams, occasional silt layers below 0.75 m., moist.	99.32	0
		CLAYEY SILT: reddish brown becoming brown below 3.0 m., layered silt and clay, fine to medium gravel, moist, firm; becoming stiff with depth	" 97.8	1 2 3 4 5 6 7 8
		GRAVEL : brown, silty, some sand, medium grained, moist.	" 92.0	9
		TERMINATED	91.70	10

N Value: 20 40 60 80 — Shear Strength 0.10 0.20 MPa

Natural Moisture Content and Atterberg Limits % Dry Weight: 10 20 30

Natural Unit Weight kN/m³

NOTES:-

(1) Borehole advanced uncased by solid stem augers to termination at 7.6 m depth, on January 15,1990, by Drilltech

(2) Water Level Record :-

Time Elapsed	Depth to W.L.,m
14 days	7.15

(3) Chemical Analysis of ground water sample from borehole:
pH = 7.62
Sulphate,SO4,content= 105.25 mg/l

(4) Standpipe installed.

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS.

Log of Borehole 4

Trow

Auger Sample ☒ | SPT (N) Value ○○▨ | Dynamic Cone Test ——— | Shelby Tube ● ● ■ | Field Vane Test + s

Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at Overburden Pressure % Strain at Failure | Penetrometer

Project Proposed Storm Sewers — Dwg. No. 10

Region of Hamilton -Wentworth, Main St. at Paisley Ave.

Hamilton, Ontario. — Project No. H01760-G

Hole location and datum see drawing No. 1

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH
		150 mm asphalt over 250 mm concrete over FILL : clayey silt/ silty clay, reddish brown becoming brown below 1.5 m., fine to medium gravel, clay layers, black clay seams in first 0.75 m., moist, firm.	99.07	0
		CLAYEY SILT: brown, layered silt and clay, moist, soft becoming firm below 3.0 m.	" 96.8	2 4 6
		GRAVEL : brown, silty, some sand, medium to coarse grained, moist.	" 92.7	8
		TERMINATED	91.45	8

N Value: 20 40 60 80 — Shear Strength 0.10 0.20 MPa

Natural Moisture Content and Atterberg Limits % Dry Weight: 10 20 30

Natural Unit Weight kN/m³

NOTES:-

(1) Borehole advanced uncased by solid stem augers to termination at 7.6 m depth, on January 15,1990,by Drilltech

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS.

Log of Borehole 5

Trow

Auger Sample ⊠ | Natural Moisture
SPT (N) Value O O ▩ | Plastic and Liquid Limit
Dynamic Cone Test ——— | Undrained Triaxial at Overburden Pressure % Strain at Failure
Shelby Tube • • ■ | Penetrometer
Field Vane Test + s

Project Proposed Storm Sewers Dwg. No. 11
Region of Hamilton -Wentworth, Main St. at Bond St.
Hamilton, Ontario. Project No. H01760-G
Hole location and datum see drawing No. 1

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value: Shear Strength 0.10 – 0.20 MPa (20 40 60 80)	Natural Moisture Content and Atterberg Limits % Dry Weight (10 20 30)	Natural Unit Weight kN/m³
		125 mm asphalt over 125 mm concrete over 25 mm granular over FILL : silty clay, grey, fine to medium gravel, moist.	99.20	0			
		CLAYEY SILT: light brown becoming greyish brown between 5.6 to 5.8 m., moist becoming wet with depth, firm to soft	97.2	2			
		SAND - coarse with fine gravel and silt, moist, dense	92.8	7			
		TERMINATED	91.58				

NOTES:-
(1) Borehole advanced uncased by solid stem augers to termination at 7.6 m depth, on January 16, 1990, by Drilltech
(2) Standpipe installed.
(3) Water Level Record:
Standpipe pinched at 3.0 m, dry to 3.0 m.

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS

Log of Borehole 6

Trow

Auger Sample ⊠ | Natural Moisture
SPT (N) Value O O ▩ | Plastic and Liquid Limit
Dynamic Cone Test ——— | Undrained Triaxial at Overburden Pressure % Strain at Failure
Shelby Tube • • ■ | Penetrometer
Field Vane Test + s

Project Proposed Storm Sewers Dwg. No. 12
Region of Hamilton -Wentworth, Main St. at Longwood Dr.
Hamilton, Ontario. Project No. H01760-G
Hole location and datum see drawing No. 1

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value: Shear Strength 0.10 – 0.20 MPa (20 40 60 80)	Natural Moisture Content and Atterberg Limits % Dry Weight (10 20 30)	Natural Unit Weight kN/m³
		125 mm asphalt over 175 mm concrete over FILL : clayey silt, brown, clay pockets and seams, cohesive, moist, firm to stiff.	99.20	0			
		SILTY CLAY/ CLAYEY SILT : brown, occasional clay seams, silt layers, moist becoming wet below 3.0 m, firm to stiff with depth	97.7	2			
		GRAVEL : brown, some sand, medium grained, moist, dense.	92.6	7			
		TERMINATED	91.58				

NOTES:-
(1) Borehole advanced uncased by solid stem augers to termination at 7.6 m depth, on January 16, 1990, by Drilltech.

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS

Log of Borehole 7

Trow

Auger Sample ☒ | Natural Moisture
SPT (N) Value ○○■ | Plastic and Liquid Limit
Dynamic Cone Test —— | Undrained Triaxial at Overburden Pressure
Shelby Tube ● ● ■ | % Strain at Failure
Field Vane Test + s | Penetrometer

Project Proposed Storm Sewers Dwg. No. 13
Region of Hamilton -Wentworth, Main St. near Paradise Rd.
Hamilton, Ontario. Project No. H01760-G
Hole location and datum see drawing No. 1

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength	Natural Moisture Content and Atterberg Limits % Dry Weight	Natural Unit Weight kN/m³
		125 mm asphalt over 175 mm concrete over FILL : clayey silt, mottled brown and reddish brown, concrete fragments at approximately 400 mm., cohesive, moist, firm.	98.92	0			
		CLAYEY SILT : light brown becoming greyish brown below 5.5 m., occasional clay seams, silt layers, trace fine gravel, cohesive, wet, soft to firm	97.4	1 2 3 4 5 6 7 8 9 10			
		TERMINATED	91.30				

NOTES:-
(1) Borehole advanced uncased by solid stem augers to termination at 7.6 m depth, on January 16, 1990, by Drilltech

(2)Standpipe installed.

(3)Water Level Record:
Standpipe pinched at 2.0 m, dry to 2.0 m.

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS.

Log of Borehole 8

Trow

Auger Sample ☒ | Natural Moisture
SPT (N) Value ○○■ | Plastic and Liquid Limit
Dynamic Cone Test —— | Undrained Triaxial at Overburden Pressure
Shelby Tube ● ● ■ | % Strain at Failure
Field Vane Test + s | Penetrometer

Project Proposed Storm Sewers Dwg. No. 14
Region of Hamilton -Wentworth, Main St. at Paradise Rd.
Hamilton, Ontario. Project No. H01760-G
Hole location and datum see drawing No. 1

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength	Natural Moisture Content and Atterberg Limits % Dry Weight	Natural Unit Weight kN/m³
		125 mm asphalt over 175 mm concrete over FILL : silty clay, reddish brown, fine gravel, weathered shale fragments, clay pockets and seams, moist, firm.	98.79	0			
		CLAYEY SILT : reddish brown becoming light brown below 3.0 m., greyish brown at 5.5 m., clay seams, silt layers, cohesive, wet, firm.	97.3	1 2 3 4 5 6 7 8 9 10			
		TERMINATED	91.17				

NOTES:-
(1) Borehole advanced uncased by solid stem augers to termination at 7.6 m depth, on January 16, 1990, by Drilltech

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS

Log of Borehole 21

Trow

Auger Sample ⊠ | Natural Moisture
SPT (N) Value ○○■ | Plastic and Liquid Limit
Dynamic Cone Test —— | Undrained Triaxial at Overburden Pressure % Strain at Failure
Shelby Tube ● ● ■
Field Vane Test + s | Penetrometer

Project Proposed Sanitary Sewer — Dwg. No. 2
Longwood Road
Hamilton, Ontario — Project No. H02273-G
Hole location and datum see drawing No. 1

GWL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength (0.10–0.20 MPa)	Natural Moisture Content and Atterberg Limits % Dry Weight (10–30)	Natural Unit Weight kN/m³
	FILL: Firm red/ brown silty clay, with occasional rootlets	98.49	0			19.1
	Loose to compact brown, clayey silt with occasional sand layers. Becoming stiff grey silty clay below 3.35 m.	" 97.3	2			18.4
			4			18.6
						19.5
	Dense to very dense grey medium to coarse sand, and fine to medium gravel. Grading into a dense medium to coarse sand below 9.1 m.	" 93.3	6			20.0
	proposed sewer invert		8			
			10			20.2
	Stiff to very stiff brownish grey silty clay interbedded with layers of coarse sand up to 125 mm thick	" 87.8	12			20.6
			14			20.5
			16			21.1
	Compact to dense reddish brown fine to medium sand with occasional layers of grey silty clay	" 81.7	18			20.6
	Continued....	" 78.5	20			

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS.

Log of Borehole 21 con't

Trow

Auger Sample ⊠ | Natural Moisture
SPT (N) Value ○○■ | Plastic and Liquid Limit
Dynamic Cone Test —— | Undrained Triaxial at Overburden Pressure % Strain at Failure
Shelby Tube ● ● ■
Field Vane Test + s | Penetrometer

Project Proposed Sanitary Sewer — Dwg. No. 2A
Longwood Road
Hamilton, Ontario — Project No. H02273-G
Hole location and datum see drawing No. 1

GWL	Soil Description	ELEV. m	DEPTH	N Value / Shear Strength (0.10–0.20 MPa)	Natural Moisture Content and Atterberg Limits % Dry Weight (10–30)	Natural Unit Weight kN/m³
	Continued....	78.49	20			21.3
	TERMINATED	" 75.2	22			20.5
			24			21.3
			26			
			28			

NOTES:-
(1) Borehole advanced cased by hollow stem augers to termination at 23.3 m depth, on January 2, 1991, by Drilltech

(2) Water Level Record :-

Time Elapsed	Depth to W.L., m
5 Days	1.9

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS.

JACQUES WHITFORD
ENVIRONMENT LIMITED

BOREHOLE RECORD

MW204

CLIENT Petro-Canada
LOCATION 906 Main Street West (at Longwood Drive), Hamilton, Ontario
DATES: BORING December 13, 2004 WATER LEVEL December 17, 2004

PROJECT No. ONW36136
DATUM Local
TPC ELEV. 100.115

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	VAPOUR CONCENTRATIONS ● %LEL ▲ ppm	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES N-VALUE	WELL CONSTRUCTION
0	100.29				0	● 20 40 60 80 ▲ 100 200 300 400				
	100.1	ASPHALT					NR			50 mm ID solid PVC pipe with bentonite and cement seal
		Brown, SILTY CLAY (FILL), dry					SS	1	23	
1		- brown to grey, some sand, moist					SS	2	11	50 mm ID slotted PVC pipe with silica sand backfill
		- trace gravel					SS	3	19	
3	97.2	Brown, very stiff, SANDY SILT (TILL), some clay, wet					SS	4	11	
4							SS	5	25	
5							SS	6	20	
							SS	7	29	
6	94.2	END OF BOREHOLE at 6.1 m.								

LABORATORY ANALYSES: MW204-3 submitted for BTEX and PH (F1 to F4)
Groundwater submitted for BTEX and PH (F1 to F4)

JACQUES WHITFORD
ENVIRONMENT LIMITED

BOREHOLE RECORD

MW211

CLIENT Petro-Canada
LOCATION 906 Main Street West (at Longwood Drive), Hamilton, Ontario
DATES: BORING December 14, 2004 WATER LEVEL December 17, 2004

PROJECT No. ONW36136
DATUM Local
TPC ELEV. 99.875

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	VAPOUR CONCENTRATIONS ● %LEL ▲ ppm	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES N-VALUE	WELL CONSTRUCTION
0	99.94				0	● 20 40 60 80 ▲ 100 200 300 400				
	99.7	ASPHALT					NR			50 mm ID solid PVC pipe with bentonite and cement seal
		CONCRETE								
		Red to brown, SILTY CLAY (FILL), trace sand, moist					SS	1	20	
1	98.3	Brown, compact, SILTY SAND (TILL), some clay, wet					SS	2	26	50 mm ID slotted PVC pipe with silica sand backfill
3							SS	3	29	
							SS	4	11	
4	96.1	Brown, stiff, SANDY SILT (TILL), wet					SS	5	15	
		- some clay					SS	6	13	
5		- brown to grey					SS	7	26	
6	93.8	END OF BOREHOLE at 6.1 m.								

LABORATORY ANALYSES: MW211-1 submitted for BTEX and PH (F1 to F4)
Groundwater submitted for BTEX and PH (F1 to F4)

HIGHWAY 403 CROSSING

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 180-60 BORE HOLE NO. 4

JOB F59-116 STATION 12+77 (19' Lt.)

DATUM 279.9' COMPILED BY B.K.

BORING DATE Dec. 22/59 CHECKED BY V.K.

LEGEND

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

1/2 UNCONFINED COMPRESSION (Qu)
VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	Ground level	279.9	0
	Granular fill		
	Silty sandy gravel with some clay (traces of garbage)		15
	Medium brown silty clay (with some sand and pebbles)	252.4	30
	Medium grey silty clay.	244.9	45
			60
			75
	Bedrock Queenston shale relatively sound.	189.6	90
	End of borehole	179.6	105
			120

Penetration resistance profile shown obtained by driving a 2" dia. cone from ground level to depth noted with an energy of 350 ft. lb. per blow.

STRENGTH AND PENETRATION RESISTANCE
1000 2000 3000 4000 P.S.F.
25 50 75 100 BLOWS/FT.

Penetration ends at elev. 216.9'

CONSISTENCY
MOIST. CONTENT - % DRY WT.
10 20 30

SAMPLE	NATURAL UNIT WT. P.C.F.
S1	-
S2	-
S3	-
S4	-
S5	-
S6	-
T7	131.0
T8	131.0
T9	-
T10	136.0
T11	133.0
T12	-
RC13	-
RC14	-

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 180-60 BORE HOLE NO. 5

JOB 559-116 STATION 14+20 (19' Rt.)

DATUM 274.8' COMPILED BY B.K.

BORING DATE Dec. 15/59 CHECKED BY V.K.

LEGEND

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

1/2 UNCONFINED COMPRESSION (Qu)
VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	Ground level	274.8	0
	Granular fill Silty sandy gravel with some clay (traces of garbage)		15
	Soft brown silty clay (with some sand and decayed vegetation)	245.8	30
	Medium to stiff grey silty clay.	238.8	45
			60
			75
	Bedrock Queenston shale Weathered - Elev. 187 to 172' Relatively sound-Elev. 172' to 167.8'.	187.0	90
		167.8	105
	End of borehole		120

Penetration resistance profile shown obtained by driving a 2" dia. cone from ground level to depth noted with an energy of 350 ft. lb. per blow.

STRENGTH AND PENETRATION RESISTANCE
1000 2000 3000 4000 P.S.F.
25 50 75 100 BLOWS/FT.

Penetration ends at Elev. 219.8'

CONSISTENCY
MOIST. CONTENT - % DRY WT.
10 20 30

SAMPLE	NATURAL UNIT WT. P.C.F.
S1	-
S2	-
S3	-
S4	-
S5	-
S6	128.0
S7	125.0
T8	127.0
T9	-
T10	136.0
T11	130.0
RC12	-
RC13	-
RC14	-

FORM OB-ML-126 (REV. 1959.)—58-5691

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 231-58-3 BORE HOLE NO. 3

JOB 59-F-125 STATION 17+00 ℄ Ramp H.

DATUM G.S.C. COMPILED BY B.K.

BORING DATE Jan. 25/60 CHECKED BY J.B.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu)
VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Groundlevel	262.0	0
	W.L. ▽	257.0	
	Grey-brown silty clay with decayed organic matter.		10
			20
		232.0	30
	Grey silty clay with layers of sand and gravel.	227.0	
	Stiff grey silty clay.		40
			50
		201.0	60
	Shale, weathered at surface.	195.0	
	End of borehole		70
	Penetration resistance profile obtained by driving a 2" dia. cone from groundlevel to depth noted with an energy of 350 ft. lb. per blow.		80

STRENGTH AND PENETRATION RESISTANCE
1000 2000 3000 4000 P.S.F.
25 50 75 100 BLOWS/FT.

+4.5, +4.8, +3.3, +4.1, +1.4, +4.4, +1.6, +1.4
127, 143, 147
Penetration ends at elev. 202.7'

CONSISTENCY
MOIST. CONTENT - % DRY WT.
15 30 45

SAMPLE	NATURAL UNIT WT. P.C.F.
S1	-
S2	-
S3	-
S4	-
S5	-
S6	-
S7	-
T8	93.5
T9	-
S10	-
S11	-
S12	-

FORM OB-ML-126 (REV. 1959.)—58-5691

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 231-58-3 BORE HOLE NO. 4

JOB 59-F-125 STATION 17+50 ℄ Ramp H.

DATUM G.S.C. COMPILED BY B.K.

BORING DATE Feb. 8/60 CHECKED BY J.B.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu)
VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Groundlevel	263.0	0
	Clayey mixture of sand, gravel and ashes. W.L. ▽	259.0	
		255.0	10
	Soft brown silty clay with decayed organic matter.	251.0	
	Brown sandy clay with decayed organic matter & some ash.	242.0	20
	Brown to grey silty clay with layers of sand & gravel.	236.0	
			30
	Stiff grey silty clay, sandy near bedrock.		40
			50
		201.0	60
	Pink Shale	200.0	
	End of borehole		70
			80

STRENGTH AND PENETRATION RESISTANCE
1000 2000 3000 4000 P.S.F.
25 50 75 100 BLOWS/FT.

+2.8, +2.5, +1.5, +2.4, +1.0

CONSISTENCY
MOIST. CONTENT - % DRY WT.
15 30 45

SAMPLE	NATURAL UNIT WT. P.C.F.
S1	-
S2	-
S3	-
S4	-
S5	-
T6	-
S7	-
T8	124.0
S9	-
S10	-

FORM OB-ML-126 (REV. 1959.)—58-5691

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 231-58-3 BORE HOLE NO. 5

JOB 59-F-125 STATION 18/00 ℄ Ramp H.

DATUM G.S.C. COMPILED BY B.K.

BORING DATE Jan. 28/60 CHECKED BY J.B.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +S
NATURAL MOISTURE AND LIQUIDITY INDEX LI X
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Groundlevel	260.0	0
	Heterogeneous mixture of ashes, gravel & sand. W.L. ▽	256.0	
	Brown sandy clay	251.0	10
	Well graded sand & gravel.	239.0	20
	Stiff grey silty clay with scattered shale fragments.	237.0	30
			40
			50
			60
	End of borehole	193.7	70
			80

Penetration resustance profile shown obtained by driving a 2" dia. cone from groundlevel to depth noted with an energy of 350 ft. lb. per blow.

STRENGTH AND PENETRATION RESISTANCE
1000 2000 3000 4000 P.S.F.
25 50 75 100 BLOWS/FT.

Penetration refusal at elev. 204.5'

CONSISTENCY
MOIST. CONTENT - % DRY WT.
15 30 45

SAMPLE: S1 S2 S3 S4 S5 S6 S7 S8 S9

NATURAL UNIT WT. P.C.F.

FORM OB-ML-126 (REV. 1959.)—58-5691

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 231-58-3 BORE HOLE NO. 7

JOB 59-F-125 STATION 20/00 ℄ Ramp H.

DATUM G.S.C. COMPILED BY B.K.

BORING DATE Feb. 11/60 CHECKED BY J.B.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +S
NATURAL MOISTURE AND LIQUIDITY INDEX LI X
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Groundlevel	274.0	0
	Brown clay with sand, gravel & rubble.	271.0	
	Well graded gravelly sand with rubble.	250.0	10
	Black peaty sand with wood.	248.0	20
	Soft brown sandy clay with decayed vegetation.	241.0	30
			40
			50
			60
	End of borehole		70
			80

STRENGTH AND PENETRATION RESISTANCE
1000 2000 3000 4000 P.S.F.
25 50 75 100 BLOWS/FT.

CONSISTENCY
MOIST. CONTENT - % DRY WT.
15 30 45

SAMPLE: S1 S2 S3 S4 S5 S6 T7

NATURAL UNIT WT. P.C.F.

FORM OB-ML-126 (REV. 1959.)—58-5691

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 231-58-3 BORE HOLE NO. 9 Ramp H.

JOB F 59-125 STATION 436+59 18' Rt. ℄ Chedoke

DATUM G.S.C. COMPILED BY B.K.

BORING DATE Dec. 3/59 CHECKED BY J.B.

LEGEND

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +S
NATURAL MOISTURE AND LIQUIDITY INDEX LI X
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Groundlevel	261.7	0
	Loose sandy mixture of ashes and organic matter also partially decayed wood, etc.	249.7	10
	Soft brown sandy clay with organic matter also ashes and sanitary fill locally.	231.7	30
	Stiff grey silty clay.	198.4	60
	Shale	188.9	70
	End of borehole. Penetration resistance profile shown obtained by driving a 2" dia cone from groundlevel to depth noted with an energy of 350 ft. lb. per blow.		80

STRENGTH AND PENETRATION RESISTANCE
1000 2000 3000 4000 P.S.F.
25 50 75 100 BLOWS/FT.
Penetration ends at Elev. 206.8'

CONSISTENCY
MOIST. CONTENT - % DRY WT.
15 30 45

SAMPLE	NATURAL UNIT WT. P.C.F.
S1	-
S2	-
S3	-
S4	-
S5	-
T6	127.5
T7	119.2
T8	119.3
T9	-
RC10	-

FORM OB-ML-126 (REV. 1959.)—58-5691

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 231-58-3 BORE HOLE NO. 10 Ramp H.

JOB F59-125 STATION 437+19 90' Rt. ℄ Chedoke.

DATUM 258.0' COMPILED BY B.K.

BORING DATE Nov. 28/59 CHECKED BY V.K.

LEGEND

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +S
NATURAL MOISTURE AND LIQUIDITY INDEX LI X
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Groundlevel	258.0	0
	Loose sandy mixture of rubble ashes and sanitary fill.		10
Limits Uncertain.	Soft brown clay with organic matter, sand, etc.	233.0	20
	Grey silty clay		30
		194.7	60
	Bedrock (shale)	184.7	70
	End of borehole Penetration resistance profile shown obtained by driving a 2" Dia. cone from ground level to depth noted with an energy of 350 ft. lb. per blow.		80

STRENGTH AND PENETRATION RESISTANCE
1000 2000 3000 4000 P.S.F.
25 50 75 100 BLOWS/FT.
Penetration ends at elev. 209.0'

CONSISTENCY
MOIST. CONTENT - % DRY WT.
15 30 45

SAMPLE	NATURAL UNIT WT. P.C.F.
S1	-
T2	-
T3	-
S4	-
T5	-
T6	-
T7	-
T8	-
RC 9	-

FORM OB-ML-126 (REV. 1959.)-58-3691 OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 231-58-3 BORE HOLE NO. 12B

JOB 59-F-125 STATION 437+00 ℄

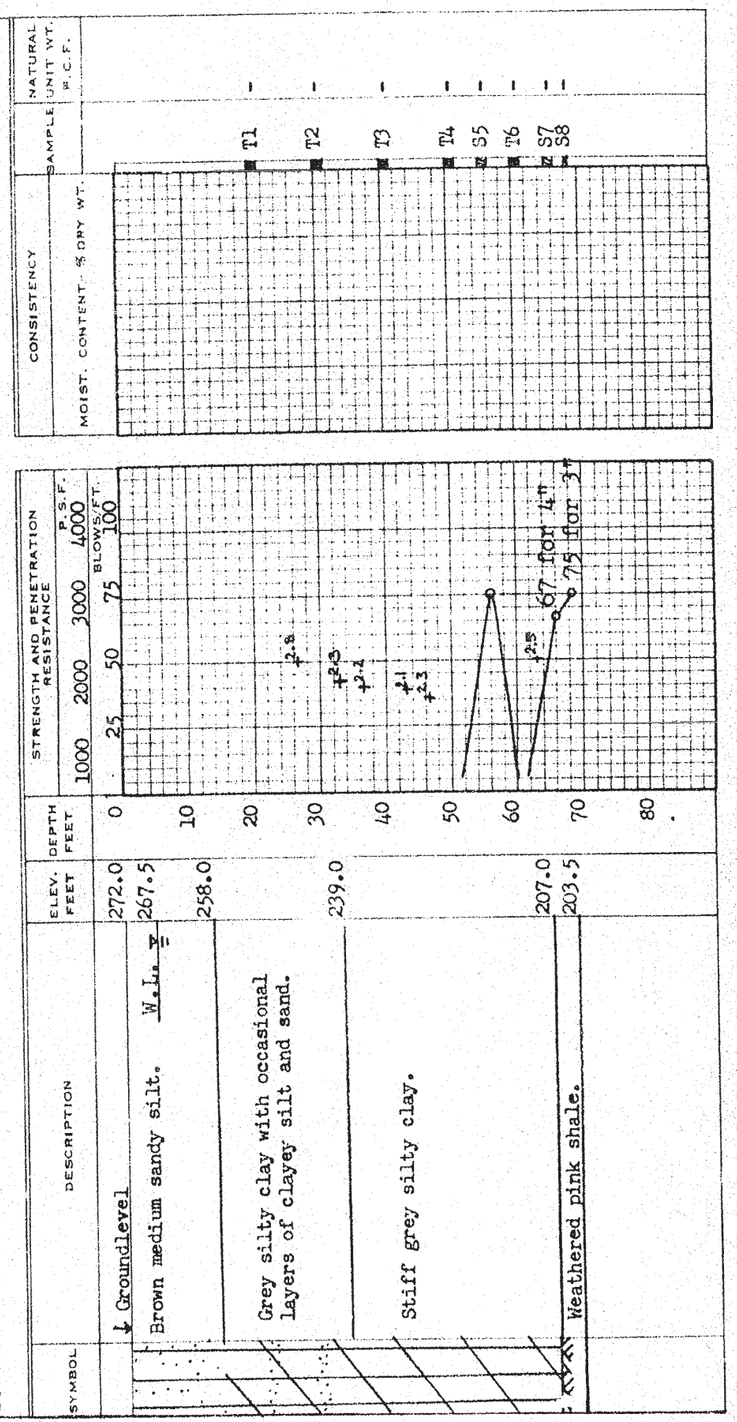
DATUM G. S. C. COMPILED BY B. K.

BORING DATE Jan. 18/60 CHECKED BY J. B.

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) — — O
VANE TEST (C) AND SENSITIVITY (S) — — +S
NATURAL MOISTURE AND LIQUIDITY INDEX — — LI
LIQUID LIMIT — — — — — — — — — — — — X
PLASTIC LIMIT — — — — — — — — — — — — ⊢

2" DIA. SPLIT TUBE — — — — — —
2" SHELBY TUBE — — — — — — —
2" SPLIT TUBE — — — — — — — —
2" DIA. CONE — — — — — — — — —
2" SHELBY — — — — — — — — — —
CASING — — — — — — — — — — —



MOUNTAINVIEW GEOTECHNICAL LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 2

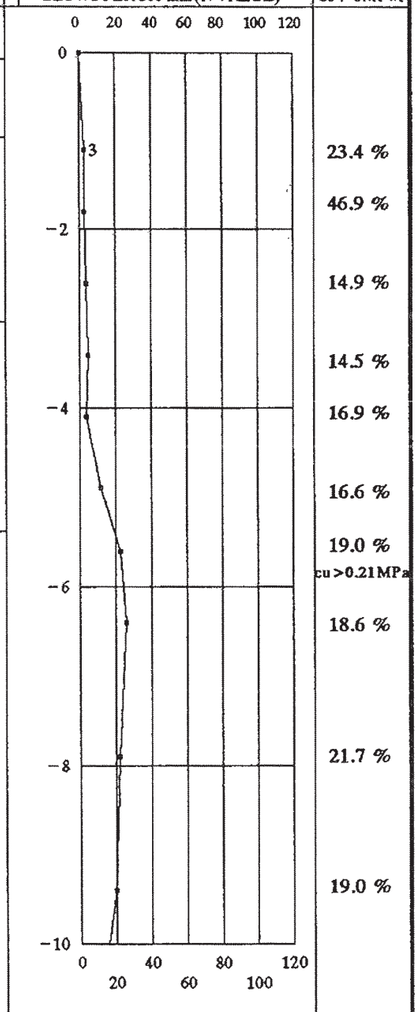
DWG NO. 4

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 10, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH	DRILLING [ ] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED CSO TANK	METHOD: [X] HOLLOW STEM
LOCATION: CATHEDRAL PARK, MAIN ST @ HWY 403, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; MC MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	MC (%) / CU / UNIT WT
85.7	Grass and surficial vegetation			0.0	
84.8	FILL silty clay with silt and sand, dark brown to brown, rootlets and organics, moist			0.9	
	FILL ash, cinders, sand, organics, decayed plant fibres and wood, pieces of porcelain and glass, generally grey to black, moist to very moist,	3	SS	1.1	23.4 %
		3	SS	1.8	46.9 %
	(VERY LOOSE)	4	SS	2.6	14.9 %
82.7	– red brick pieces			3.0	
		5	SS	3.4	14.5 %
	SAND AND SILT fine sand sizes, slightly clayey, greyish brown below 4.7 m, very moist,	4	SS	4.1	16.9 %
	(LOOSE TO COMPACT)	12	SS	4.9	16.6 %
80.4				5.3	
		23	SS	5.6	19.0 % cu > 0.21 MPa
	SILTY CLAY layered with silt and sand seams, vertical fissures, red shale fragments, trace of gravel, oxidized brown to unoxidized grey below 10.9 m, moist to very moist,	26	SS	6.4	18.6 %
	(VERY STIFF TO STIFF)	22	SS	7.9	21.7 %
	– dessicated and oxidized grey-brown becoming unoxidized grey below 10.9 m				
		20	SS	9.4	19.0 %
	BOREHOLE CONTINUED ON NEXT PAGE				

STD PENETRATION TEST
BLOWS PER 300 mm (N VALUE)



BORELOG.FRM May-94

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LOG OF BOREHOLE NO. 2 (CONT'D)

DWG NO. 5

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 10, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING [ ] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED CSO TANK	METHOD: [X] HOLLOW STEM
LOCATION: CATHEDRAL PARK, MAIN ST. @ HWY 403, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; M/C MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	M/C (%) CU / UNIT WT
75.7	Continued from previous page			10.0		
	SILTY CLAY layered with silt and sand seams, vertical fissures, red shale fragments, trace of gravel, oxidized brown to unoxidized grey below 10.9 m, moist to very moist, (VERY STIFF TO STIFF)	9	SS	11		21.4 %
		8	SS	12.5		18.3 %
	– dessicated and oxidized grey–brown becoming unoxidized grey below 10.9 m	6	SS	14		23.8 %
		21	SS	15.5		19.9 %
68.7	**SHALE (Queenston Formation)**					
	layered with grey siltstone seams, weathered, red,	80+	SS	17.0	/80 mm	
68.5	moist, (HARD)			17.2		19.5 %
	BOREHOLE TERMINATED					

NOTES:
1. BOREHOLE OPEN TO 16.3 m ON COMPLETION.
2. WATER LEVEL AT 5.2 m ON COMPLETION.

BORELOG.FRM May–94

MOUNTAINVIEW GEOTECHNICAL LTD.
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LOG OF BOREHOLE NO. 3

DWG NO. 6

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 10, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING [ ] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED CSO TANK	METHOD: [X] HOLLOW STEM
LOCATION: CATHEDRAL PARK, MAIN ST @ HWY 403, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; M/C MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	M/C (%) CU / UNIT WT
87.2	Grass and surficial vegetation			0.0		
	FILL					
86.4	silty clay with silt and sand, dark brown to brown, rootlets and organics, moist			0.8		
	FILL	5	SS	1.1		18.2 %
85.9	ash, cinders, sand, organics, decayed plant fibres and wood, pieces of porcelain and glass, generally grey to black (LOOSE TO VERY LOOSE)			1.5		
		15	SS	1.8		11.6 %
		14	SS	2.6		16.1 %
	SAND AND SILT fine sand sizes, slightly clayey, oxidized brown, clay seams @ 4.0 m (COMPACT)	10	SS	3.4		20.9 %
		17	SS	4.1		7.4 %
82.3		16	SS	4.9		11.5 %
	SILTY CLAY layered with silt and sand seams, vertical fissures, red shale fragments, trace of gravel, oxidized brown to unoxidized grey below 6.1 m, moist to very moist (FIRM TO STIFF)	23	SS	5.6		15.9 %
		28	SS	6.4		15.8 %
		15	SS	7.9		15.3 %
		13	SS	9.4		20.7 %

BOREHOLE CONTINUED ON NEXT PAGE

BORELOG.FRM Jun–94

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LOG OF BOREHOLE NO. 3
(CONT'D)

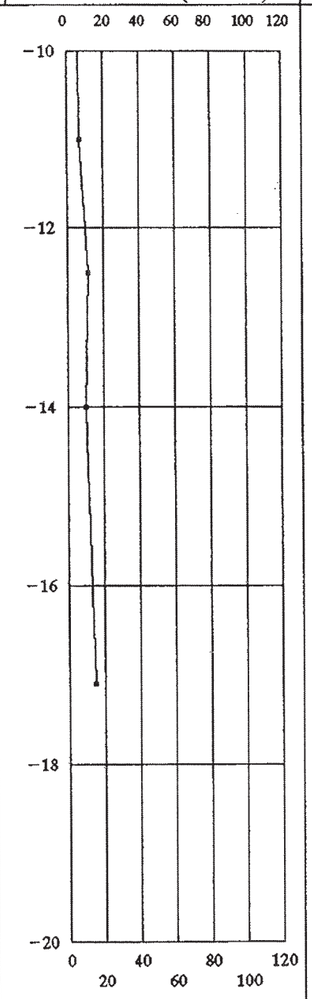
DWG NO. 7

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 10, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING METHOD: [ ] SOLID STEM CONTINUOUS FLIGHT [X] HOLLOW STEM [ ] DIAMOND DRILL; [ ] NX or [ ] BX
PROJECT NAME: PROPOSED CSO TANK	
LOCATION: CATHEDRAL PARK, MAIN ST. @ HWY 403, HAMILTON	
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; MC MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	MC (%) CU / UNIT WT
77.2	Continued from previous page			10.0		
	SILTY CLAY layered with silt and sand seams, vertical fissures, red shale fragments, trace of gravel, oxidized brown to unoxidized grey below 6.1 m, moist to very moist (FIRM TO STIFF)	7	SS	11		14.9 %
		12	SS	12.5		21.7 %
		10	SS	14		21.3 %
		15	SS	17.1		20.9 %
	SHALE (Queenston Formation) layered with grey siltstone seams, weathered, red,					
67.1	moist (HARD)			20.4		
67.2	BOREHOLE TERMINATED			20.5		

NOTES:
1) BOREHOLE OPEN TO 20.5 m ON COMPLETION.
2) BOREHOLE WAS DRY UPON COMPLETION.



BORELOG.FRM May–94

MOUNTAINVIEW GEOTECHNICAL LTD.
CONSULTING ENGINEERS

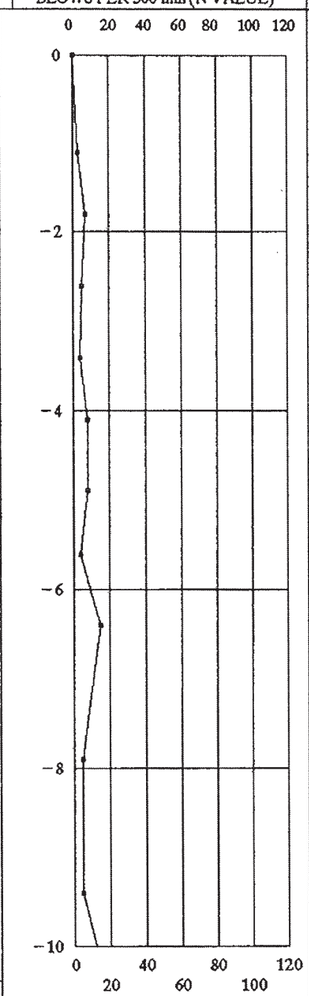
LOG OF BOREHOLE NO. 4

DWG NO. 8

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 10, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING METHOD: [X] SOLID STEM CONTINUOUS FLIGHT [ ] HOLLOW STEM [ ] DIAMOND DRILL; [ ] NX or [ ] BX
PROJECT NAME: PROPOSED CSO TANK	
LOCATION: CATHEDRAL PARK, MAIN ST @ HWY 403, HAMILTON	
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; MC MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	MC (%) CU / UNIT WT
88.2	Grass and surficial vegetation			0.0		
	FILL silty clay with silt and sand, dark brown to brown,					
87.5	rootlets and organics, moist			0.7		
		3	SS	1.1		33.0 %
		7	SS	1.8		31.2 %
		5	SS	2.6		30.4 %
	FILL ash, cinders, sand, organics, decayed plant fibres and wood, pieces of porcelain and glass, generally grey to black, possible asphalt shingles @ 5m, black cemented foundry sand @ 6 m, wet below 7 m (LOOSE TO VERY LOOSE)	4	SS	3.4		29.0 %
		8	SS	4.1		37.6 %
		8	SS	4.9		33.7 %
		4	SS	5.6		34.4 %
		15	SS	6.4		19.5 %
		5	SS	7.9		61.2 %
		5	SS	9.4		16.6 %
	SILTY CLAY layered with silt and sand seams, vertical fissures,					
78.1	red shale fragments, trace of gravel, oxidized brown, moist to very moist (HARD)			10.1		
	BOREHOLE CONTINUED ON NEXT PAGE					



BORELOG.FRM May–94

MOUNTAINVIEW GEOTECHNICAL LTD.
CONSULTING ENGINEERS

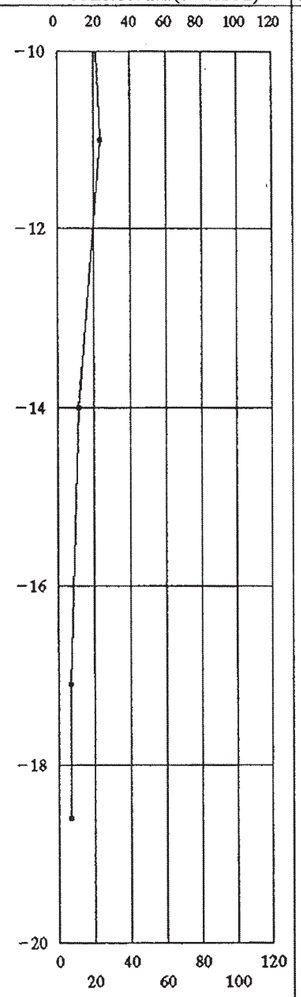
LOG OF BOREHOLE NO. 4 (CONT'D)

DWG NO. 9

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 10, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING [X] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED CSO TANK	METHOD: [ ] HOLLOW STEM
LOCATION: CATHEDRAL PARK, MAIN ST. @ HWY 403, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; MC MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	MC (%) CU / UNIT WT
78.2	Continued from previous page			10.0		
	SILTY CLAY layered with silt and sand seams, vertical fissures, red shale fragments, trace gravel, oxidized brown, unoxidized grey below 11.6 m, moist to very moist (HARD)	24	SS	11		19.5 %
		12	SS	14		18.1 %
		7	SS	17.1		24.2 %
		7	SS	18.6		23.1 %
65.0	**SHALE (Queenston Formation)** layered with grey siltstone seams, weathered, red, moist (HARD)			23.2		
63.8	BOREHOLE TERMINATED ON PRACTICAL AUGER REFUSAL			24.4		



BOREHOLOG.FRM May–94

MOUNTAINVIEW GEOTECHNICAL LTD.
CONSULTING ENGINEERS

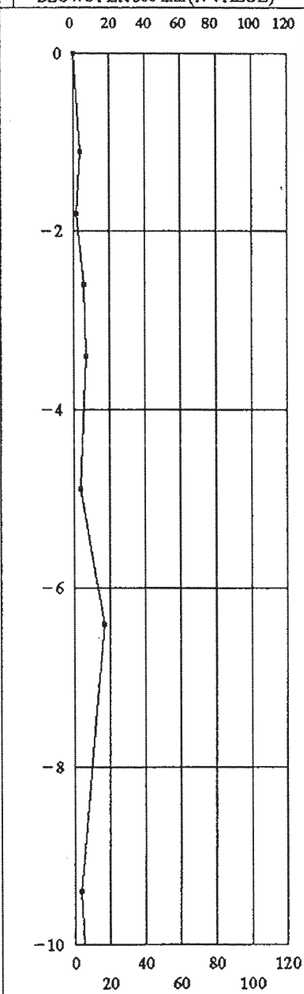
LOG OF BOREHOLE NO. 5

DWG NO. 10

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 16, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING [ ] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED CSO TANK	METHOD: [X] HOLLOW STEM
LOCATION: CATHEDRAL PARK, MAIN ST @ HWY 403, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; MC MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	MC (%) CU / UNIT WT
89.8	Grass and surficial vegetation			0.0		
89.2	**FILL** silty clay with silt and sand, dark brown to brown, rootlets and organics, moist			0.6		
		4	SS	1.1		39.5 %
		2	SS	1.8		45.6 %
		6	SS	2.6		36.5 %
		7	SS	3.4		34.6 %
	FILL ash, cinders, sand, organics, decayed plant fibres and wood, pieces of porcelain and glass, generally grey to black, wet below 9.4 m	4	SS	4.9		21.2 %
		17	SS	6.4		45.5 %
		4	SS	9.4		26.8 %
	BOREHOLE CONTINUED ON NEXT PAGE					



BOREHOLOG.FRM May–94

MOUNTAINVIEW GEOTECHNICAL LTD.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 5
(CONT'D)

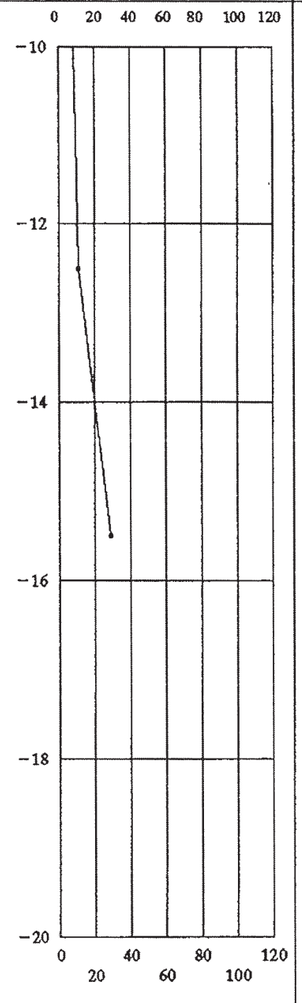
DWG NO. 11

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 16, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING METHOD: [ ] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED CSO TANK	[X] HOLLOW STEM
LOCATION: CATHEDRAL PARK, MAIN ST. @ HWY 403, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; MC MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	M/C (%) CU / UNIT WT
79.8	Continued from previous page			10.0		
	FILL ash, cinders, sand, organics, decayed plant fibres and wood, pieces of porcelain and glass, generally					
78.2	grey to black, wet (LOOSE TO VERY LOOSE)			11.6		
	SILTY CLAY layered with silt and sand seams, vertical fissures, red shale fragments, trace of gravel, oxidized brown to grey, beamy unoxidized grey below 17 m, moist to very moist (FIRM TO STIFF)	11	SS	12.5		19.8 %
		29	SS	15.9		14.0 %
66.3	SHALE (Queenston Formation) layered with grey siltstone seams, weathered, red,			23.5		
	moist (HARD)			23.8		
	BOREHOLE TERMINATED ON AUGER REFUSAL					

NOTES:
1) WET CAVE TO 8.2 m. WATER LEVEL @ 6.7 m.



BORELOG.FRM Jun–94

MOUNTAINVIEW GEOTECHNICAL LTD.
CONSULTING ENGINEERS

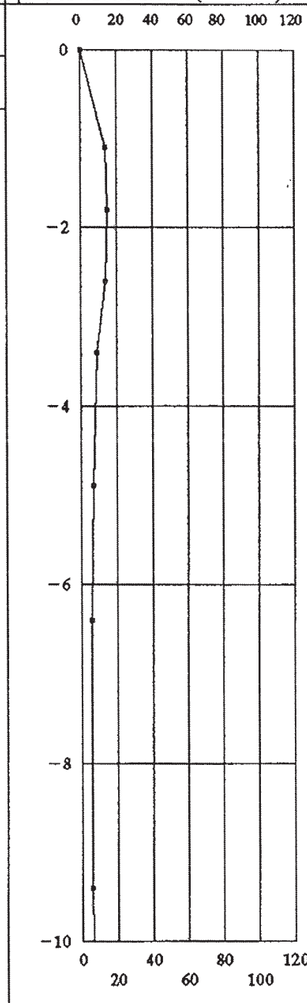
LOG OF BOREHOLE NO. 20

DWG NO. 40

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 12, 13, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING METHOD: [ ] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED CSO TANK	[X] HOLLOW STEM
LOCATION: CATHEDRAL PARK, MAIN ST @ HWY 403, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; MC MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	M/C (%) CU / UNIT WT
84.1	Grass and surficial vegetation			0.0		
83.2	FILL silty clay with silt and sand, dark brown to brown, rootlets and organics, moist			0.9		
		14	SS	1.1		19.0 %
	SILTY CLAY layered with silt and sand seams, vertical fissures, red shale fragments, trace of gravel, dessicated and oxidized brown becoming unoxidized grey below 2.4 m (STIFF TO FIRM)	15	SS	1.8		19.1 %
		14	SS	2.6		17.3 %
		9	SS	3.4		21.5 %
		7	SS	4.9		24.2 %
		6	SS	6.4		31.6 %
		6	SS	9.4		17.5 %
	BOREHOLE CONTINUED ON NEXT PAGE					



BORELOG.FRM May–94

MOUNTAINVIEW GEOTECHNICAL LTD.
CONSULTING ENGINEERS

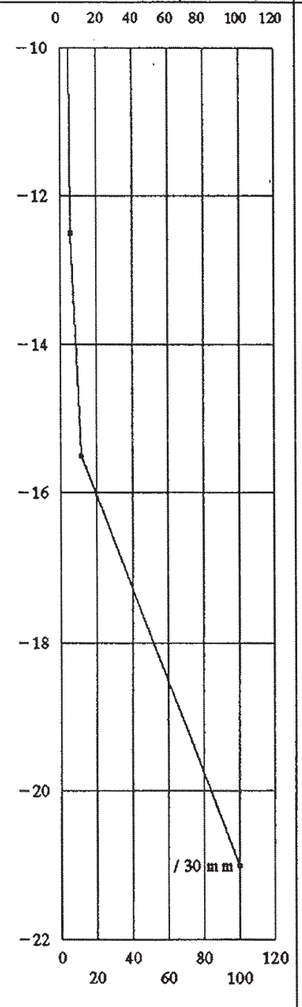
LOG OF BOREHOLE NO. 20
(CONT'D)

DWG NO. 41

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 13, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING METHOD: [ ] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED CSO TANK	[X] HOLLOW STEM
LOCATION: CATHEDRAL PARK, MAIN ST. @ HWY 403, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; M/C MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	M/C (%) CU / UNIT WT
74.1	Continued from previous page			10.0		
	SILTY CLAY layered with silt and sand seams, vertical fissures, red shale fragments, trace of gravel, desiccated and oxidized brown becoming unoxidized grey below 2.4 m, (STIFF TO FIRM)	6	SS	12.5		12.1 %
		12	SS	15.5		23.4 %
	SHALE (Queenston Formation)					
63.4	layered with grey siltstone seams, weathered, red	100+	SS	20.7		
	BOREHOLE TERMINATED					



NOTES:
1) BOREHOLE OPEN TO 20.1 m ON COMPLETION
2) WATER LEVEL AT 19.5 m ON COMPLETION

MOUNTAINVIEW GEOTECHNICAL LTD.
CONSULTING ENGINEERS

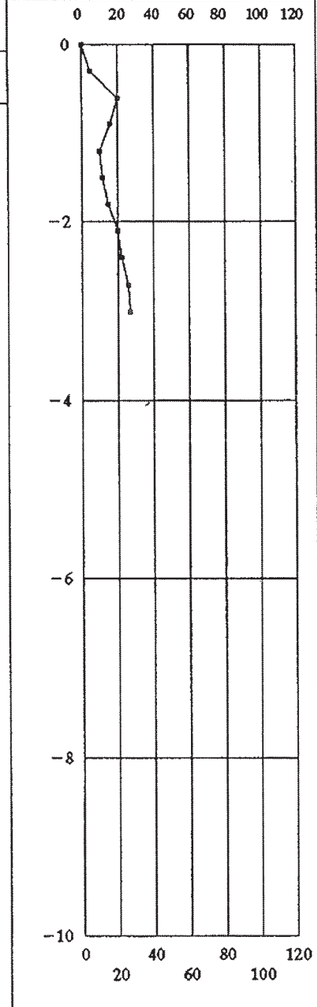
DYNAMIC CONE PENETRATION TEST NEAR BOREHOLE NO. 20

DWG NO. 41A

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 12, 13, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING METHOD: [ ] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED CSO TANK	[X] HOLLOW STEM
LOCATION: CATHEDRAL PARK, MAIN ST @ HWY 403, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; M/C MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	M/C (%) CU / UNIT WT
84.1	Grass and surficial vegetation			0.0		
83.2	**FILL** silty clay with silt and sand, dark brown to brown, rootlets and organics, moist			0.9		
	SILTY CLAY layered with silt and sand seams, vertical fissures, red shale fragments, trace of gravel, dessicated and oxidized brown becoming unoxidized grey below 2.4 m (STIFF TO FIRM)					



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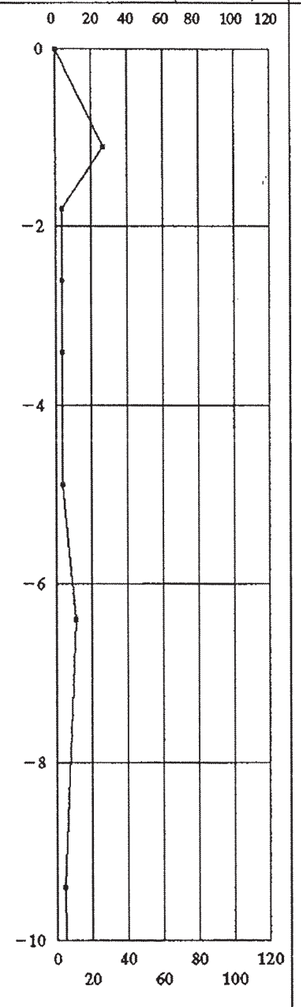
LOG OF BOREHOLE NO. 21

DWG NO. 42

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 12, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING [X] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED CSO TANK	METHOD: [ ] HOLLOW STEM
LOCATION: CATHEDRAL PARK, MAIN ST @ HWY 403, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; M/C MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	M/C (%) CU / UNIT WT
91.4	Grass and surficial vegetation			0.0		
90.9	**FILL** silty clay with silt and sand, dark brown to brown, rootlets and organics, moist			0.5		
	FILL ash, cinders, sand @ 1.2 m, foundry sand @ 6 m, organics, decayed plant fibres and wood, pieces of porcelain and glass, generally grey to black, wet @ 6 m (LOOSE TO VERY LOOSE)	27	SS	1.1		14.3 %
		4	SS	1.8		34.3 %
		4	SS	2.6		28.0 %
		4	SS	3.4		34.5 %
		4	SS	4.9		42.6 %
		11	SS	6.4		5.9 %
82.0		5	SS	9.4		20.0 %
	SAND AND SILT fine sand sizes, slightly clayey, greyish brown, decayed plant fibres, gravel sizes, very moist (LOOSE TO COMPACT)					
	BOREHOLE CONTINUED ON NEXT PAGE					



BORELOG.FRM May–94

MOUNTAINVIEW GEOTECHNICAL LTD.
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LOG OF BOREHOLE NO. 21 (CONT'D)

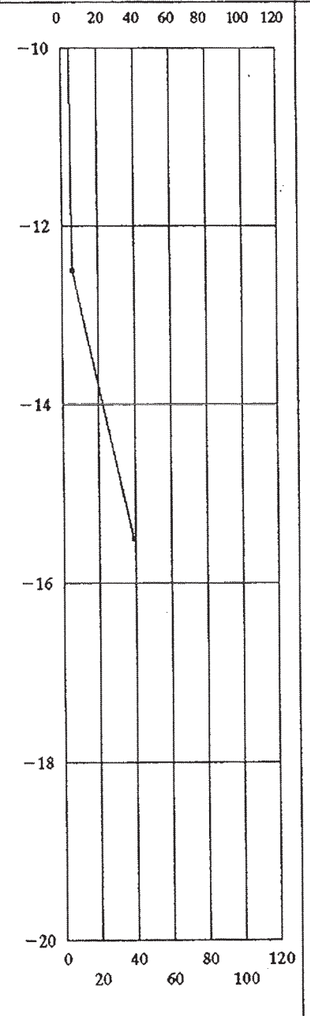
DWG NO. 43

MGL PROJECT NO.: S0520	DRILLING DATE: MAY 12, 1994
CLIENT: REGIONAL MUNICIPALITY OF HAMILTON–WENTWORTH	DRILLING [X] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED CSO TANK	METHOD: [ ] HOLLOW STEM
LOCATION: CATHEDRAL PARK, MAIN ST. @ HWY 403, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; M/C MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	M/C (%) CU / UNIT WT
81.4	Continued from previous page			10.0		
80.4	**SAND AND SILT** fine sand sizes, slightly clayey, greyish brown, decayed plant fibres, gravel sizes, very moist (LOOSE TO COMPACT)			11.0		
	SILTY CLAY layered with silt and sand seams, vertical fissures, red shale fragments, trace of gravel, unoxidized grey, moist to very moist (FIRM TO STIFF)	6	SS	12.5		29.2 %
		39	SS	15.5		17.3 %
75.2				16.2		
	SHALE (Queenston Formation) layered with grey siltstone seams, weathered, red, moist (HARD)					
71.4				20.0		
	BOREHOLE TERMINATED ON PRACTICAL AUGER REFUSAL					

NOTES:
1) BOREHOLE OPEN TO 19.2 m ON COMPLETION
2) WATER LEVEL AT 11.6 m ON COMPLETION



BORELOG.FRM Jun–94

KING STREET WEST

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Interceptor Trunk Sanitary Sewer
Client: The Corporation of the City of Hamilton
Elevation: Geodetic 324.9
Job No.: 62220
Casing: Auger 4-1/2" and 6"
Compiled By: A. A.M.
Borehole No.: 2
Boring Date: Dec. 27, 1962 - Jan. 11/63
Checked By: P. L.

SAMPLE CONDITION
UNDISTURBED
FAIR
DISTURBED
LOST

SAMPLE TYPE
A.S. AUGER SAMPLE
C.S. CASING SAMPLE
S.S. 2" STANDARD SPLIT TUBE SAMPLE
S.L. SPLIT BARREL WITH LINERS
S.T. THIN-WALLED SHELBY TUBE SAMPLE
W.S. WASH SAMPLE
R.C. ROCK CORE

ABBREVIATIONS
V.T. IN SITU VANE SHEAR TEST
M. MOIST
W.L. WATER LEVEL IN CASING
W.T. GROUND WATER TABLE IN SOIL
W.T.P.L. WETTER THAN PLASTIC LIMIT
D.T.P.L. DRIER THAN PLASTIC LIMIT
A.P.L. ABOUT PLASTIC LIMIT

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth (Elevation)	Legend	Sample No. and Condition	Sample Type	No. of Blows per ft.	Water Content %	WATER LEVELS & REMARKS
Ground surface			0'0"						
Topsoil to 12"	Black & Brown								
Silty, sandy loam	Yellowish brown								
Silty, sandy clay, sandy silt seams & fissures	Reddish brown	Stiff to very stiff			1	SS	17	27.0	D. T. P. L. and moist.
Med. to fine sand & silty clay interlayered	Brownish red		4'6"						
Silty clay, some grits and pebbles sandy silt seams	Brownish grey	Loose to Compact	6'0"		2 3	SS	9	28.5	Wet and W. T. P. L. W. T. P. L.
									Slight water seepage at 9'6"
Silty clay, some g. & p. layers, of sandy silt	Reddish brown	Stiff to very stiff			4	SS	15	25.0	W. T. P. L. and Saturated.
			14'0"						
Silty clay, some g. & p.	Grey with red tint	Firm			5	SS	7	26.3	W. T. P. L.
Sandy silty clay, grits and pebbles	Yellowish brown	Very	18'0"		6	2"S.L.			
		Hard	19'0"				48/6"		
Coarse to fine gravel, boulder pieces, some sand		Extremely dense	22'6"		7	SS	100/3"	2.7	Dry
Layer of coarse to med. sand	Grey & brown		23'0"						
Coarse to fine gravel, some sand		Ditto			8	SS	100/6"	2.6	Dry
Coarse to medium sand, some fine gravel	Light brown				9	CS			Slightly moist.
Coarse to fine gravel and sand	Grey and brown	Ditto			10	SS	100/3"		Dry
			32'10"						
Coarse to fine sand	Brown	Dense			11	SS	39	14.7	Wet
			37'6"						
								22.8	Water sample #1 (38'-40')
			40'0"						Sand backing up into casing. Quiet.
Sandy silt pockets of fine sand	Brown	Very dense			12	SS	63	14.7	
			45'0"						
Clayey silt with pockets of silty fine sand	Grey-brown	Hard			13	SS	37	19.9	D. T. P. L.
			51'3"		14	SS	18	23.0	W. T. P. L.
Silty clay, with pockets of reddish-brown sand	Grey-brown	Very stiff							
			55'0"						
Silty clay with grits and pebbles	Grey	Very stiff to hard			15	SS	31	18.4	D. T. P. L.
			57'6"						Started using wash water
Fine to medium sand pebbles,					16	W. S.			Layer of fine to medium sand, pebbles (57'6"-59'6")
			59'6"						
Silty clay, grits and pebbles fragments of shale	Grey	Firm to Stiff			17	SS	8	24.1	M. W. T. P. L.
As above	As above changing to grey-brown	Very hard			18 19	SS	56	17.2	D. T. P. L. Getting less plastic (increasing silt content with depth).
Clayey silt, fragments of shale	Grey-brown	Very hard			20	SS	50	20.1	Slightly plastic
			72'10"						
									Water seepage at 73'6"
									Water sample #2 73'-75'
Weathered shale (Queenston shale)	Red-brown	Very hard			21	SS	144/9"	10.8	Slightly moist.
			77'10"						Refusal at 77'10"

Test Hole Terminated at 77'10".

PETO MacCALLUM LTD.

CONSULTING GEOTECHNICAL ENGINEERS

LOG OF BOREHOLE No. 1 & 2

JOB NAME: PROPOSED SEWER CONSTRUCTION — JOB No.: 77 F 25
LOCATION: King Street, Hamilton — BORING DATE: Feb. 17, 1977 — ENGINEER: J.F.W.
BORING METHOD: 4" ϕ Solid Stem, Continuous Flight Augers — TECHNICIAN: P.W.

DEPTH	SOIL PROFILE: DESCRIPTION	LEGEND	ELEVATION	SAMPLES: NUMBER	TYPE	BLOWS/FOOT N-VALUES	SHEAR STRENGTH C_u ▲ / DYNAMIC CONE PENETRATION ▪ / STANDARD PENETRATION TEST ● — BLOWS/FOOT 20 40 60 80	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W — W_P W W_L — WATER CONTENT % 10 20 30	GROUNDWATER OBSERVATIONS AND REMARKS
	Borehole No. 1 GROUND ELEVATION: 327.5								
	SAND: Compact to loose reddish brown silty fine sand.		325	1	SS	11			
5	With clayey silt layers.			2	AS	-			
				3	SS	6			
			320						
				4	SS	14			
10	Becoming brown.			5	SS	19			
			315						
				6	SS	10			
15	Becoming dense reddish brown silty fine sand.								
18'0"			310	7	SS	61/11"			
	Borehole terminated at 18'0".								Upon completion of augering no water no cave.
	Borehole No. 2 Ground Elevation: 329.9								
0	8½" CONCRETE								
	SAND: Compact reddish brown silty fine sand with gravel sizes.			1	SS	22			
	Becoming very loose.		325	2	AS	-			
5				3	SS	4			
	Becoming brown fine to medium sand.		320	4	SS	3			
10	Becoming compact reddish brown.			5	SS	18			
	Becoming silty with gravel sizes.			6	SS	16			
15			315						
	Becoming very dense and dark brown.								
18'0"				7	SS	52			
	Borehole terminated at 18'0".		310						Upon completion of augering no water no cave.

NOTES:

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PETO MacCALLUM LTD.
CONSULTING GEOTECHNICAL ENGINEERS

LOG OF BOREHOLE No. 3 & 4

JOB NAME: PROPOSED SEWER CONSTRUCTION — JOB No.: 77 F 25
LOCATION: King Street, Hamilton — BORING DATE: Feb. 17, 1977 — ENGINEER: J.F.W.
BORING METHOD: 4" ϕ Solid Stem, Continuous Flight Augers — TECHNICIAN: P.W.

Borehole No. 3
GROUND ELEVATION: 340.2

DEPTH	DESCRIPTION	ELEVATION	NUMBER	TYPE	BLOWS/FOOT N-VALUES
	SAND: Compact brown silty fine sand.		1	SS	28
5	Becoming loose.	335	2	AS	-
			3	SS	8
			4	SS	8
10	Becoming dense reddish brown silty fine to medium sand.	330	5	SS	37
			6	SS	66
15		325			
18'0"	Becoming compact.		7	SS	12
20	Borehole terminated at 18'0".				

Upon completion of augering no water no cave.

Borehole No. 4
Ground Elevation: 361.6

DEPTH	DESCRIPTION	ELEVATION	NUMBER	TYPE	BLOWS/FOOT N-VALUES
0'5"	CONCRETE				
	SAND: Compact brown silty fine to coarse sand and gravel.	360	1	SS	17
5	Becoming very loose dark brown silty fine to coarse sand.	355	2	SS	2
9'6"	Becoming compact.		3	SS	17
10	SAND AND GRAVEL: Very dense brown fine to coarse sand and gravel.	350	4	SS	68
			5	SS	96
15		345	6	SS	62/11"
17'5"	Borehole terminated at 17'5".				
20					

Upon completion of augering no water no cave.

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT W_L
PLASTIC LIMIT W_P
WATER CONTENT W
W_P W W_L
WATER CONTENT % 10 20 30

NOTES:

CHECKED BY: KK

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CONSULTING GEOTECHNICAL ENGINEERS

LOG OF BOREHOLE No. 5 & 6

JOB NAME: PROPOSED SEWER CONSTRUCTION — JOB No.: 77 F 25
LOCATION: King Street, Hamilton — BORING DATE: Feb. 17, 1977 — ENGINEER: J.F.W.
BORING METHOD: 4" ϕ Solid Ste[illegible], Continuous Flight Augers — TECHNICIAN: P.W.

Borehole No. 5
GROUND ELEVATION: 355.0

DEPTH	DESCRIPTION	ELEVATION	NUMBER	TYPE	BLOWS/FOOT N-VALUES
	SAND: Loose light brown fine sand.		1	SS	6
5		350	2	AS	-
6'6"			3	SS	5
	SAND AND GRAVEL: Dense to very dense dark brown coarse sand with gravel sizes.		4	SS	31
10		345	5	SS	35
	Becoming silty fine to coarse sand with gravel sizes.		6	AS	-
15		340	7	SS	65
18'0"	Less silty.		8	SS	40
20	Borehole terminated at 18'0".				

Upon completion of augering no water no cave.

Borehole No. 6
Ground Elevation: 352.6

DEPTH	DESCRIPTION	ELEVATION	NUMBER	TYPE	BLOWS/FOOT N-VALUES
	SAND: Loose light brown silty fine sand.	350	1	SS	5
5			2	AS	-
			3	SS	7
8'0"		345			
	SAND AND GRAVEL: Very dense brown silty fine to coarse sand and gravel.		4	SS	52
10			5	SS	106
	Becoming dark brown fine to medium sand and gravel.	340	6	AS	-
15			7	SS	85
18'0"		335	8	SS	60
20	Borehole terminated at 18'0".				

Upon completion of augering no water no cave.

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT W_L
PLASTIC LIMIT W_P
WATER CONTENT W
W_P W W_L
WATER CONTENT % 10 20 30

NOTES:

CHECKED BY: KK

PME/504 — MEMBER OF THE ASSOCIATION OF CONSULTING ENGINEERS OF CANADA

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CONSULTING GEOTECHNICAL ENGINEERS

LOG OF BOREHOLE No. 7 & 8

JOB NAME: PROPOSED SEWER CONSTRUCTION — JOB No. 77 F 25
LOCATION: King Street, Hamilton — BORING DATE: 17 Feb. 1977 — ENGINEER: J.F.W.
BORING METHOD: 4" ϕ Solid Stem, Continuous Flight Augers — TECHNICIAN: P.W.

DEPTH	DESCRIPTION	ELEVATION	NUMBER	TYPE	BLOWS/FOOT N-VALUES
	Borehole No. 7				
	GROUND ELEVATION: 346.5				
0'3"	CONCRETE				
	SAND: Compact reddish brown silty fine sand.	345			
			1	SS	83
			2	AS	-
	Becoming brown fine to medium sand.		3	SS	20
		340			
			4	SS	25
			5	SS	26
		335			
			6	AS	-
			7	SS	23
		330			
18'0"			8	SS	20
	Borehole terminated at 18'0".				
	Borehole No. 8				
	Ground Elevation: 336.8				
	CLAYEY SILT: Stiff reddish brown clayey silt.	335			
			1	SS	9
5'0"±			2	AS	-
	SAND: Loose brown silty fine to medium sand.	330	3	SS	5
			4	SS	4
	Becoming dark brown fine to medium sand.		5	SS	4
		325			
			6	SS	5
15'6"±					
	CLAYEY SILT: Hard brown clayey silt.	320	7	SS	30
22'0"±		315			
24'5"	SAND: Very dense brown medium to coarse sand.		8	SS	79/11"
	Borehole terminated at 24'5".				

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT ——— W_L
PLASTIC LIMIT ——— W_P
WATER CONTENT ——— W
W_P W W_L
WATER CONTENT % 10 20 30

GROUNDWATER OBSERVATIONS AND REMARKS:
Upon completion of augering no water no cave.
Upon completion of augering no water cave at 21'6".

NOTES:

CHECKED BY KC

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PETO MacCALLUM LTD.
CONSULTING GEOTECHNICAL ENGINEERS

LOG OF BOREHOLE No. 9

JOB NAME: PROPOSED SEWER CONSTRUCTION — JOB No. 77 F 25
LOCATION: King Street, Hamilton — BORING DATE: Feb. 17, 1977 — ENGINEER: J.F.W.
BORING METHOD: 4" ϕ Solid Stem, Continuous Flight Augers — TECHNICIAN: P.W.

DEPTH	DESCRIPTION	ELEVATION	NUMBER	TYPE	BLOWS/FOOT N-VALUES
	GROUND ELEVATION: 328.8				
	SAND: Loose brown fine sandy silt to silty fine sand.	325	1	SS	4
4'6"			2	AS	-
	CLAYEY SILT: Stiff reddish brown silty clay to clayey silt, becoming brown clayey fine sandy silt.		3	SS	15
		320	4	SS	13
			5	SS	11
13'0"					
	SAND AND GRAVEL: Compact brown coarse sand with fine gravel sizes.	315	6	SS	18
			7	SS	10
	Becoming dense silty fine to coarse sand and gravel.	310			
		305			
25'0"	Borehole terminated at 25'0".		8	SS	47

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT ——— W_L
PLASTIC LIMIT ——— W_P
WATER CONTENT ——— W
W_P W W_L
WATER CONTENT % 10 20 30

GROUNDWATER OBSERVATIONS AND REMARKS:
Upon completion of augering no water cave at 19'6".

NOTES:

CHECKED BY KC

PML/504 — MEMBER OF THE ASSOCIATION OF CONSULTING ENGINEERS OF CANADA

MOUNTAINVIEW GEOTECHNICAL LTD.
CONSULTING ENGINEERS

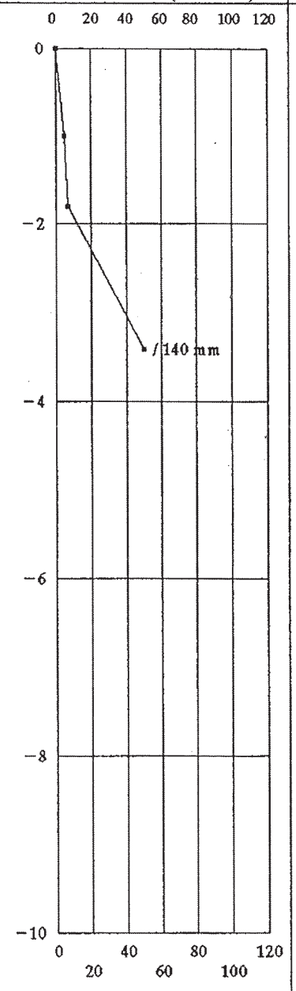
LOG OF BOREHOLE NO. 20

DWG NO. 21

MGL PROJECT NO.: S0858	DRILLING DATE: OCTOBER 25, 1995
CLIENT: THE REGION OF HAMILTON–WENTWORTH	DRILLING METHOD: [X] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED WATERMAIN & SEWER INSTALLATION	[ ] HOLLOW STEM
LOCATION: MARKET STREET, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; M/C MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	M/C (%) CU / UNIT WT
108.5				0.0		
	75 mm Asphalt over 150 mm crushed limestone					
	FILL sand with some silt, medium to coarse grained, clayey, brown, moist,	5	SS	1.0		14.0 %
	(LOOSE)	7	SS	1.8		19.2 %
106.5				2.0		
	SAND AND GRAVEL medium to coarse grained sand, meduim gravel sizes, brown, moist,					
	(DENSE)					
105.0		>50	SS	3.4	140 mm	5.0 %
	BOREHOLE TERMINATED			3.5		



NOTES:
1. BOREHOLE OPEN TO 2.9 m ON COMPLETION.
2. BOREHOLE WAS DRY ON COMPLETION.

GEO DISK # 25 Nov–95

MOUNTAINVIEW GEOTECHNICAL LTD.
CONSULTING ENGINEERS

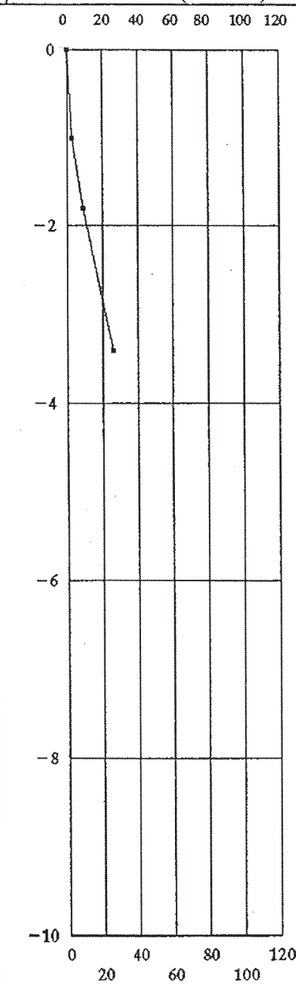
LOG OF BOREHOLE NO. 21

DWG NO. 22

MGL PROJECT NO.: S0858	DRILLING DATE: OCTOBER 25, 1995
CLIENT: THE REGION OF HAMILTON–WENTWORTH	DRILLING METHOD: [X] SOLID STEM CONTINUOUS FLIGHT
PROJECT NAME: PROPOSED WATERMAIN & SEWER INSTALLATION	[ ] HOLLOW STEM
LOCATION: MARKET STREET, HAMILTON	[ ] DIAMOND DRILL; [ ] NX or [ ] BX
ELEV. DATUM: GEODETIC	DRILLER: K. & S DRILLING

SS SPLIT SPOON; TW THIN WALL SHELBY TUBE; AUG AUGER SAMPLE; CU UNDRAINED SHEAR STRENGTH; M/C MOISTURE CONTENT; PL PLASTIC LIMIT

ELEV. (m)	SOIL DESCRIPTION	N	SAMPLE TYPE	STRATA DEPTH	STD PENETRATION TEST BLOWS PER 300 mm (N VALUE)	M/C (%) CU / UNIT WT
103.0				0.0		
	100 mm Asphalt over 175 mm crushed limestone					
	FILL sand with some silt, medium to coarse grained, clayey, brown, moist,	3	SS	1.0		11.9 %
101.2	(LOOSE)	9	SS	1.8		15.2 %
	SAND AND GRAVEL medium to coarse grained sand, meduim gravel sizes, brown, moist,					
	(COMPACT)					
99.5		26	SS	3.4		6.0 %
	BOREHOLE TERMINATED			3.5		



NOTES:
1. BOREHOLE OPEN TO 2.7 m ON COMPLETION.
2. BOREHOLE WAS DRY ON COMPLETION.

GEO DISK # 25 Nov–95

PETO ASSOCIATES LTD. — CONSULTING SOIL ENGINEERS

RECORD OF BOREHOLE NO. 4 P

JOB NO. 73 F 48 — JOB NAME Parking Garage - Main Street, Hamilton — TECHNICIAN W.J.

BORING DATE Mar. 13/73 — CLIENT Corporation of the City of Hamilton — ENGINEER GDP/APJ

GROUND ELEV. 324.3 — BOREHOLE TYPE Hollow Stem Augers — TYPED BY jnc

DEPTH ELEV.	SOIL PROFILE DESCRIPTION	LEGEND	SAMPLES NUMBER	TYPE	BLOWS/FOOT	REMARKS
0'0"						
1'0"	CINDER FILL					
	MIXED FILL: Dark brown sandy silt fill, some gravel.		1	SS	4	#4A augered 10' north of #4. Fill to 16'. Boulders to 25'.
	Mainly loose sandy fill.		2	SS	2	
	Ashes and bricks fill. Moist.		3	SS	2	
14'6"±						
309.8	SAND: Brown fine to medium sand with gravel and boulders. Dense.		4	SS	43	After sample #4, hole dry.
20'0"±						
304.3	SANDY TILL: Hard, dry.		5	SS	30/0"	
22'0"±						
302.	SAND: Fine to coarse sand, wet below 25' ±, compact to dense, saturated.		6	SS	56	P1 E = 505 bars PL = not determined
			7	SS	27	
	Becoming grey brown, pockets of sandy till.		8	SS	185	After sample #8 - W.L. @ 26' ±
32'6"±						
	SILTY CLAY: Grey silty clay. W.T.P.L. Odd pebble, till like, stiff.		9	SS	32	P2 E = 68 bars PL = 16 bars
			10	SS	19	
	Reddish brown pockets of silt.		11	TW	Push	
			12	SS	27	P3 E = 58 bars PL = 11 bars
			13	SS	32	
			14	TW	Push	
	Firm to stiff clayey silt/silty clay.		15	SS	20	P4 E = 59 bars PL = 12 bars
	Mainly silty clay. W.T.P.L.		16	SS	29	
			17	TW	Push	
	Interbedded clayey silt and sandy silt layers.		18	SS	13	P5 E = 48 bars PL = 10.5 bars
			19	SS	18	
71'0"±						
253.3	CLAYEY SILT TILL: Reddish brown to grey silt till. Hard. A.P.L. Variable gravel content.		20	SS	17	
			21	SS	77	P6 E = 102 bars PL = 23 bars
			22	SS	90	
			23	SS	40	
97'0"±						
227.3	SILTY CLAY: Grey clayey silt to silty clay. W.T.P.L. Silt pockets and seams red and grey. Stiff.		24	SS	34	P7 E = 139 bars PL = not determined
			25	SS	28	
			26	TW	Push	
97'0"±	Borehole terminated at 97'0"					

Hollow augers at 95', W.L. - 25'1" Pulled augers W.L. - 25' ± Cave - 35' Installed piezometer - 30' - 35'

May 15/73: W.L. 27'5"

PAL/504

PETO ASSOCIATES LTD. — CONSULTING SOIL ENGINEERS

RECORD OF BOREHOLE NO. 5

JOB NO. 73 F 48 — JOB NAME Parking Garage - Main Street, Hamilton — TECHNICIAN W.J.

BORING DATE Mar. 9/73 — CLIENT corporation of the City of Hamilton — ENGINEER GDP/APJ

GROUND ELEV. 322.8± — BOREHOLE TYPE Hollow Stem Augers — TYPED BY jnc

DEPTH ELEV.	SOIL PROFILE DESCRIPTION	LEGEND	SAMPLES NUMBER	TYPE	BLOWS/FOOT	REMARKS
0'0"						
1'6"±	CRUSHED STONE AND FINES.					
321.3	MIXED FILL: Mixed sand and gravel fill. Bricks, concrete slabs, etc.		1	SS	13	
			2	SS	10	
			3	SS	15	
9'6"±	CONCRETE SLAB					
10'0"						
312.8	Clayey sandy silt fill, wet.		4	SS	6	
12'0"±						
310.8	SAND: Brown fine to medium sand, moist, loose.		5	SS	4	
15'0"±						
16'6"±	SANDY TILL: Brown		6	SS	39	
306.3	SAND: Brown fine to coarse, gravel layers. Boulders. Very moist, compact.		7	SS	37	Hole dry to 22'. W.L. 23'8"
	Becoming dark brown fine to medium sand.		8	SS	19	Hole at 25' water - 23'8"
	Fine to coarse sand. Saturated, dense.		9	SS	62	Hole at 30' water - 24'
33'0"±						
289.8	SILTY CLAY: Grey silty clay, stiff, A.P.L. Stiff, grit content, till like.		10	SS	32	
	Silt seams and pockets.		11	SS	26	
	Becoming W.T.P.L.		12	SS	24	After pulling augers, cave - 9'
	Seams of sandy silt.		13	SS	16	
51'6"±						
271.3	Borehole terminated at 51'6" 1					

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PETO ASSOCIATES LTD.

RECORD OF BOREHOLE NO. 6P

CONSULTING SOIL ENGINEERS

JOB NO. 73 F 48 | JOB NAME Parking Garage - Main Street, Hamilton | TECHNICIAN W.J.

BORING DATE Mar. 9/73 | CLIENT Corporation of the City of Hamilton | ENGINEER GDP/APJ

GROUND ELEV. 322.6± | BOREHOLE TYPE Hollow Stem Augers | TYPED BY jnc

DEPTH ELEV.	SOIL PROFILE: DESCRIPTION	LEGEND	SAMPLES: NUMBER	TYPE	BLOWS/FOOT	STANDARD PENETRATION TEST BLOWS/FOOT (10 20 30 40 50) / SHEAR STRENGTH C_u LB/SQ.FT. (1000 2000 3000 4000 5000)	LIQUID LIMIT W_L / PLASTIC LIMIT W_p / WATER CONTENT W (W_p W W_L; WATER CONTENT % 10 20 30)	REMARKS
0'0"	CRUSHED STONE							
0'6"	MIXED FILL: Sandy fill to 2 feet below. Mixed sand and gravel fill. Bricks, wood, concrete slabs. Very moist. Odd boulder.		1	SS	25			Hole #6A augered 10' East. After 16 feet of drilling, W.L. - 13'1"
			2	SS	7			After 5 mins. 13'1" cave - 15'1"
			3	SS	18			After 22 feet W.L. - 22'
9'9"	BASEMENT FLOOR LEVEL							After 5 mins. 21'8"
312.4	SAND: Brown fine to medium sand. Compact. Moist. Some fine gravel.		4	SS	15			On pulling augers, W.L. and cave 9'6".
			5	SS	33			BH. #6B
18'0"±								20'0" Water running into hole.
304.6	SANDY TILL: Clayey sandy till, brown							
20'0"±								
302.6	SAND: Brown fine to coarse sand. Wet.		6B1	SS	95	95	E=61 bars PL=40 bars	P1 22'0"
	Boulders.		6B2	SS	75	75 W.L. 24'8"		Hole #6B augered 5' East of #6. After 25' augering, moist at bottom.
	Becoming saturated.		6B3	SS	35			29'0" After 10 mins. W.L. - 24'8"
	Layers of gravel.						E=287 bars	P
			7	SS	23/6"		PL=>40 bars	31'0"
33'0"±								BH. #6P
289.6	SILTY CLAY: Grey silty clay. Stiff. Grits and pebbles. Till like. W.T.P.L.		8	SS	22	▲ 3590 PSF		35'6" BH.#6P P1 E = 61 bars PL = 10.5 "
			9	SS	26	▲ 2300 PSF		37'6"
			10	SS	28			41'0" P2 E = 66 bars
			11	SS	35			28 43'0" P2 PL = 13 bars
			12	SS	22			46'0" P3 E = 78 bars
	Gravel sizes present.		13	SS	32	▲ 1550 PSF		22 48'0" P3 PL = 12 bars
	Soft mainly silty clay. Clayey silt/ silty clay. Reddish brown silty sand seams.		14	SS	8			56'0" P4 E = 55 bars
			15	SS	17			P4 58'0" PL = 9.5 "
	Interbedded							
	Silty clay							
66'6"±								
256.1	CLAYEY SILT TILL: Reddish brown to grey clayey silt till. Hard. Silt seams and pockets.		16	SS	14			66'0" P5 E = 71 bars
			17	SS	48	▲ 4180 PSF		P5 68'0" PL = 12 bars
	Variable gravel content.		18	SS	42			
			19	SS	70	70		81'0" P6 E = 127 bars
			20	SS	51			P6 83'0" PL ~ 28 bars
87'0"±								
245.6	SILTY CLAY: Grey clayey silt to silty clay. W.T.P.L. Silt pockets and seams. Red and grey. Stiff.		21	SS	15			
			22	SS	16			96'0" P7 E = 58 bars
98'0"±			23	SS	31	20		31 P7 PL = 17 bars
224.6	Borehole terminated at 98'0"							98'0"

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PETO ASSOCIATES LTD.

RECORD OF BOREHOLE NO. 7

CONSULTING SOIL ENGINEERS

JOB NO. 73 F 48 | JOB NAME Parking Garage - Main Street, Hamilton | TECHNICIAN W.J.

BORING DATE Mar. 19/73 | CLIENT Corporation of the City of Hamilton | ENGINEER GDP/APJ

GROUND ELEV. 321.8± | BOREHOLE TYPE Hollow Stem Augers | TYPED BY jnc

DEPTH ELEV.	SOIL PROFILE: DESCRIPTION	LEGEND	SAMPLES: NUMBER	TYPE	BLOWS/FOOT	DYNAMIC CONE PENETRATION BLOWS/FOOT / STANDARD PENETRATION TEST BLOWS/FOOT (10 20 30 40 50) / SHEAR STRENGTH C_u LB/SQ.FT.	LIQUID LIMIT W_L / PLASTIC LIMIT W_p / WATER CONTENT W (W_p W W_L; WATER CONTENT % 10 20 30)	REMARKS
0'0"	MIXED FILL: Mixed sand, silt, bricks, etc., loose, moist to wet. Sandy fill.		1	SS	5			
9'6"								
10'9"±	OLD BASEMENT FLOOR LEVEL							
311.5	SAND: Brown, fine to medium sand. Compact to dense, odd pebble. Moist.		2	SS	14			
			3	SS	62			No free water to 24'. Hole at 25' W.L. @ 23'8"
21'0"±								
300.8	SAND: Grey brown fine to coarse sand, wet. Compact to dense. Saturated.		4	SS	57			Hole at 31' W.L. @ 23'8". Took water sample. pH = 6.8 SO_3 = 480 ppm
			5	SS	35	W.L. 23'4"		Mildly aggressive.
31'2"								29'3"
290.6	SILTY CLAY: Grey brown to grey silty clay. A.P.L. Very stiff.		6	SS	47			31'0" Hole at 31' augers at 30'. Sand backed to 28'.
			7	SS	24			Bailed to 26'10".
	Odd pebble.		8	SS	21	17 27		2 mins. later 26'2". 6 mins. later 25'3".
	Becoming W.T.P.L.							10 mins. later 24'8".
	Reddish grey.		9	TW	Push			Stopped checking.
	Sandy silt to silty sand layers.		10	SS	20			On completion installed piezometer 29' to 31' W.L.-23'3" initially.
50'0"								
271.8	Borehole terminated at 50'0"							May 16/73: W.L. 23'4"

PAL/504

Order No. S3831/H551 Enclosure No. 5

RACEY, MacCALLUM & BLUTEAU LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: (3) King St.W.

Project: Proposed Sanitary & Storm Sewers
Location: King St.W., Hamilton, Ont.
Hole Location: See Drawing No. 1
Hole Elevation and Datum: 320.8
Start Date: March 11/71 Prep.: P.H.
End Date: " " Checked: D.B.

LEGEND
- Split spoon
- Wash sample
- Shelby Tube
- Core sample

Shear Strength (C)
Unconfined compression
Vane test and sensitivity (S) ⊕ +S
Penetration Resistance (P)
2" Split tube
2" Dia. Cone
Casing

Symbol	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE C P.S.F. P BLOWS/FT. 20 40 60 80	Sample No.	Recovery
		320.8	0			
	Asphalt & Concr.Base	319				
	Sand-dense to very dense; silty; fine to medium; reddish brown to grey; moist becoming wet below approx. 24 ft.depth.		10		SS1 SS2 SS3	
	Conglomorate layer at approx. 20 ft. depth*		20	6"	SS4 SS5	
	W.L	297				
	End of Borehole	289.3	30		SS6	

Notes:
1. Borehole advanced using flight auger equipment.
2. On completion, hole open to approx. 23 ft. depth.
3. *Layer of conglomorate gravel encountered at 20 ft. depth; difficult to penetrate by auger.

Order No. S3831/H551 Enclosure No. 7

RACEY, MacCALLUM & BLUTEAU LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: (5) King St.W.

Project: Proposed Sanitary & Storm Sewers
Location: King St.W., Hamilton, Ont.
Hole Location: See Drawing No. 1
Hole Elevation and Datum: 323.4
Start Date: March 12/71 Prep.: P.H.
End Date: " " Checked: D.B.

LEGEND
- Split spoon
- Wash sample
- Shelby Tube
- Core sample

Shear Strength (C)
Unconfined compression
Vane test and sensitivity (S) ⊕ +S
Penetration Resistance (P)
2" Split tube
2" Dia. Cone
Casing

Symbol	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE C P.S.F. P BLOWS/FT. 20 40 60 80	Sample No.	Recovery
		323.4	0			
	Asphalt & Concr.Base	322				
	Sand-loose, fine to medium; reddish brown; moist; (probably fill to approx. 16 ft.depth)		10		SS1 SS2 SS3	
	Refusal on conglomorate layer of sand and gravel.	304	20			
			30			

Notes:
1. Borehole advanced to 19'6" using flight auger equipment.
2. Refusal to augering encountered at approx. 19'6" depth.

Order No. S3831/H551 Enclosure No. 8

RACEY, MacCALLUM & BLUTEAU LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: (6) King St.W.

Project: Proposed Sanitary & Storm Sewers

Location: King St.W., Hamilton, Ont.

Hole Location: See Drawing No. 1

Hole Elevation and Datum: 325.4

Start Date: March 15/71 Prep.: P.H.

End Date: " " Checked: D.B.

LEGEND

- Split spoon
- Wash sample
- Shelby Tube
- Core sample

Shear Strength (C)
Unconfined compression
Vane test and sensitivity (S) ⊕ +S

Penetration Resistance (P)
2" Split tube
2" Dia. Cone
Casing

Symbol	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE C P.S.F. P BLOWS/FT. 20 40 60 80	Sample No.	Recovery
		325.4	0			
	Asphalt & Concr. Base	324				
	Sand-loose; fine to medium; reddish brown; moist (probably fill).	317			SS1	
	Sand-dense; fine to medium; reddish brown; moist		10		SS2	
R	Layer of conglomorate sand and gravel; approx. 9" thick at 17 ft. depth; underlain by sand & gravel.			Refusal	SS3	
	End of Borehole	302	20		SS4	
			30			

Notes:

1. Borehole advanced to 17 ft. depth using flight auger equipment together with conventional wash boring technique for breaking through the conglomorate layer.
2. On completion, hole dry and open to 21 ft. depth.

KING STREET WEST

Log of Borehole 1

Project No. HAGE-0060496-A Drawing No. 4

Project: Geotechnical Investigation - Proposed Sewer and Watermain Construction Sheet No. 1 of 1

Location: James Street (King Street to Wilson Street), Hamilton, Ontario

Date Drilled: May 12, 2001

Drill Type: Truck Mount

Datum:

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S) | Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH m	N Value (20 40 60 80) Shear Strength 0.1 0.2 MPa	Combustible Vapour Reading (ppm) 250 500 750; Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30	SAMPLES	Natural Unit Weight kN/m³
		ASPHALT: ~ 290 mm thick	96.14	0				
		FILL: Sand and gravel, brown, moist, ~ 150 mm thick	95.85					
		FILL: Silty sand, reddish brown, fine grained, some clay, moist, very loose to loose	95.70	1				
		SAND: Light brown, fine grained, layered, silty sand seams, moist, compact to dense	93.84	2				
		BOREHOLE TERMINATED	92.64	3				

Notes:

1. Borehole was advanced by solid stem auger equipment to a termination depth of 3.5 m on May 12, 2001.

2. Upon completion of drilling, no cave, no water.

3. In hole methane reading using MSA explosimeter: 0% methane.

4. Upon completion of drilling, 19 mm (3/4 in.) diameter P.V.C. standpipe installed to 3.5 m depth, screened portion 2.6 to 3.5 m depth, bentonite seal 0.2 to 1.1 m depth and asphalt patch from 0 to 0.2 m depth.

LAGWGL02 BHLOG.GPJ NEW.GDT 6/21/01

Trow Consulting Engineers Ltd.
428 Millen Road
Stoney Creek, Ontario, L8E 3N9
Telephone: 905-664-3300
Fax: 905-662-4144
E-Mail: hamilton@trow.com

Time	Water Level (m)	Depth to Cave (m)
June 1, 2001	3.50	

Borehole Log

Trow Ltd

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test +S | Lab Vane Test t | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at Overburden Pressure % Strain at Failure (0, 5, 10, 15) | Penetrometer

Project: Proposed Amphitheatre Dwg. No. 2

Gore Park Borehole No. 1

Hamilton, Ontario Project No. H4596-G

Hole location and datum see drawing No. 1

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH m	N Value (ASTM) D1586-CSA A119.1 (20 40 60 80) Shear Strength 0.1 0.2 MPa	Natural Moisture Content and Atterberg Limits % Dry Weight (10 20 30)	Natural Unit Weight kN/m³
		0.3 m TOPSOIL	99.83	0			
		SAND-reddish brown to brown, stratified frequently silty, occ. wet seams, loose		1			
		SAND & GRAVEL-brown, very dense	95.8	2			
		SILTY CLAY TILL-grey, with traces of sand & gravel, very stiff	91.3	3			
		TERMINATED	90.2	4			
		NOTES: See attached sheet		5			
				6			
				7			
				8			
				9			
				10			

TL101rD

Log of Borehole BH16

Project No. SPB481-3 — Drawing No. 3

Project: Geo-environmental Investigation — Sheet No. 1 of 1

Location: Hughson St. N., King St. E. to King William St., City of Hamilton, Ontario

Date Drilled: Sept.2, 2004

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ☒
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✦
Sensitivity S
Piezometric Water Level ▼

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit |—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH m	N Value: Shear Strength (Blows/0.3m; 20 40 60 80; kPa 0.1 0.2)	Combustible Vapour Reading (ppm) 250 500 750; Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30	SAMPLES	Natural Unit Weight kN/m³
		ASPHALTIC CONCRETE: 150 mm CONCRETE: 200 mm GRANULAR BASE: 50 mm, crusher run limestone FILL: silty sand to sandy silt, brown, moist, compact	96.16	0	○	×		
				1	○	×		
				2	○	×		
		SAND: coarse to medium grained, some silt seams, brown, moist, very dense	93.86	3	○	×		
		End of Borehole	92.66					

S & P Shaheen & Peaker Consulting Engineers

Borehole BH16

Time	Water Level (m)	Depth to Cave (m)
on completion	dry	3.0

PROJECT: 941-6037 — **RECORD OF BOREHOLE BH-C** — SHEET 1 OF 1

LOCATION: SEE PLAN FIGURE 1 — BORING DATE: 11/10/94 — DATUM: GEODETIC

DIP: — SAMPLER HAMMER, 63.5 kg; DROP, 760 mm

BORING METHOD: CME 55 TRUCKMOUNTED AUGER, 114mm HOLLOW STEM AUGERS

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION (ppm) ⊕ / % LEL □	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT, PERCENT Wp W Wl (10 20 30 40)	INSTALLATIONS (1 2 3)
-1	GROUND SURFACE		96.34								
0	80mm PAVING STONE.		96.20								
	SAND and GRAVEL. (FILL)		96.14	1A							
	Dense, brown, SANDY SILT; trace brick fragments, cinders. (FILL)		0.20	1B	SS	50/0.0	50				
1	Loose, brown, SILTY SAND; trace topsoil, occasional gravel. (possibly FILL)		95.74 0.60	2	SS	50/0.0	5				NOTE: Borehole dry during drilling.
2				3	SS	50/0.0	6				
	Loose, reddish-brown, SANDY SILT; trace clay with sand layers.		94.19 2.15	4	SS	50/0.0	7				
3				5	SS	50/0.0	6				
	Compact, brown, fine to medium SAND; trace silt, occasional gravel.		92.69 3.65	6	SS	50/0.0	24				
4				7	SS	50/0.0	29				
5	Compact, brown, SAND and GRAVEL.		91.16 5.18	8	SS	50/0.0	27				
6	END OF BOREHOLE		90.55 5.79								
7											
8											
9											

DATA INPUT: D.Popovich 11/14/94

DEPTH SCALE (ALONG HOLE) 1 to 50

Golder Associates

LOGGED: K.G.

CHECKED: J.G.M.

PROJECT: 941-6037

LOCATION: SEE PLAN FIGURE 1

DIP:

RECORD OF BOREHOLE BH-D

BORING DATE: 10/27/94

SHEET 1 OF 1

DATUM: LOCAL

SAMPLER HAMMER, 63.5kg; DROP, 760 mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	RECOVERY %	LAB. TESTING	GAS CONCENTRATION (ppm)	HYDRAULIC CONDUCTIVITY, k, cm/s	WATER CONTENT, PERCENT Wp W Wl	INSTALLATIONS
0	CME 55 TRUCKMOUNTED AUGER 114mm HOLLOW STEM AUGERS	GROUND SURFACE		96.15						% LEL		10 20 30 40	1 2 3
		80mm PAVING STONE.		96.06									
		Sand and Gravel. (FILL)		0.09 95.85									
		Dense, brown, sandy silt. (FILL)		0.30	1	SS	37						
				95.39									
1		Loose to compact, brown, SILTY SAND; some gravel. (possibly FILL)		0.76	2	SS	10						NOTE: Borehole dry during and following drilling.
					3	SS	6						
2				94.00									
		Loose, reddish brown, SANDY SILT; with sand seams and layers.		2.15	4	SS	9						
				93.40									
3		Loose, brown, fine to medium SILTY SAND.		2.75	5	SS	8						
				92.50									
4		Compact, brown, fine to medium SAND; trace silt, occasional gravel.		3.65	6	SS	27						
					7	SS	29						
5				90.97									
		Dense, brown, SAND and GRAVEL.		5.16	8	SS	47						
6		END OF BOREHOLE		90.36 5.79									
7													
8													
9													

DATA INPUT: D.Popovich 11/13/94

DEPTH SCALE (ALONG HOLE)

1 to 50

Golder Associates

LOGGED: K.G.

CHECKED: J.G.M.

SITEST ENGINEERING

DATA SHEET FOR BOREHOLE 5

DRAWING 10 (SHEET ___ OF ___)

8614

Project No. PROPOSED SEWERS (Your No. ___)

Project CATHARINE ST. (HAMILTON)

Location REGION OF HAMILTON-WENTWORTH

SEE DRAWING NO: 2

Hole Location APRIL 18, 1988 VERTICAL

Date Drilled 100 mm SOLID STEM AUGER

Drilled by GEODETIC (BOREHOLE ELEV. = (94.567m))

Datum

Field: 3" OD Split Tube; 3", 3"ID Shelby Tube; Rotary Core Sample; Auger or Wash Sample; 3" Dia Cone; Field Vane; Pressure Meter; Sample Pushed (pressure); Water Table (definite, apparent)

Laboratory: Natural Moisture; Plastic & Liquid Limit; Lab Vane Test; Torvane; Unconfined Compression; Undrained Triaxial at Overburden Pressure; Strain at Failure; Sensitivity

Symbol	Description / Classification	Elevation (metres)	Depth (metres)	Penetration Resistance N, 350 ft lbs blows/ft (10 20 30 40); Shear Strength	Natural Water Content & Atterberg Limits (10 % dry weight 20 30); Sensitivity	Sample Type & Number	Recovery %
	PAVEMENT	94.47	0.10				
	FILL, sandy gravel	94.17	0.40				
	SAND, some silt loose, reddish-brown, wet occasional coarse sand seams		1	10		1	100
			2				
			3	8		2	100
	GRAVELLY SAND, some silt cobbles and boulders very dense	90.46	4.11	62/275mm		3	100
	▽	89.57	5.00				
	SILTY SAND, layered, wet brown, very dense	88.63	5.94	53		4	100
	BOREHOLE TERMINATED	88.02	6.55				

Notes
1. Free water encountered @ 6.5m. Level observed @ 5.0 m on completion.
2. Borehole was backfilled on completion of the fieldwork.

Borehole #: A

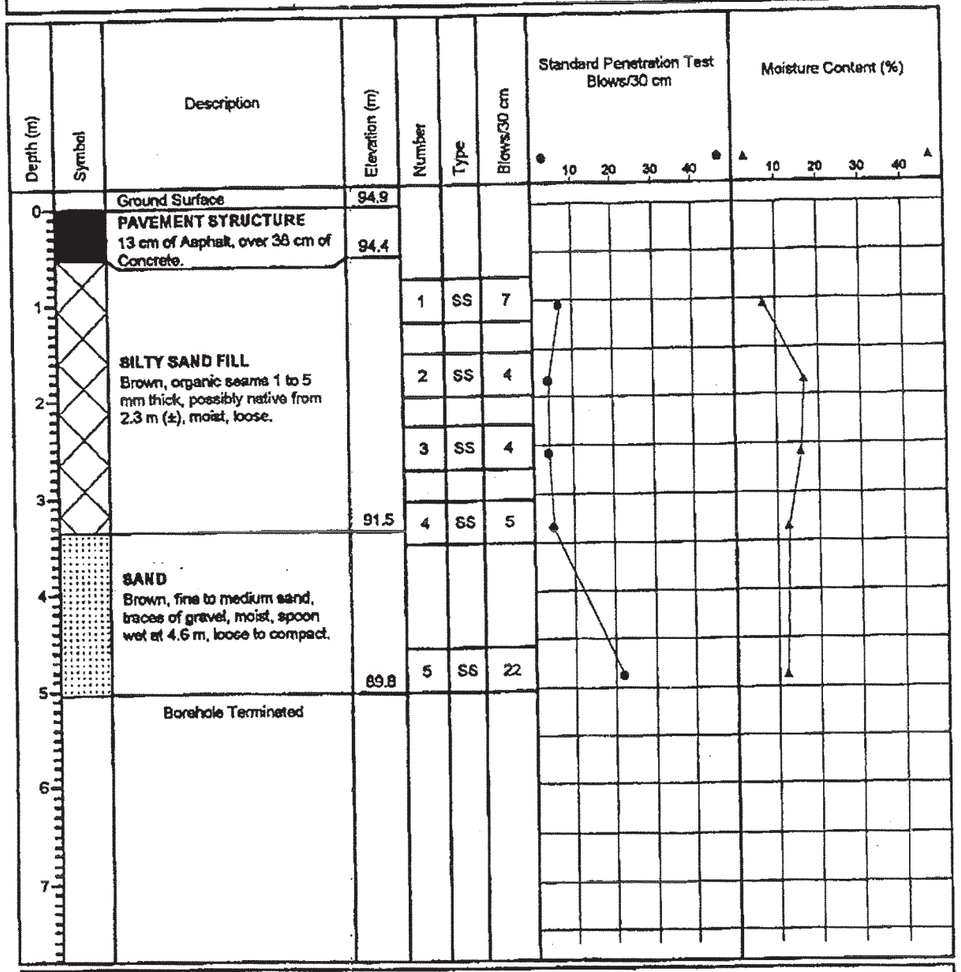
Project No: TB99002G

Project: Storm Sewer Construction

Client: Reg. Mun. of Hamilton-Wentworth

Location: King & Walnut St., Hamilton

Prepared By: M. Leitch



Drilled by: Elite Drilling

Drill Method: Solid Stem Augers

Upon Completion: Caved and wet at 4.9 m.

AGRA Earth and Environmental
505 Woodward Avenue
Hamilton, Ontario
L8H 6N6

Hole Size: 150 mm

Datum: Geodetic

Drill Date: 99 02 04

Borehole #: B

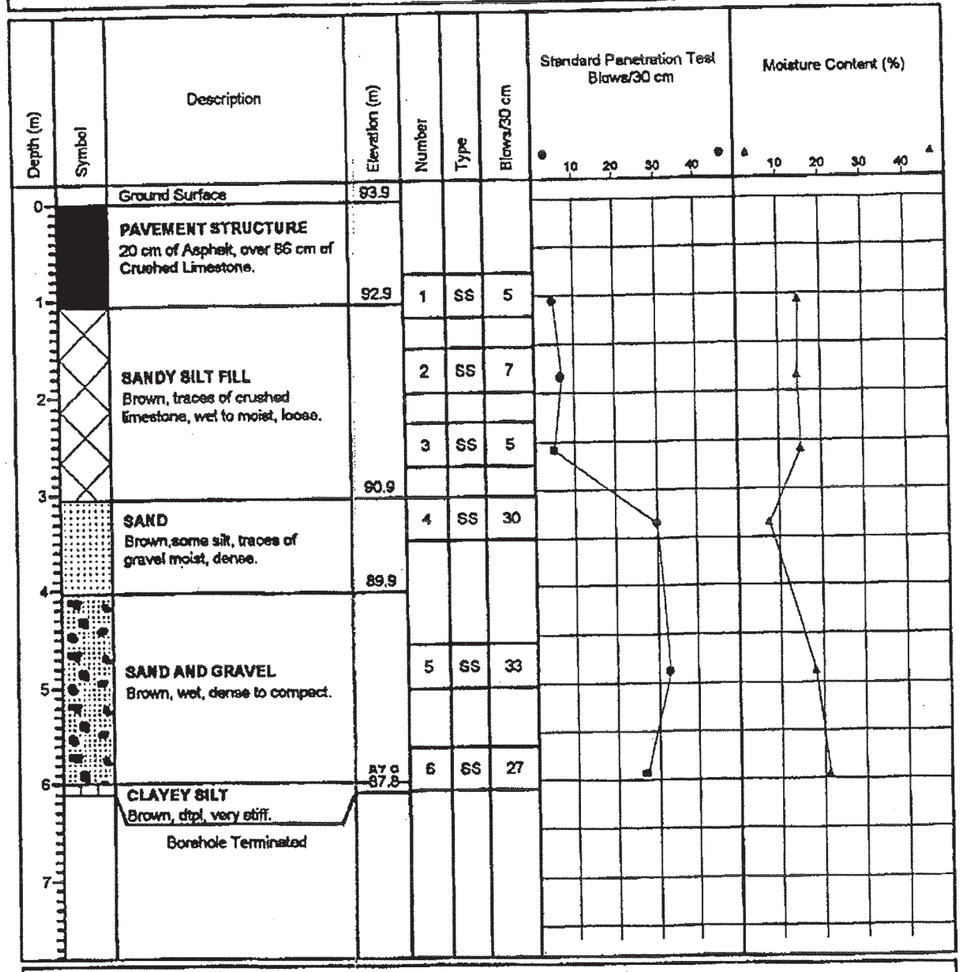
Project No: TB99002G

Project: Storm Sewer Construction

Client: Reg. Mun. of Hamilton-Wentworth

Location: King & Walnut St., Hamilton

Prepared By: M. Leitch



Drilled by: Elite Drilling

Drill Method: Solid Stem Augers

Upon Completion: Caved and wet at 4.4 m.

AGRA Earth and Environmental
505 Woodward Avenue
Hamilton, Ontario
L8H 6N6

Hole Size: 150 mm

Datum: Geodetic

Drill Date: 99 02 04

Terraprobe

LOG OF BOREHOLE 3

PROJECT No: 7-02-0137-2
CLIENT: City of Hamilton
LOCATION: Walnut St. Hamilton, Ontario

BORING DATE: November 26, 2002
ELEVATION DATUM: Geodetic
SAMPLER HAMMER, 63.5kg; DROP, 760mm

BORING METHOD	DEPTH SCALE IN METRES	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUE	PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (20 40 60 80)	WATER CONTENT (%) (P, x, L; 10 20 30)	INSTALLATION INFORMATION
CME 55 TRUCKMOUNT	0	GROUND SURFACE		94.87						
		125mm Asphalt		0.0						
		CONCRETE		0.13						
		(FILL) Granular Base/Subbase		0.33						
		Firm, reddish brown; CLAYEY SILT		0.48						
	1			93.87	1	SS	8	o	o	
				1.00						
	2	Loose to compact, reddish brown; SANDY SILT, with seams and layers of fine sand			2	SS	9	o	o	
					3	SS	16	o	o	
	3				4	SS	21	o	o	
		END OF BOREHOLE		91.36 3.51						
	4									
	5									
	6									
	7									
	8									
	9									

NOTES:
Borehole dry upon completion of drilling.

SHEET 1 OF 1

A. CUMMINGS
7-02-0137-2-3.DWG

LOG OF BOREHOLE 1

Trow

Auger Sample
SPT(N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Natural Moisture
Plastic and Liquid Limit
Penetrometer

Project: Geotechnical Investigation
Proposed Watermain Construction
King Street East (Mary Street to Wellington Street)
Hamilton, Ontario

Dwg. No: 3
Project No: H0 4362-A/G
Ground Elevation : m

Borehole location and datum see Drawing No. 2

Water Level	Elev. Scale (m)	Soil Description	Depth Scale m	Depth Scale ft	N Value	N Value / Shear Strength kPa (20 40 60 80; 100; 200)	Natural Moisture Content % Dry Weight (10 20 30)	Sample	Unit Weight (Kn/m³)
	93.70	Asphaltic Concrete - 200 mm thick							
		FILL: Sand and gravel, some slag, grey, damp	0.5	2			X		
	92.9	- silty sand, reddish brown, trace of gravel, occasional concrete fragments, moist	1	4	40	o	X		
	92.3	SILTY SAND: Reddish brown, trace of clay and gravel, moist, loose to dense	1.5	6	9	o	X		
			2						
			2.5	8	31	o	X		
			3	10					
		- becoming brown from 3.3 to 3.5m depth.			24	o	X		
	90.2	BOREHOLE TERMINATED	3.5	12					
			4	14					
			4.5	16					
			5						
			6.5	18					

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS.

1. Borehole advanced by solid stem augers to a termination depth of 3.5 m on March 16, 1998 by Landtest Drilling Ltd.
2. Upon completion of drilling, no cave, no free water.
3. Borehole backfilled and patched upon completion of drilling.

LOG OF BOREHOLE 2

Trow

Auger Sample
SPT(N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test + S
Natural Moisture X
Plastic and Liquid Limit
Penetrometer

Project: Geotechnical Investigation
Proposed Watermain Construction
King Street East (Mary Street to Wellington Street)
Hamilton, Ontario

Dwg. No: 4
Project No: H0 4362-A/G
Ground Elevation : m

Borehole location and datum see Drawing No. 2

Water Level	Elev. Scale (m)	Soil Description	Depth Scale m	Depth Scale ft	N Value	Sample	Unit Weight (Kn/m³)
	92.53	Asphaltic Concrete - 150 mm thick					
		FILL: Sand and gravel, some slag, grey, moist	0.5	2	22		
	91.7	SILTY SAND: Reddish brown, trace of clay and gravel, moist, compact to dense	1	4	35		
			1.5	6	24		
			2				
			2.5	8	18		
		- becoming brown from 3.2 to 3.5m depth	3	10	35		
	89.0	BOREHOLE TERMINATED	3.5	12			
			4	14			
			4.5	16			
			5				
			6.5	18			

N Value: 20 40 60 80 — Shear Strength 100 kPa 200
Natural Moisture Content % Dry Weight: 10 20 30

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS.

1. Borehole advanced by solid stem augers to a termination depth of 3.5 m on March 16, 1998 by Landtest Drilling Ltd.
2. Upon completion of drilling, no cave, no free water.
3. Borehole backfilled and patched upon completion of drilling.

LOG OF BOREHOLE 3

Trow

Auger Sample
SPT(N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test + S
Natural Moisture X
Plastic and Liquid Limit
Penetrometer

Project: Geotechnical Investigation
Proposed Watermain Construction
King Street East (Mary Street to Wellington Street)
Hamilton, Ontario

Dwg. No: 5
Project No: H0 4362-A/G
Ground Elevation : m

Borehole location and datum see Drawing No. 2

Water Level	Elev. Scale (m)	Soil Description	Depth Scale m	Depth Scale ft	N Value	Sample	Unit Weight (Kn/m³)
	91.67	Asphaltic Concrete - 200mm thick					
		FILL: Sand and gravel, some slag, brown, damp	0.5	2	20		
	90.8	SILTY SAND: Reddish Brown, trace of clay and gravel, moist, compact to dense	1	4	12		
		- with trace rootlets from 1.5 to 2.0m depth	1.5	6	14		
			2				
			2.5	8	12		
			3	10	35		
	88.2	- brown cemented sand seams from 3.4 to 3.5 m depth	3.5	12			
		BOREHOLE TERMINATED	4	14			
			4.5	16			
			5				
			6.5	18			

N Value: 20 40 60 80 — Shear Strength 100 kPa 200
Natural Moisture Content % Dry Weight: 10 20 30

NOTE: BOREHOLE DATA REQUIRES INTERPRETATION ASSISTANCE FROM TROW BEFORE USE BY OTHERS.

1. Borehole advanced by solid stem augers to a termination depth of 3.5 m on March 16, 1998 by Landtest Drilling Ltd.
2. Upon completion of drilling, no caving, no free water.
3. Standpipe monitoring well installed to a 3.0 m depth (slotted from 0.3 to 3.0 m depth), March 25, 1995 - Water Level: Dry.
4. Borehole backfilled, sealed and patched upon completion of drilling.

RECORD OF BOREHOLE 7

PROJECT: 951-6031 | SHEET 1 OF 1

LOCATION: SEE PLAN FIGURE 1 | BORING DATE: 06/05/95 | DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm | PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (netV - +, rem.V - ⊕) (Q - ●, U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT, PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		91.37							
0	CME 75 TRUCKMOUNTED DRILLING 146mm SOLID STEM AUGERS	ASPHALT 91.27 CONCRETE 91.09 SAND and GRAVEL : (FILL) 90.99		0.38	1	SS	14				
1		Loose, brown, SILTY SAND to SANDY SILT; occasional gravel. (FILL)			2	SS	4				
					3	SS	15				
2				89.22							
		Very loose, brown, fine to medium, SAND; with silt layers.		2.15	4	SS	2				GROUND WATER ENCOUNTERED DURING DRILLING AT ELEVN 87.72m
3				88.32							
		Compact, brown, fine to medium, SAND.		3.05	5	SS	12				
4					6	SS	4				06/05/95
		Loose, brown, SILT.		87.20							
		END OF BOREHOLE		87.10 4.27							
5											
6											
7											
8											
9											

DATA INPUT: B.MCLEAN 06/06/95

DEPTH SCALE 1 to 50

LOGGED: K.G.

CHECKED: J.G.M.

Golder Associates

Project No: SM 031428-G

Log of Borehole No. 6-1

Project: Proposed Road Reconstruction - Phase II

Location: Hamilton, Ontario

Borehole Location: Wellington St. N, N of King St. E : 14m N, 2m W of wood hydro pole #8396

Client: Sutton & Associates

Project Manager: Ian Shaw, B.Eng., E.I.T.

Soil-Mat

SUBSURFACE PROFILE: Depth (ft / m)	Symbol	Description	Elevation	SAMPLE: Type	Number	Blows/300mm	PP (kgf/cm2)	U.Wt.(kN/m3)	Recovery	Moisture Content w% (10 20 30 40) / Standard Penetration Test blows/300mm (20 40 60 80)
0 / 0		Ground Surface	91.29							
		Asphaltic Concrete Approximately 75mm	91.02							
2		***Portland Cement Concrete*** Approximately 200mm		SS	1	18				
4		***Granular Base*** Approximately 150mm	89.89	SS	2	10				
6 / 2		***Silty Sand Fill*** Brown, trace of fine gravel, moist, compact.		SS	3	17				
8		***Sand*** Brown, medium to fine grained, trace of to some silt, occasional thin layering, moist, compact.		SS	4	7				
10				SS	5	21				
12 / 4			87.29							
14		***Silty Clay*** Grey, trace fine gravel, moist, very stiff.								
16				SS	6	27			4.0-4.5	
18 / 6			86.09							
20		End of Borehole								
22		NOTES: 1. Borehole advanced using solid stem continuous flight auger equipment on October 23, 2003 to a depth of 5.2 metres. 2. No free groundwater present at completion. Borehole backfilled with auger cuttings and topped with portland cement concrete. 3. Soil samples will be discarded after three months unless otherwise directed by the client.								
24										
26 / 8										
28										

Drill Method: Solid Stem Auger

Drill Date: October 23, 2003

Hole Size: 150mm

SOIL-MAT ENGINEERS & CONSULTANTS LTD.
130 Lancing Drive, Hamilton, ON L8W 3A1
Phone: (905) 318-7440 Fax: (905) 318-7455
e-mail: info@soil-mat.on.ca

Datum: Geodetic

Checked by: IS

Sheet: 1 of 1

this margin reserved for binding

PETO ASSOCIATES LTD.

RECORD OF BOREHOLE NO. 2

CONSULTING SOIL ENGINEERS

JOB NO. 69F66 | JOB NAME West Avenue Storm Sewer | TECHNICIAN BG

BORING DATE Mar. 18/69 | CLIENT Corporation of the City of Hamilton, c/o Proctor and Redfern Ltd. | ENGINEER JH

GROUND ELEV. 300.± | BOREHOLE TYPE Auger | TYPED BY JC

DEPTH ELEV.	SOIL PROFILE DESCRIPTION	LEGEND	SAMPLES NUMBER	TYPE	BLOWS/FOOT
	3" Black Pavement				
1'0"	PAVEMENT & CRUSHED STONE				
	FILL. Dark brown sandy silt fill moist		1	SS	4
6'2"	Loose		2	SS	8
	SILT/SAND. Brown interbedded sandy and silty sand, moist compact		3	SS	11
11'0"	SAND. Grey fine to medium sand, wet		4	SS	12
			5	SS	15
			6	SS	21
18'0"	Compact TILL. Grey clayey silt till		7	SS	21
			8	SS	18
	Wet		9	SS	15
			10	TW	Push
36'6"	Compact		11	SS	11
	Terminated at 36'6"				

DYNAMIC CONE PENETRATION BLOWS/FOOT
STANDARD PENETRATION TEST BLOWS/FOOT
10 20 30 40 50
SHEAR STRENGTH C_u LB/SQ.FT.

LIQUID LIMIT ——— W_L
PLASTIC LIMIT ——— W_p
WATER CONTENT ——— W
W_p W W_L
WATER CONTENT % 10 20 30

REMARKS

SITEST ENGINEERING DATA SHEET FOR BOREHOLE 3 DRAWING 4

Project No: 8916
Project: Proposed Sewers
Location: Steven Street, Hamilton, Ontario
Hole Location: See Drawing No: 1
Date Drilled: July 6, 1989
Drilled By: Solid Stem Auger (125 mm O.D.)
Datum: Geodetic Borehole Elevation 88.598 M

FIELD TESTS
50 mm O.D. Split Tube
50 mm I.D. Shelby Tube
Auger Sample
Core Sample
Cone Test ....
Vane Test +
Water Level

LABORATORY TESTS
Natural Moisture X
Plastic & Liquid Limits
Lab Vane Test
Torvane
Penetrometer 0
Unconfined Compression

SYMBOL	DESCRIPTION/CLASSIFICATION	ELEV M	DEPTH M	PENETRATION RESISTANCE 'N' blows/300mm 10 20 30 40 50 60 70	WATER CONTENT % 10 20 30	SAMPLE Type No:	REC %
	ASPHALT	88.51	0.09				
	CONCRETE	88.42	0.18				
	SILTY SAND, trace of gravel, brown, loose to compact, moist, layered		1	6	X	1	100
			2				
		86.00	2.60				
	SILTY CLAY TILL, trace of embedded sand and gravel, grey, moist, very stiff		3	17	X	2	100
	sand and gravel decreasing with depth		4	22	X	3	100
	some large gravel		5				
	—	83.11	5.49				
	BOREHOLE TERMINATED		6				

NOTES:
1. Borehole was moist and open to 4.1 metres on completion.
2. Borehole was backfilled on completion of the fieldwork.

Log of Borehole 1

Project No. HAGE-0060494-A Drawing No. 4

Project: Geotechnical Investigation - Proposed Sewer and Watermain Construction Sheet No. 1 of 1

Location: Wentworth Street (King Street to Barton Street), Hamilton, Ontario

Date Drilled: April 29, 2001

Drill Type: Truck Mount

Datum:

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test
Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH
		ASPHALT: ~ 90 mm thick	88.33	0
		CONCRETE (possible slag): ~ 190 mm thick	88.24	
		FILL: Silty sand, brown, fine grained, moist, compact	88.05	
		-reddish brown from 0.6 to 1.2 m		1
		SILTY SAND: Light brown to dark brown, oxidized stains, damp to moist, dense	85.93	2
		SILTY CLAY TILL: Grey, moist	84.93	3
		BOREHOLE TERMINATED	84.83	

N Value: Shear Strength 20 40 60 80 MPa 0.1 0.2

Combustible Vapour Reading (ppm): 250 500 750

Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

SAMPLES

Natural Unit Weight kN/m³

Notes:

1. Borehole advanced by solid stem auger equipment to a termination depth of 3.5 m on April 29, 2001.

2. Upon completion of drilling, cave at 3.4 m depth, no water.

3. In hole methane reading using MSA explosimeter: 0% methane.

4. Upon completion of drilling, 19 mm (3/4 in.) diameter P.V.C. standpipe installed to 3.4 m depth, screened portion 2.1 to 3.4 m depth, bentonite seal 0.2 to 1.1 m depth and asphalt patch from 0 to 0.2 m depth.

LAGWGL02 BHLOGS.GPJ NEW.GDT 5/14/01

Trow Consulting Engineers Ltd.
428 Millen Road
Stoney Creek, Ontario, L8E 3N9
Telephone: 905-664-3300
Fax: 905-662-4144
E-Mail: hamilton@trow.com

Time	Water Level (m)	Depth to Cave (m)
April 29, 2001		3.4
May 7, 2001	3.30	

PETO MacCALLUM LTD.
CONSULTING GEOTECHNICAL ENGINEERS

LOG OF BOREHOLE No. 1

JOB NAME Proposed Sanitary Sewers - Vineland and Vicinity JOB No. 76 F 153

LOCATION Hamilton, Ontario BORING DATE July 9/76 ENGINEER T.R.

BORING METHOD 4½" Auger (solid) TECHNICIAN H.K.

DEPTH	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS FOOT N - VALUES
0'0"	GROUND ELEVATION: 278.0					
0'9"	2" ASPHALT 7" CRUSHED STONE					
	SILTY SAND: gravelly fill, reddish brown, compact, uniform, wet		275			
3'8"	SILTY CLAY (TILL): brown to grey brown, very stiff, N.P.L., some multicoloured silt pockets			1	SS	15
			270	2	SS	22
12'0"±	becoming grey, stiff, W.T.P.L.		265	3	SS	15
16'0"	Borehole terminated at 16'0"			4	SS	11

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION ▪ STANDARD PENETRATION TEST ●
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT W_L
PLASTIC LIMIT W_P
WATER CONTENT W
W_P — W — W_L
WATER CONTENT % 10 20 30

GROUNDWATER OBSERVATIONS AND REMARKS

#1 Borehole dry and open at completion

NOTES:

CHECKED BY: KK

PML/304

MEMBER OF THE ASSOCIATION OF CONSULTING ENGINEERS OF CANADA

PETO MacCALLUM LTD.
CONSULTING GEOTECHNICAL ENGINEERS

LOG OF BOREHOLE No. 4

JOB NAME Proposed Sanitary Sewers - Vineland and Vicinity — JOB No. 76 F 153
LOCATION Hamilton, Ontario — BORING DATE July 13/76 — ENGINEER T.R.
BORING METHOD 4½" flight auge. — TECHNICIAN T.R.

DEPTH	DESCRIPTION	LEGEND	ELEVATION	SAMPLES NUMBER	SAMPLES TYPE	BLOWS FOOT N - VALUES
	GROUND ELEVATION: 286.4					
0'8"	2" ASPHALT& 6" CONCRETE BASE					
	SILTY SAND: fill, probably roadbase material, loose to compact, saturated		285	1	SS	9
			280	2	SS	12
9'3"	SILTY CLAY (TILL): grey, stiff to very stiff in siltier zones, W.T.P.L., quite gritty		275	3	SS	13
				4	SS	16
16'6"	Borehole terminated at 16'6"		270	5	SS	12

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION x
STANDARD PENETRATION TEST •
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT W_L
PLASTIC LIMIT W_P
WATER CONTENT W
W_P W W_L
WATER CONTENT % 10 20 30

GROUNDWATER OBSERVATIONS AND REMARKS

After Sad cave 7'
Water 6'8"
(perched in sand fill)

Cave 14'6"
Water 11'6"
(mostly saturated sands)

Note: Borehole moved 60' west of anticipated location due to parked cars.

NOTES:

CHECKED BY: KK

PML/504 — MEMBER OF THE ASSOCIATION OF CONSULTING ENGINEERS OF CANADA

PETO MacCALLUM LTD.
CONSULTING GEOTECHNICAL ENGINEERS

LOG OF BOREHOLE No. 6

JOB NAME Proposed Sanitary Sewer - Vineland and Vicinity — JOB No. 76 F 153
LOCATION Hamilton, Ontario — BORING DATE July 13/76 — ENGINEER T.R.
BORING METHOD 4½" flight auger — TECHNICIAN T.R.

DEPTH	DESCRIPTION	LEGEND	ELEVATION	SAMPLES NUMBER	SAMPLES TYPE	BLOWS FOOT N - VALUES
0'0"	GROUND ELEVATION: 283.2					
0'8"	2"ASPHALT 6" CONCRETE BASE					
2'0"	CRUSHED STONE:					
2'6"	SILTY SAND: fill					
	SILTY CLAY (TILL): brown to grey brown, very stiff, O.T.P.L., quite gritty, numerous multicoloured silt seams and pockets.		280	1	SS	22
				2	SS	28
10'7"			275			
	becoming grey, stiff, A.P.L. some silt pockets, shale fragments, gritty to depth.			3	SS	11
			270	4	SS	11
16'6"	Borehole terminated at 16'6"			5	SS	10
			265			

SHEAR STRENGTH C_u ▲
DYNAMIC CONE PENETRATION x
STANDARD PENETRATION TEST •
BLOWS/FOOT 20 40 60 80

LIQUID LIMIT W_L
PLASTIC LIMIT W_P
WATER CONTENT W
W_P W W_L
WATER CONTENT % 10 20 30

GROUNDWATER OBSERVATIONS AND REMARKS

Upon completion hole open and dry.

Note: Borehole located 20' south of anticipated location due to overhead wires.

NOTES:

CHECKED BY: KK

PML/504 — MEMBER OF THE ASSOCIATION OF CONSULTING ENGINEERS OF CANADA

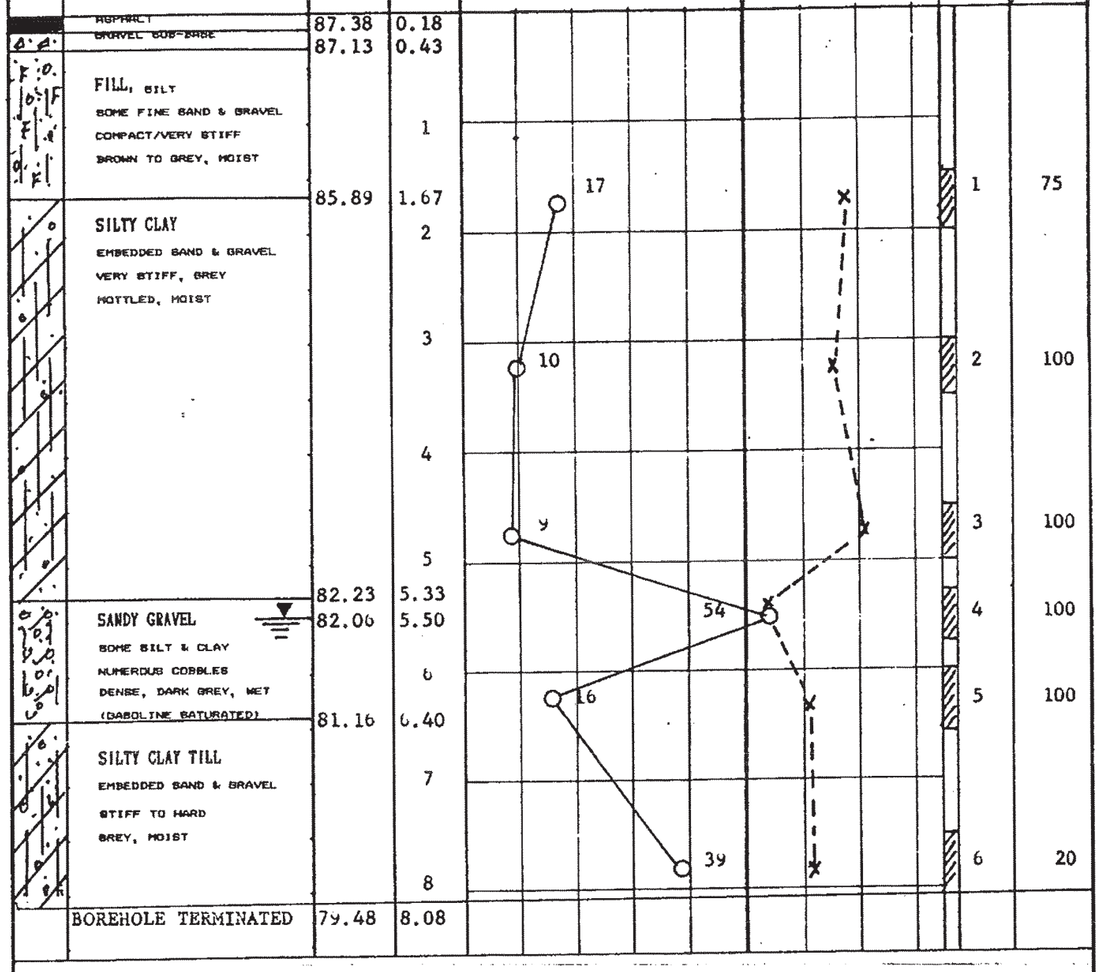
SITEST ENGINEERING — DATA SHEET FOR BOREHOLE 1 — DRAWING ____ (SHEET ____ OF ____)

Project No. 8903 (Your No. ____)
Project PROPOSED SEWERS
Location KING STREET @ GAGE
HAMILTON, ONTARIO
Hole Location SEE DRAWING NO: 1
Date Drilled APR 07, 1989 Hole VERTICAL
Drilled by SOLID STEM AUGER (165 MM O.D.)
Datum GEODETIC 87.564 METRES

Field: 3" O.D. Split Tube; 3", 3" I.D. Shelby Tube; Rotary Core Sample; Auger or Wash Sample; 3" Dia. Cone; Field Vane; Pressure Meter; Sampler Pushed (pressure); Water Table (definite, apparent); P( )
Laboratory: Natural Moisture; Plastic & Liquid Limit; Lab Vane Test; Torvane; Unconfined Compression; Undrained Triaxial at Overburden Pressure; Stress at Failure; Sensitivity

Symbol	Description / Classification	Elevation (metres)	Depth (metres)	Sample Type & Number	Unit weight / Recovery %
	ASPHALT	87.38	0.18		
	GRAVEL SUB-BASE	87.13	0.43		
	FILL, SILT SOME FINE SAND & GRAVEL COMPACT/VERY STIFF BROWN TO GREY, MOIST			1	75
	SILTY CLAY EMBEDDED SAND & GRAVEL VERY STIFF, GREY MOTTLED, MOIST	85.89	1.67	2	100
	SANDY GRAVEL SOME SILT & CLAY NUMEROUS COBBLES DENSE, DARK GREY, WET (DABOLINE SATURATED)	82.23 82.06	5.33 5.50	3 4	100 100
	SILTY CLAY TILL EMBEDDED SAND & GRAVEL STIFF TO HARD GREY, MOIST	81.16	6.40	5 6	100 20
	BOREHOLE TERMINATED	79.48	8.08		

Penetration Resistance, N, 350 ft.lbs. blows/ft. (10 20 30 40; Shear Strength 50 100 150 200 kPa)
Natural Water Content & Atterberg Limits (% dry weight) (10 20 30; Sensitivity)



Notes
1. WATER LEVEL OBSERVED AT 5.5 METRES 1/2 HOUR AFTER COMPLETION OF BOREHOLE.
2. BOREHOLE WAS BACKFILLED ON COMPLETION.
3. BOREHLOE WAS RELOCATED TO THE SOUTHEAST CORNER OF KING/GAGE.
4. ACTUAL ELEVATIONS ARE SLIGHTLY LOWER THAN SHOWN.

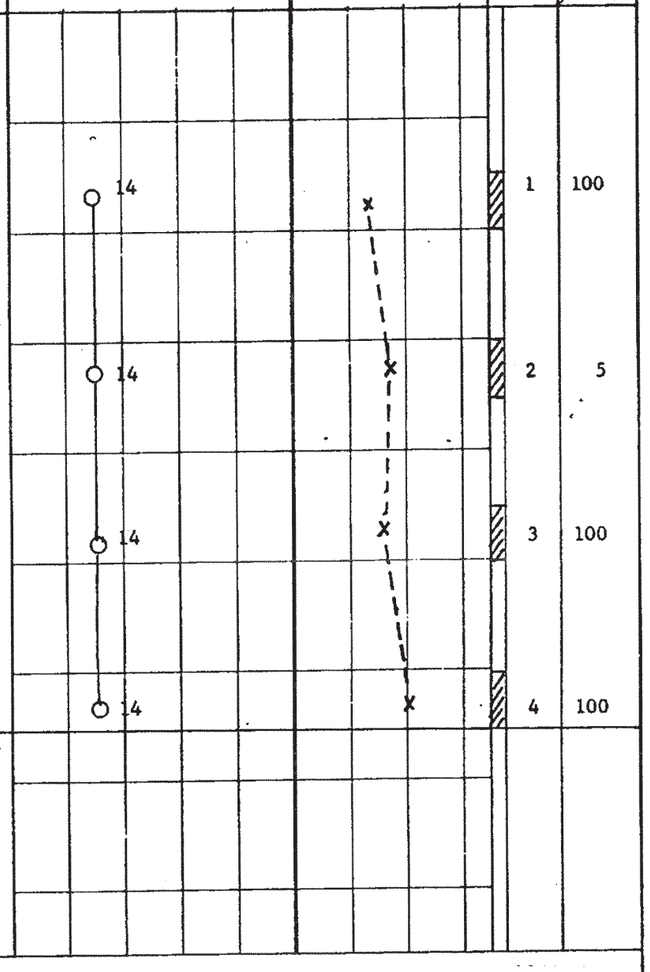
SITEST ENGINEERING — DATA SHEET FOR BOREHOLE 2 — DRAWING ____ (SHEET ____ OF ____)

Project No. 8903 (Your No. ____)
Project PROPOSED SEWERS
Location KING STREET @ EASTBEND
HAMILTON, ONTARIO
Hole Location SEE DRAWING NO: 1
Date Drilled APR 07, 1989 Hole VERTICAL
Drilled by SOLID STEM AUGER (165 MM O.D.)
Datum GEODETIC 89.432 METRES

Field: 3" O.D. Split Tube; 3", 3" I.D. Shelby Tube; Rotary Core Sample; Auger or Wash Sample; 3" Dia. Cone; Field Vane; Pressure Meter; Sampler Pushed (pressure); Water Table (definite, apparent); P( )
Laboratory: Natural Moisture; Plastic & Liquid Limit; Lab Vane Test; Torvane; Unconfined Compression; Undrained Triaxial at Overburden Pressure; Stress at Failure; Sensitivity

Symbol	Description / Classification	Elevation (metres)	Depth (metres)	Sample Type & Number	Unit weight / Recovery %
	ASPHALT	89.28	0.15		
	CONCRETE	89.08	0.35		
	SILT SOME SAND AND CLAY MOTTLED BROWN/GREY MULTI-COLOURED, REDDISH BROWN COMPACT, MOIST			1	100
	SILTY CLAY TILL EMBEDDED SAND & GRAVEL THIN WET SILT SEAMS STIFF, GREY, MOIST	86.23	3.20	2 3 4	5 100 100
	BOREHOLE TERMINATED	82.88	6.55		

Penetration Resistance, N, 350 ft.lbs. blows/ft. (10 20 30 40; Shear Strength 50 100 150 200 kPa)
Natural Water Content & Atterberg Limits (% dry weight) (10 20 30; Sensitivity)



Notes
1. BOREHOLE WAS MOIST AND OPEN TO 6.0 METRES ON COMPLETION OF BOREHOLE.
2. BOREHOLE WAS BACKFILLED ON COMPLETION.
3. BOREHLOE WAS RELOCATED TO THE SOUTHWEST CORNER OF KING/EASTBEND.
4. ACTUAL ELEVATIONS ARE SLIGHTLY LOWER THAN SHOWN.

SITEST ENGINEERING DATA SHEET FOR BOREHOLE 3 DRAWING ____ (SHEET ____ OF ____)

Project No. 8903 (Your No. ____)
Project PROPOSED SEWERS
Location KING STREET @ GLENDALE
HAMILTON, ONTARIO
Hole Location SEE DRAWING NO: 1
Date Drilled APR 07, 1989 Hole VERTICAL
Drilled by SOLID STEM AUGER (165 MM O.D.)
Datum GEODETIC 90.078 METRES

Field
3" O.D. Split Tube
3", 3" I.D. Shelby Tube
Rotary Core Sample
Auger or Wash Sample
3" Dia. Cone
Field Vane
Pressure Meter
Sampler Pushed (pressure) P( )
Water Table (date/hrs. elapsed)

Laboratory
Natural Moisture
Plastic & Liquid Limit
Lab Vane Test
Torvane
Unconfined Compression
Undrained Triaxial at Overburden Pressure
Direct or Fixture
Sensitivity

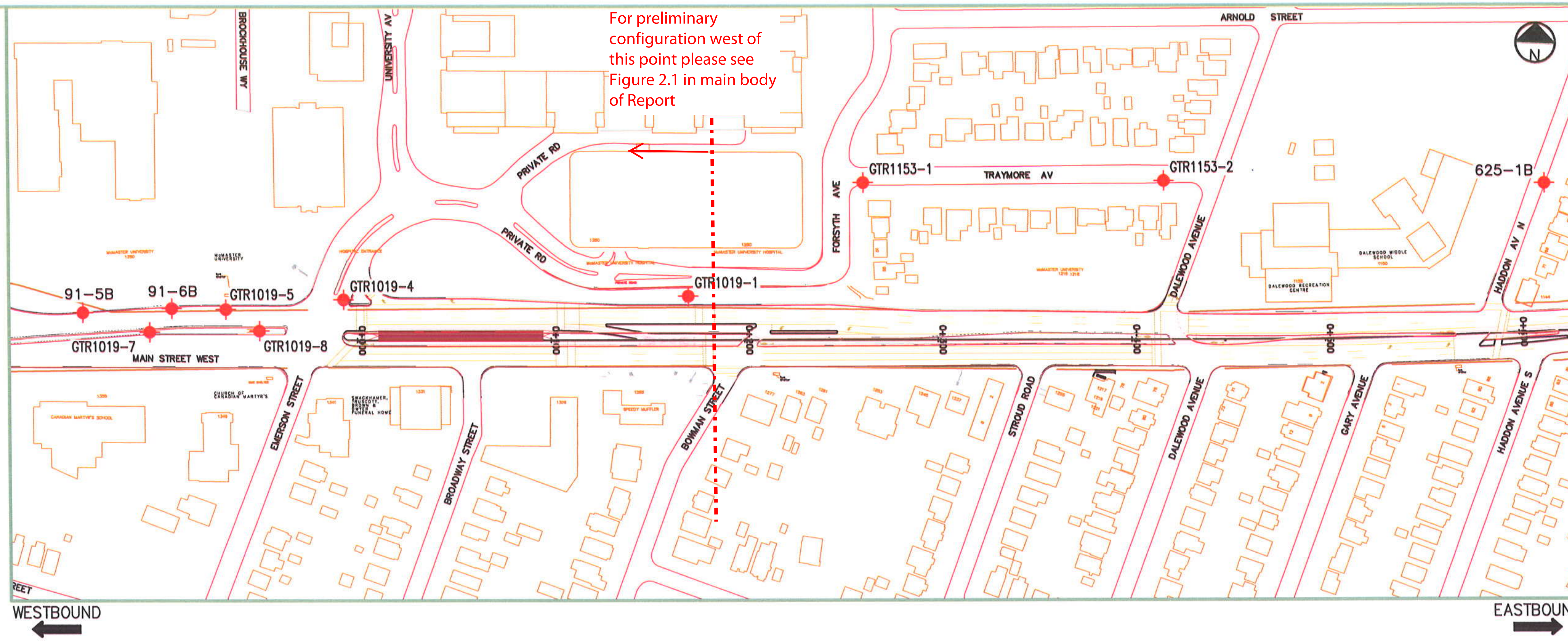
Symbol	Description / Classification	Elevation (metres)	Depth (metres)	Penetration Resistance, N, 350 ft lbs blows/ft. (10 20 30 40) Shear Strength (kPa) 50 100 150 200	Natural Water Content & Atterberg Limits (% dry weight) 10 20 30 Sensitivity	Sample Type & Number	Unit weight / Recovery %
	ASPHALT	89.98	0.10				
	CONCRETE	89.83	0.25				
	SILTY CLAY MOTTLED BROWN/GREY STIFF, MOIST		1	12		1	100
		88.68	1.40				
	SILTY CLAY TILL EMBEDDED SAND & GRAVEL THIN WET SILT SEAMS BROWN GREY		2	26		2	75
			3	15		3	100
			4				
	GRAVELLY CLAY	85.13	4.95	15		4	100
	BOREHOLE TERMINATED	85.05	5.03				

Notes
1. BOREHOLE WAS MOIST AND OPEN TO 4.5 METRES ON COMPLETION OF BOREHOLE.
2. BOREHOLE WAS BACKFILLED ON COMPLETION.
3. BOREHLOE WAS RELOCATED TO THE SOUTHWEST CORNER OF KING/GLENDALE.
4. ACTUAL ELEVATIONS ARE SLIGHTLY LOWER THAN SHOWN

MAIN STREET EAST

APPENDIX C

BOREHOLE LOCATION PLANS AND INFERRED STRATIGRAPHIC PROFILE



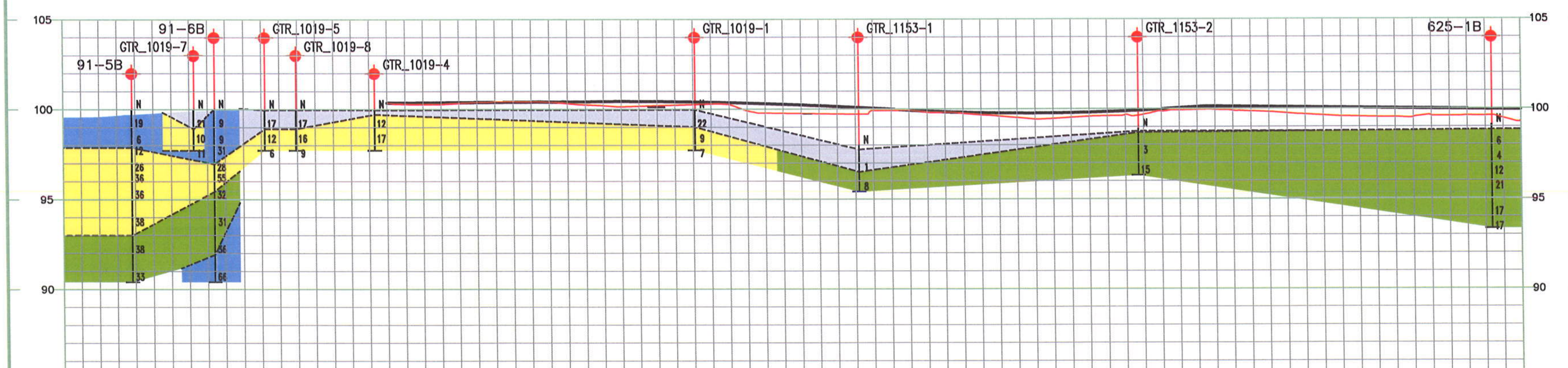
FILE No. | CONTRACT No. PW 00-00 (-) | SHEET No.

DIMENSIONS SHOWN ON THIS PLAN ARE IN METRES UNLESS OTHERWISE NOTED

LEGEND

- NEW CONSTRUCTION
- EXISTING
- PROPERTY LINE (ROAD ALLOWANCE)
- EXISTING BOREHOLE LOCATION
- FILL
- CLAY
- SILT
- SAND
- TILL
- SHALE

DRAFT



CONSTRUCTION ℄ CHAINAGE	PROPOSED TOP OF RAIL PROFILE	EXISTING GROUND ELEVATION
0+000	100.344	100.346
	100.361	100.278
	100.379	100.380
	100.396	100.416
0+100	100.413	100.334
	100.428	100.187
	100.420	100.112
	100.387	100.240
0+200	100.329	99.923
	100.245	99.760
	100.136	99.735
	100.004	99.913
0+300	99.875	99.836
	99.789	99.720
	99.752	99.523
	99.764	99.501
0+400	99.826	99.617
	99.938	99.805
	100.094	99.955
	100.104	99.883
0+500	100.076	99.759
	100.048	99.609
	100.020	99.543
	99.992	99.615
0+600	99.964	99.614
	99.936	99.326

No.	REVISIONS	INITIAL	DATE

DRAWN BY: Initials DATE:

REFERENCE MATERIAL:
Surveyed By :
Sewer Plans :
Water Plans :
Survey Plan :

Geodetic Bench Mark Index Elevation=
Borehole Report –

SCALES
HORIZONTAL 0 12.5m 25m 50m 1:2500
VERTICAL 0 1.25m 2.5m 5m 1:250

Project Manager (Design)
NAME
Manager of Design
NAME

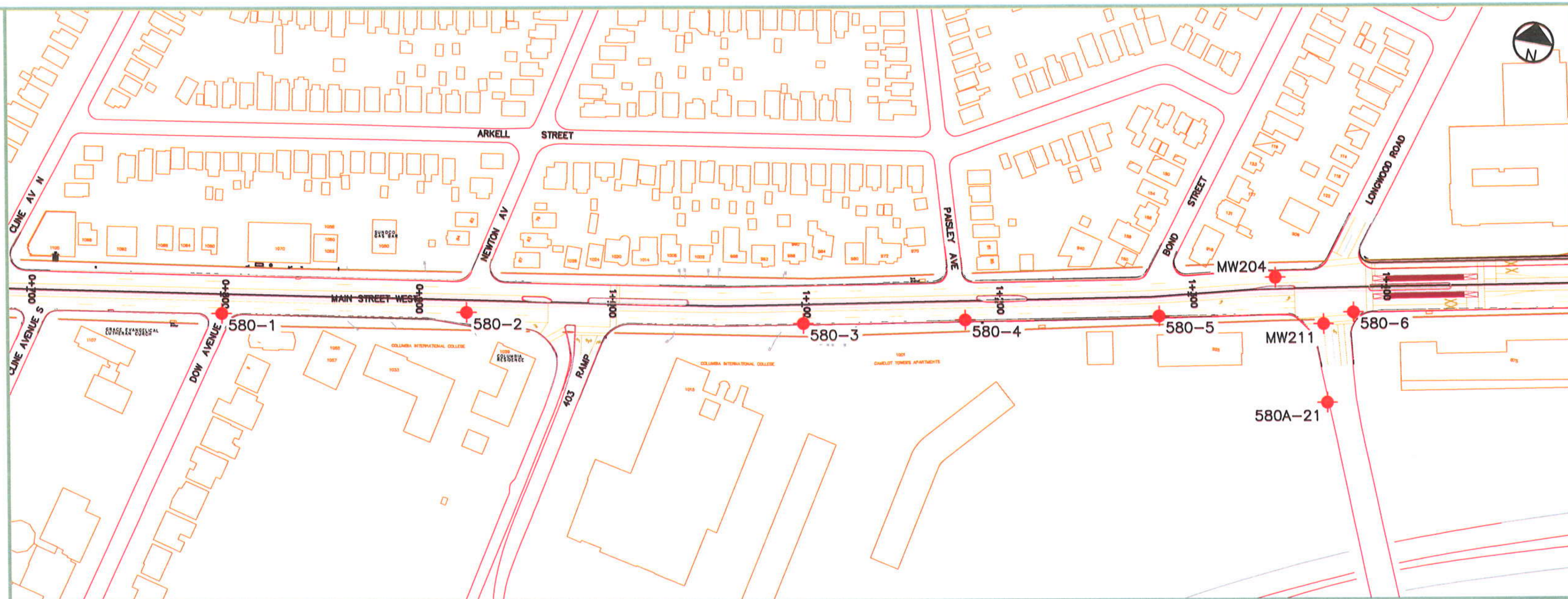
SNC·LAVALIN | steer davies gleave | DIALOG | THURBER ENGINEERING LTD. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

DRAWN . . . . .
CHECKED . . . . .
APPROVED . . . . .

Hamilton Public Works | RAPIDTransit moving HAMILTON forward | METROLINX An agency of the Government of Ontario

HAMILTON LRT 'B' LINE BOREHOLE PLAN AND STRATIGRAPHIC PROFILE

SHEET 1 OF 17



WESTBOUND ← → EASTBOUND

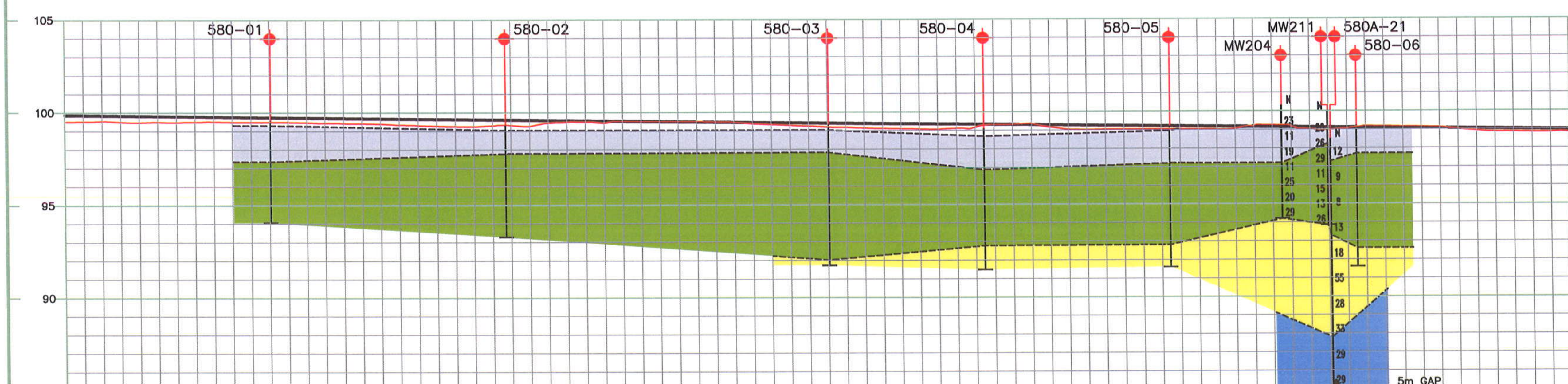
FILE No.	CONTRACT No. PW 00-00 (-)	SHEET No.

DIMENSIONS SHOWN ON THIS PLAN ARE IN METRES UNLESS OTHERWISE NOTED

LEGEND

- NEW CONSTRUCTION
- EXISTING
- PROPERTY LINE (ROAD ALLOWANCE)
- EXISTING BOREHOLE LOCATION
- FILL
- CLAY
- SILT
- SAND
- TILL
- SHALE

DRAFT



CONSTRUCTION ℄ CHAINAGE	PROPOSED TOP OF RAIL PROFILE	EXISTING GROUND ELEVATION
0+700	99.852	99.523
	99.824	99.480
	99.796	99.483
	99.768	99.507
0+800	99.740	99.486
	99.712	99.451
	99.685	99.419
	99.657	99.339
0+900	99.629	99.258
	99.601	99.333
	99.573	99.441
	99.545	99.469
1+000	99.517	99.507
	99.489	99.505
	99.461	99.459
	99.433	99.317
1+100	99.405	99.207
	99.377	99.128
	99.349	99.089
	99.322	99.107
1+200	99.294	99.307
	99.267	99.111
	99.240	99.044
	99.213	99.043
1+300	99.187	99.035
	99.161	99.155
	99.135	99.172
	99.108	99.018
1+400	99.082	99.170
	99.056	99.140
	99.030	98.900
	99.003	98.860
1+500	[illegible]	[illegible]

No.	REVISIONS	INITIAL	DATE

DRAWN BY: Initials DATE:

REFERENCE MATERIAL:
Surveyed By :
Sewer Plans :
Water Plans :
Survey Plan :

Geodetic Bench Mark Index Elevation=
Borehole Report –

SCALES
HORIZONTAL 0 12.5m 25m 50m 1:2500
VERTICAL 0 1.25m 2.5m 5m 1:250

Project Manager (Design)
NAME
Manager of Design
NAME

SNC·LAVALIN
steer davies gleave
DIALOG
THURBER ENGINEERING LTD. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

DRAWN . . . . .
CHECKED . . . . .
APPROVED . . . . .

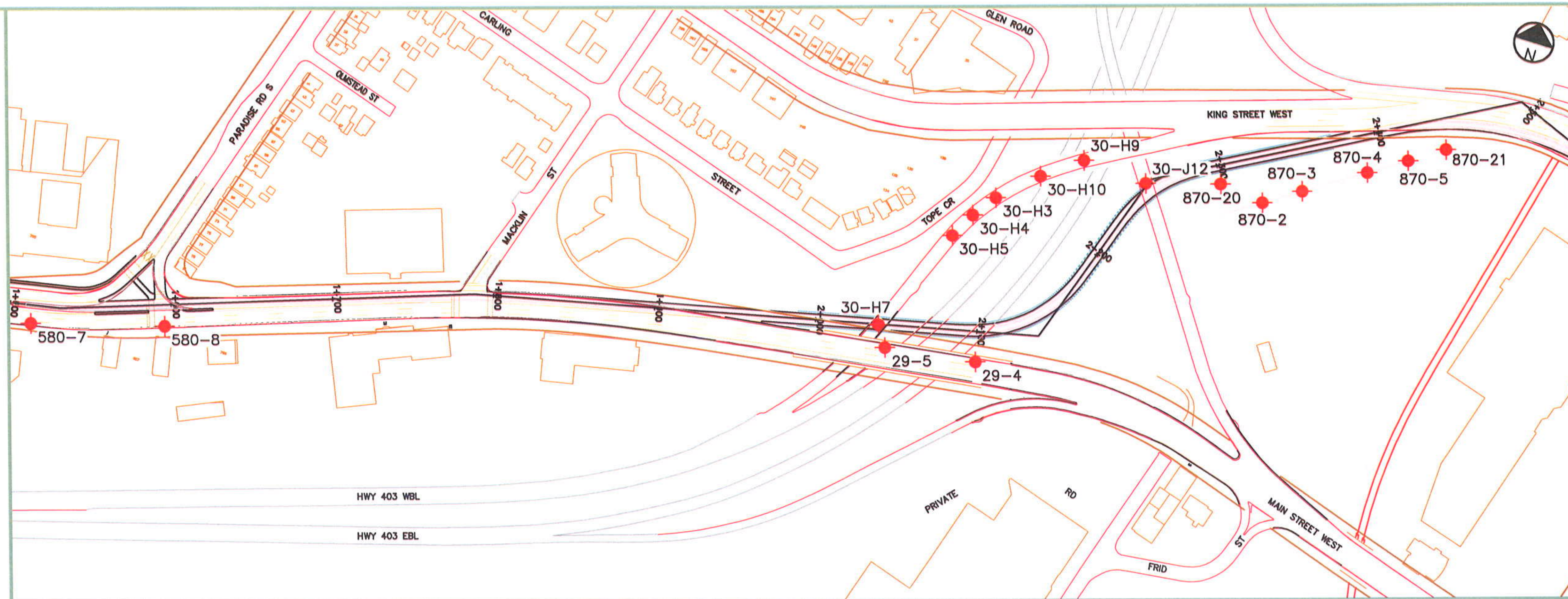
Hamilton Public Works
RAPIDTransit moving HAMILTON forward
METROLINX An agency of the Government of Ontario

HAMILTON LRT 'B' LINE BOREHOLE PLAN AND STRATIGRAPHIC PROFILE

SHEET 2 OF 17

FILE No.	CONTRACT No. PW 00-00 (-)	SHEET No.

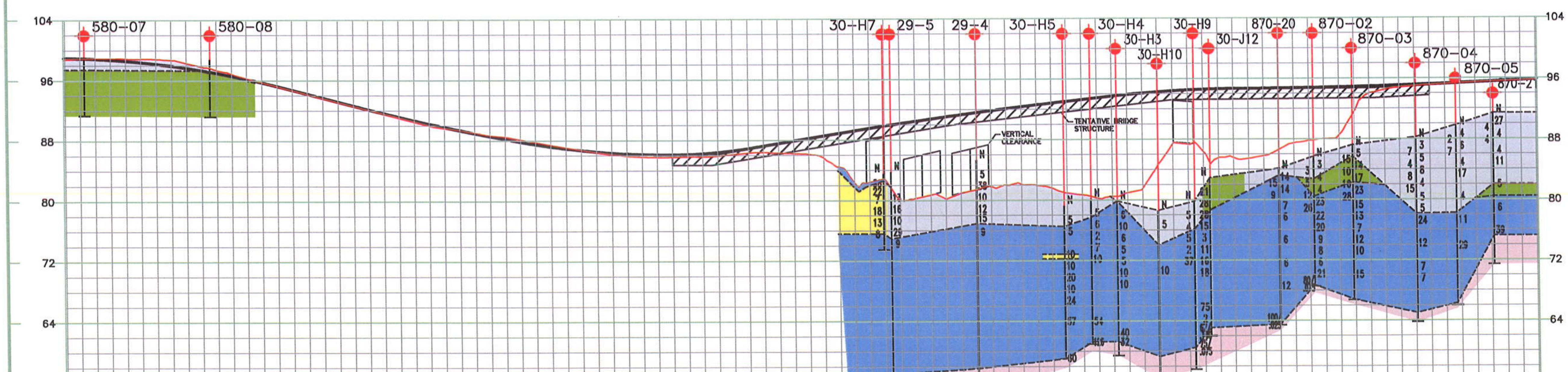
DIMENSIONS SHOWN ON THIS PLAN ARE IN METRES UNLESS OTHERWISE NOTED



LEGEND

- NEW CONSTRUCTION
- EXISTING
- PROPERTY LINE (ROAD ALLOWANCE)
- EXISTING BOREHOLE LOCATION
- FILL
- CLAY
- SILT
- SAND
- TILL
- SHALE

DRAFT



CONSTRUCTION ℄ CHAINAGE	PROPOSED TOP OF RAIL PROFILE	EXISTING GROUND ELEVATION
1+500	98.975	98.888
	98.798	98.932
	98.409	98.889
	97.808	98.617
1+600	96.993	97.428
	95.966	96.044
	94.730	94.681
	93.426	93.354
1+700	92.129	92.071
	90.910	90.775
	89.787	89.663
	88.759	88.865
1+800	87.821	88.148
	87.050	87.265
	86.510	86.421
	86.201	85.902
1+900	86.120	85.810
	86.330	85.881
	86.916	86.364
	87.738	86.312
2+000	88.563	85.687
	89.381	82.331
	90.157	79.817
	90.887	80.733
2+100	91.57[illegible]	81.422
	92.214	82.235
	92.810	81.657
	93.368	80.519
2+200	93.910	80.961
	94.319	85.977
	94.567	86.390
	94.655	85.340
2+300	94.695	86.642
	94.765	87.933
	94.869	91.670
	95.007	94.686
2+400	95.181	95.095
	95.389	95.396
	95.628	95.613

No.	REVISIONS	INITIAL	DATE	DRAWN BY: Initials	DATE:

REFERENCE MATERIAL:
Surveyed By :
Sewer Plans :
Water Plans :
Survey Plan :

Geodetic Bench Mark Index Elevation=
Borehole Report –

SCALES
HORIZONTAL 1:3000 (0 15m 30m 60m)
VERTICAL 1:600 (0 3m 6m 12m)

Project Manager (Design)
NAME
Manager of Design
NAME

steer davies gleave
SNC·LAVALIN
DIALOG
THURBER ENGINEERING LTD. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

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CHECKED . . . . .
APPROVED . . . . .

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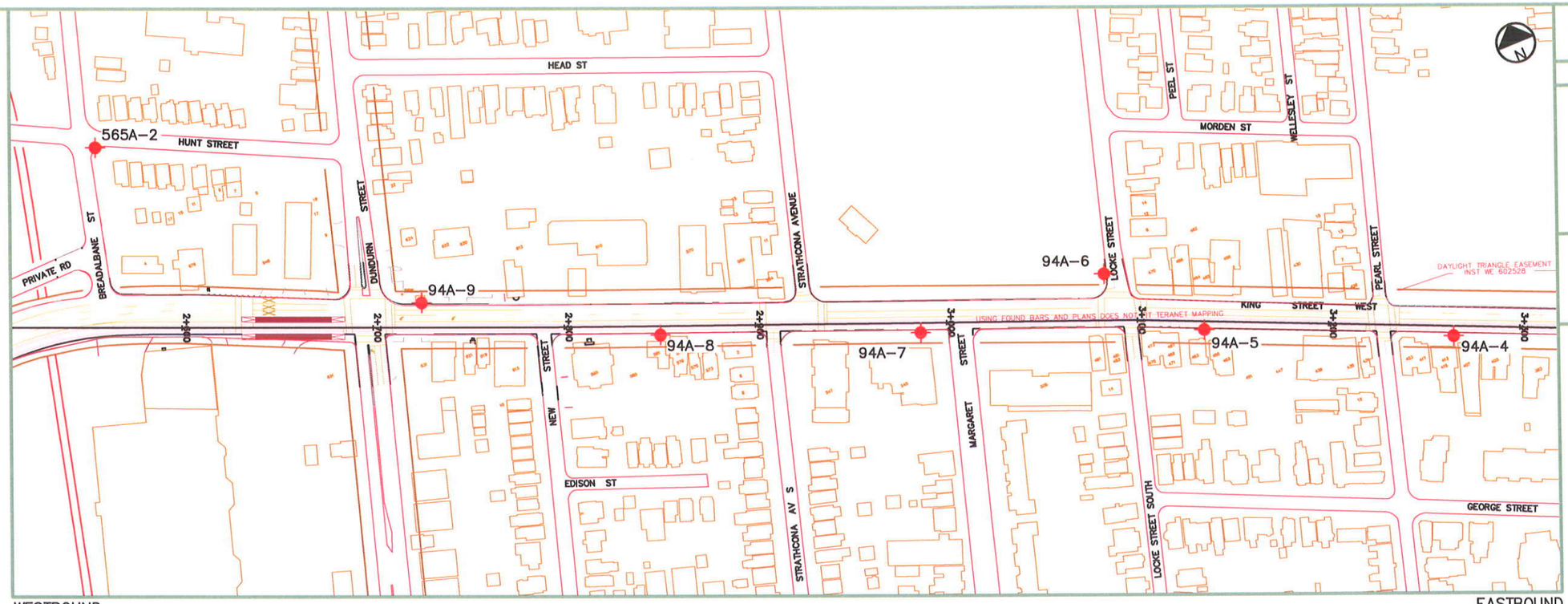
METROLINX An agency of the Government of Ontario

HAMILTON LRT 'B' LINE BOREHOLE PLAN AND STRATIGRAPHIC PROFILE

SHEET 3 OF 17

FILE No.	CONTRACT No. PW 00-00 (-)	SHEET No.

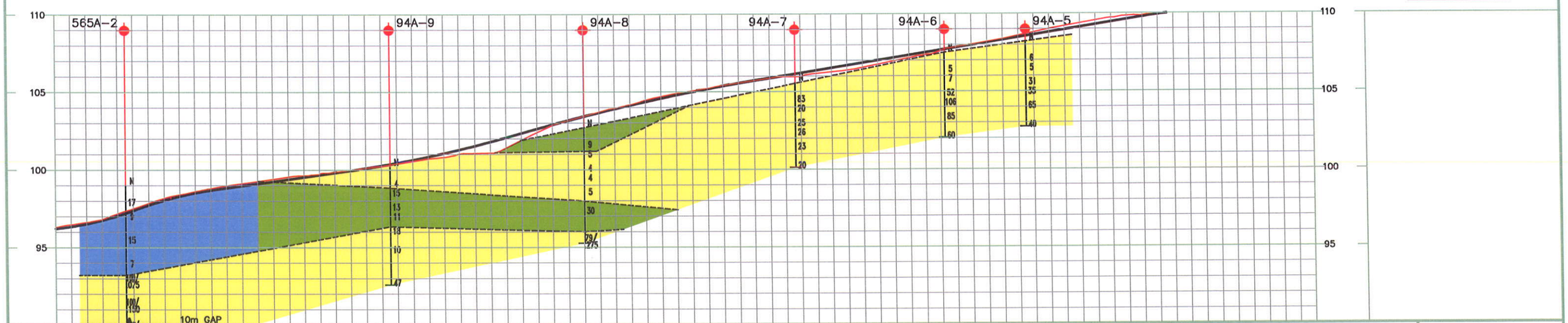
DIMENSIONS SHOWN ON THIS PLAN ARE IN METRES UNLESS OTHERWISE NOTED



LEGEND

- NEW CONSTRUCTION
- EXISTING
- PROPERTY LINE (ROAD ALLOWANCE)
- EXISTING BOREHOLE LOCATION
- FILL
- CLAY
- SILT
- SAND
- TILL
- SHALE

DRAFT



	2+600	2+700	2+800	2+900	3+000	3+100	3+200	3+300
PROPOSED TOP OF RAIL PROFILE	98.422 97.035 97.883	98.509 98.893 99.243 99.594 99.945	100.346 100.832 101.405 102.063 102.754	103.407 104.012 104.569 105.077 105.538 105.953	106.359 106.764 107.170 107.575	107.981 108.387 108.792 109.198 109.603	109.975 110.245 110.410	110.471
EXISTING GROUND ELEVATION	98.555 97.183 98.025	98.611 99.059 99.409 99.685 99.988	100.311 100.722 101.067 101.422 102.597	103.425 104.052 104.704 105.130 105.579 105.934	106.170 106.469 106.971 107.489	108.020 108.483 109.018 109.473 109.843	110.088 110.388 110.579	110.619
CONSTRUCTION ℄ CHAINAGE								

No.	REVISIONS	INITIAL	DATE

DRAWN BY: Initials DATE:

REFERENCE MATERIAL:
Surveyed By :
Sewer Plans :
Water Plans :
Survey Plan :

Geodetic Bench Mark Index Elevation=
Borehole Report –

SCALES
0 12.5m 25m 50m
HORIZONTAL 1:2500
0 1.25m 2.5m 5m
VERTICAL 1:250

Project Manager (Design)
NAME
Manager of Design
NAME

steer davies gleave
SNC·LAVALIN DIALOG
THURBER ENGINEERING LTD.
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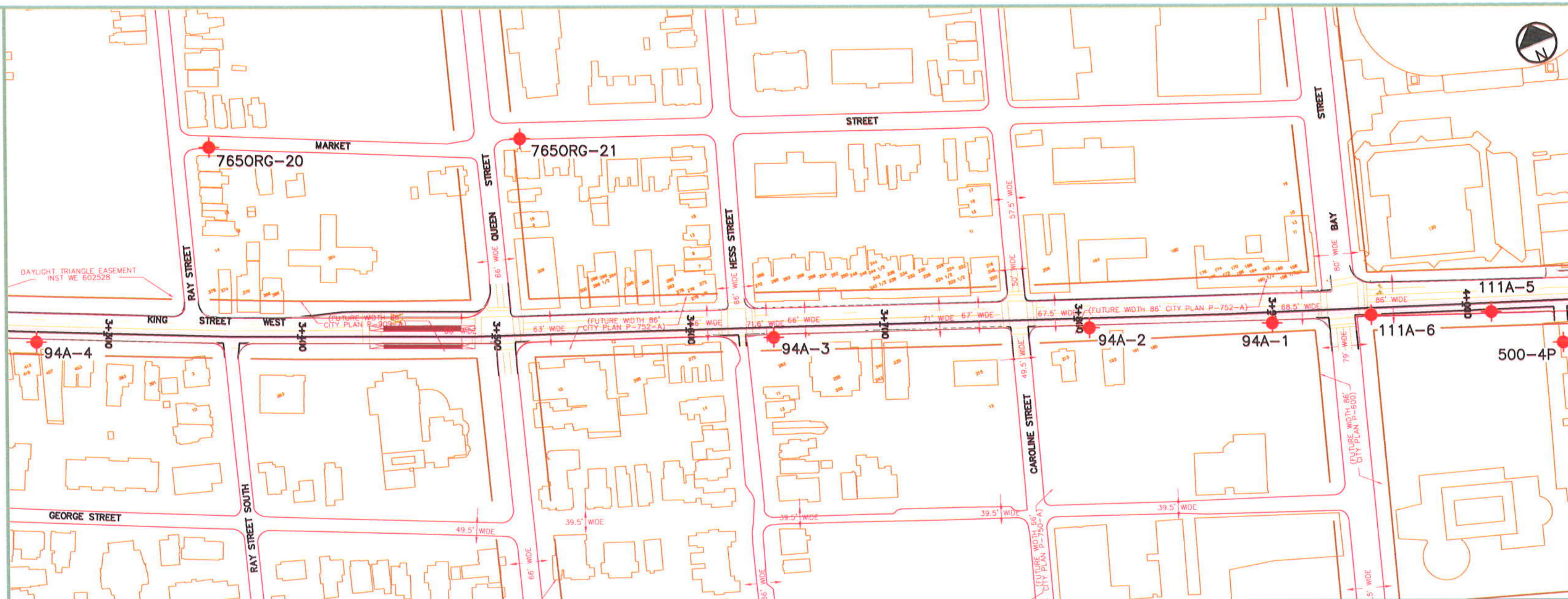
HAMILTON LRT 'B' LINE BOREHOLE PLAN AND STRATIGRAPHIC PROFILE

SHEET 4 OF 17



WESTBOUND

EASTBOUND

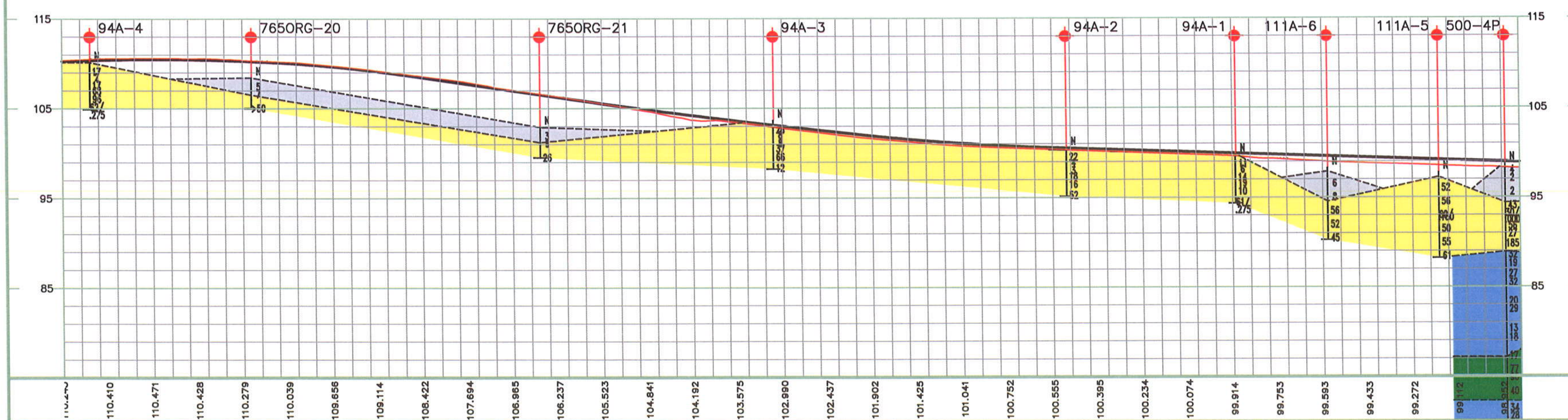
FILE No.	CONTRACT No. PW 00-00 (-)	SHEET No.

DIMENSIONS SHOWN ON THIS PLAN ARE IN METRES UNLESS OTHERWISE NOTED

LEGEND

- NEW CONSTRUCTION
- EXISTING
- PROPERTY LINE (ROAD ALLOWANCE)
- EXISTING BOREHOLE LOCATION
- FILL
- CLAY
- SILT
- SAND
- TILL
- SHALE

DRAFT



PROPOSED TOP OF RAIL PROFILE	EXISTING GROUND ELEVATION	CONSTRUCTION ℄ CHAINAGE
[illegible]	[illegible]	
110.410	110.579	
110.471	110.619	3+300
110.428	110.596	
110.279	110.385	
110.039	110.167	
109.656	109.765	3+400
109.114	109.224	
108.422	108.587	
107.694	107.931	
106.965	107.038	3+500
106.237	106.313	
105.523	105.502	
104.841	104.705	
104.192	103.689	3+600
103.575	103.409	
102.990	102.792	
102.437	102.191	
101.902	101.628	3+700
101.425	101.166	
101.041	100.773	
100.752	100.541	
100.555	100.318	3+800
100.395	100.165	
100.234	100.005	
100.074	99.848	
99.914	99.643	3+900
99.753	99.308	
99.593	99.022	
99.433	98.813	
99.272	98.663	4+000
99.112	98.477	
98.952	98.317	

No.	REVISIONS	INITIAL	DATE	DRAWN BY: Initials	DATE:

REFERENCE MATERIAL:
Surveyed By :
Sewer Plans :
Water Plans :
Survey Plan :

Geodetic Bench Mark Index Elevation=
Borehole Report –

SCALES
HORIZONTAL 0 12.5m 25m 50m 1:2500
VERTICAL 0 2.5m 5m 10m 1:500

Project Manager (Design)
NAME
Manager of Design
NAME

SNC·LAVALIN
steer davies gleave
DIALOG
THURBER ENGINEERING LTD. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

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CHECKED . . . . .
APPROVED . . . . .

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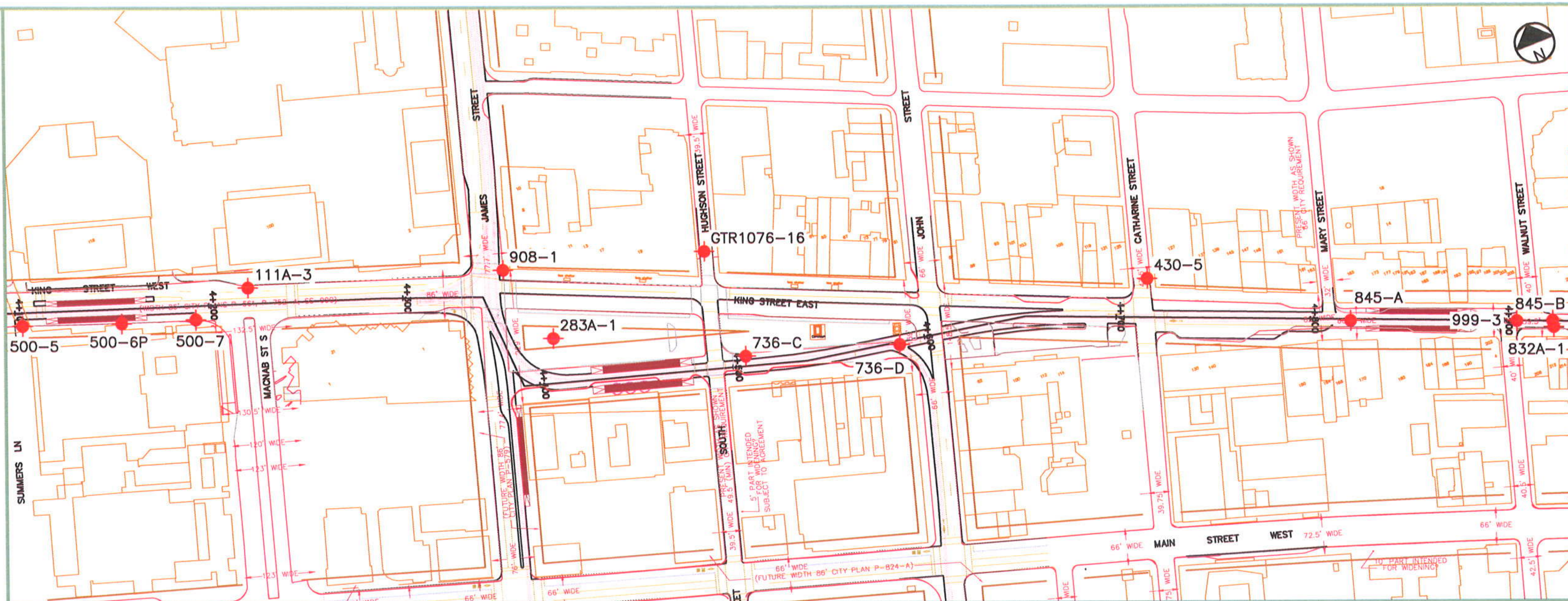
HAMILTON LRT 'B' LINE BOREHOLE PLAN AND STRATIGRAPHIC PROFILE

SHEET 5 OF 17

FILE No.	CONTRACT No. PW 00-00 (-)	SHEET No.

DIMENSIONS SHOWN ON THIS PLAN ARE IN METRES UNLESS OTHERWISE NOTED

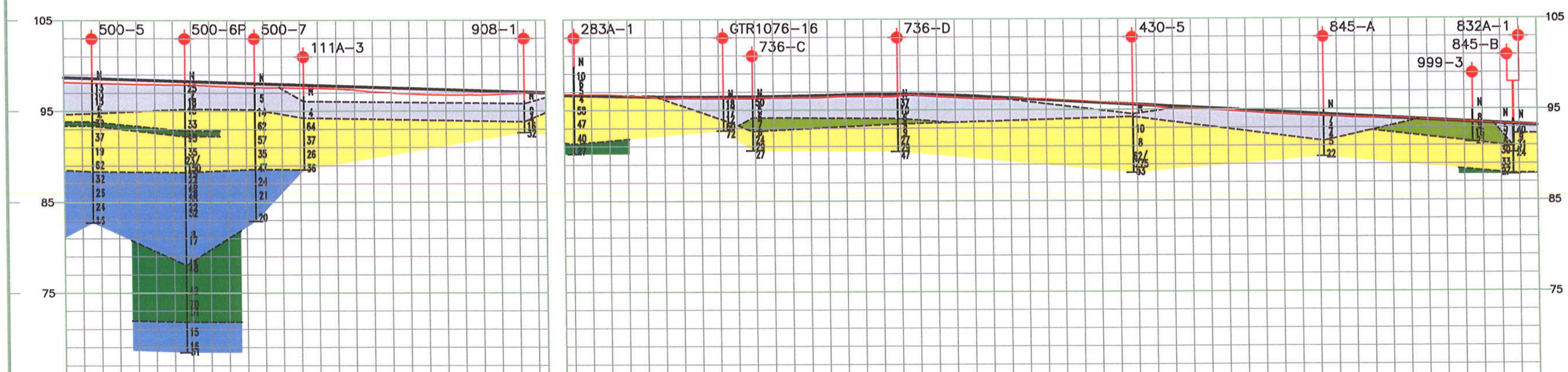


LEGEND

- NEW CONSTRUCTION
- EXISTING
- PROPERTY LINE (ROAD ALLOWANCE)
- EXISTING BOREHOLE LOCATION
- FILL
- CLAY
- SILT
- SAND
- TILL
- SHALE

WESTBOUND ← → EASTBOUND

DRAFT



PROPOSED TOP OF RAIL PROFILE	EXISTING GROUND ELEVATION	CONSTRUCTION ℄ CHAINAGE
98.631	98.154	4+100
98.471	98.022	
98.310	97.928	
98.150	97.776	
97.990	97.627	4+200
97.829	97.550	
97.669	97.354	
97.509	96.970	
97.349	96.788	4+300
97.188	96.819	
97.028	96.977	
96.573	96.747	
96.486	96.501	
96.447	96.332	
96.456	96.299	4+500
96.512	96.362	
96.616	96.450	
96.714	96.513	
96.694	96.605	4+600
96.552	96.314	
96.300	96.190	
96.032	96.136	
95.763	95.839	4+700
95.495	95.476	
95.227	95.101	
94.958	94.814	
94.690	94.479	4+800
94.421	94.245	
94.153	94.040	
93.885	93.878	
93.616	93.594	4+900
93.348	93.361	

No.	REVISIONS	INITIAL	DATE

DRAWN BY: Initials DATE:

REFERENCE MATERIAL:
Surveyed By :
Sewer Plans :
Water Plans :
Survey Plan :

Geodetic Bench Mark Index Elevation=
Borehole Report –

SCALES
0 12.5m 25m 50m HORIZONTAL 1:2500
0 2.5m 5m 10m VERTICAL 1:500

Project Manager (Design)
NAME
Manager of Design
NAME

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CHECKED . . . . .
APPROVED . . . . .

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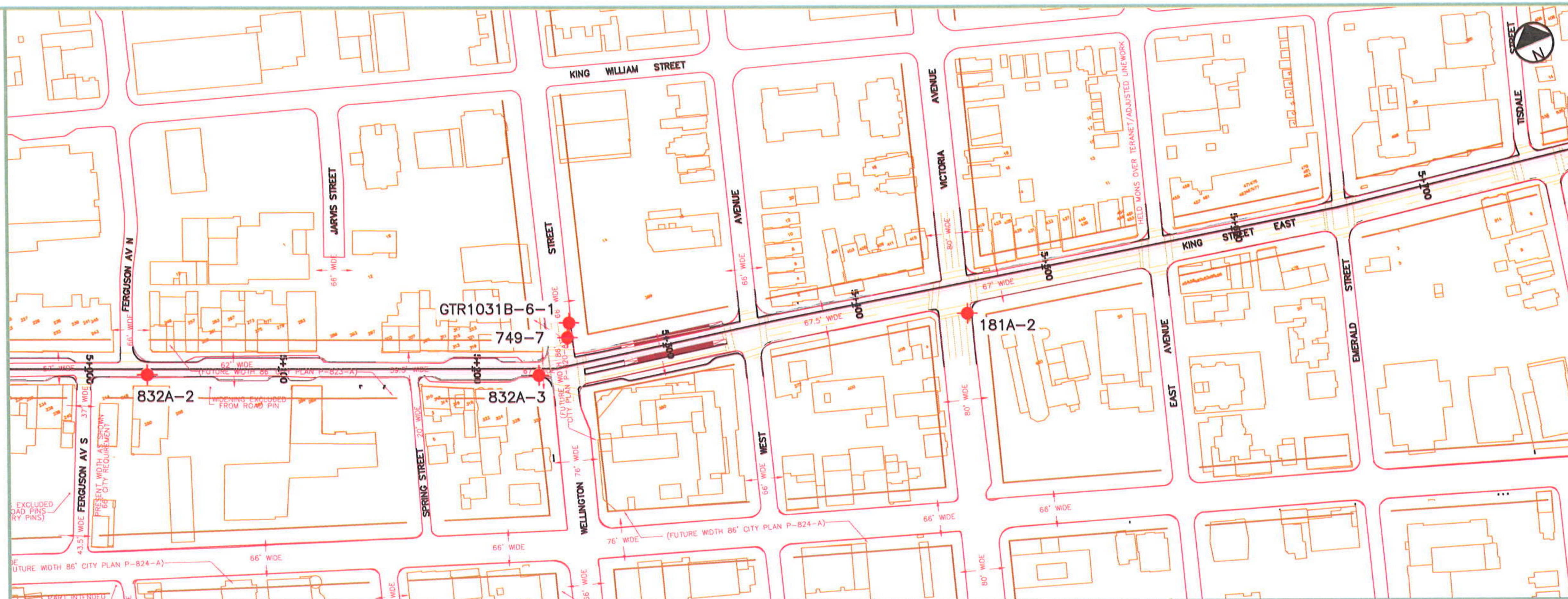
HAMILTON LRT 'B' LINE BOREHOLE PLAN AND STRATIGRAPHIC PROFILE

SHEET 6 OF 17

FILE No.	CONTRACT No. PW 00-00 (-)	SHEET No.

DIMENSIONS SHOWN ON THIS PLAN ARE IN METRES UNLESS OTHERWISE NOTED

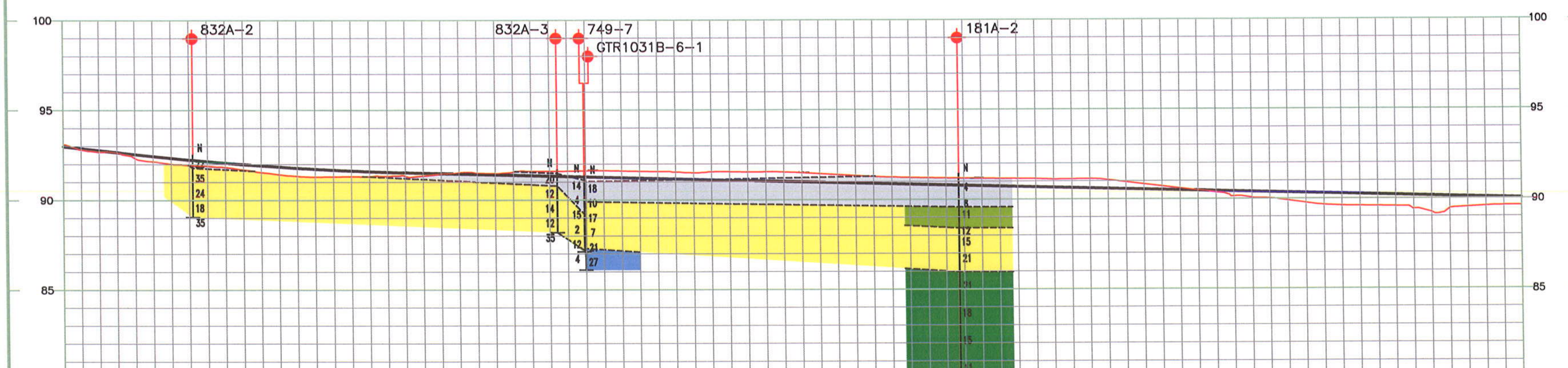


WESTBOUND ← → EASTBOUND

LEGEND

- NEW CONSTRUCTION
- EXISTING
- PROPERTY LINE (ROAD ALLOWANCE)
- EXISTING BOREHOLE LOCATION
- FILL
- CLAY
- SILT
- SAND
- TILL
- SHALE

DRAFT



CONSTRUCTION ℄ CHAINAGE	PROPOSED TOP OF RAIL PROFILE	EXISTING GROUND ELEVATION
	92.811	92.738
5+000	92.543	92.349
	92.286	91.992
	92.063	91.823
	91.874	91.497
5+100	91.720	91.299
	91.601	91.309
	91.517	91.315
	91.456	91.483
5+200	91.396	91.477
	91.335	91.601
	91.275	91.627
	91.215	91.609
5+300	91.155	91.550
	91.095	91.567
	91.035	91.550
	90.975	91.490
5+400	90.914	91.347
	90.854	91.237
	90.794	91.189
	90.734	91.175
5+500	90.674	91.139
	90.614	91.122
	90.553	90.964
	90.493	90.644
5+600	90.433	90.344
	90.373	90.042
	90.313	89.775
	90.253	89.593
5+700	90.193	89.566
	90.132	89.169
	90.072	89.564

No.	REVISIONS	INITIAL	DATE

DRAWN BY: Initials DATE:

REFERENCE MATERIAL:
Surveyed By :
Sewer Plans :
Water Plans :
Survey Plan :

Geodetic Bench Mark Index Elevation=
Borehole Report –

SCALES
HORIZONTAL 1:2500 (0 12.5m 25m 50m)
VERTICAL 1:250 (0 1.25m 2.5m 5m)

Project Manager (Design)
NAME
Manager of Design
NAME

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CHECKED . . . . .
APPROVED . . . . .

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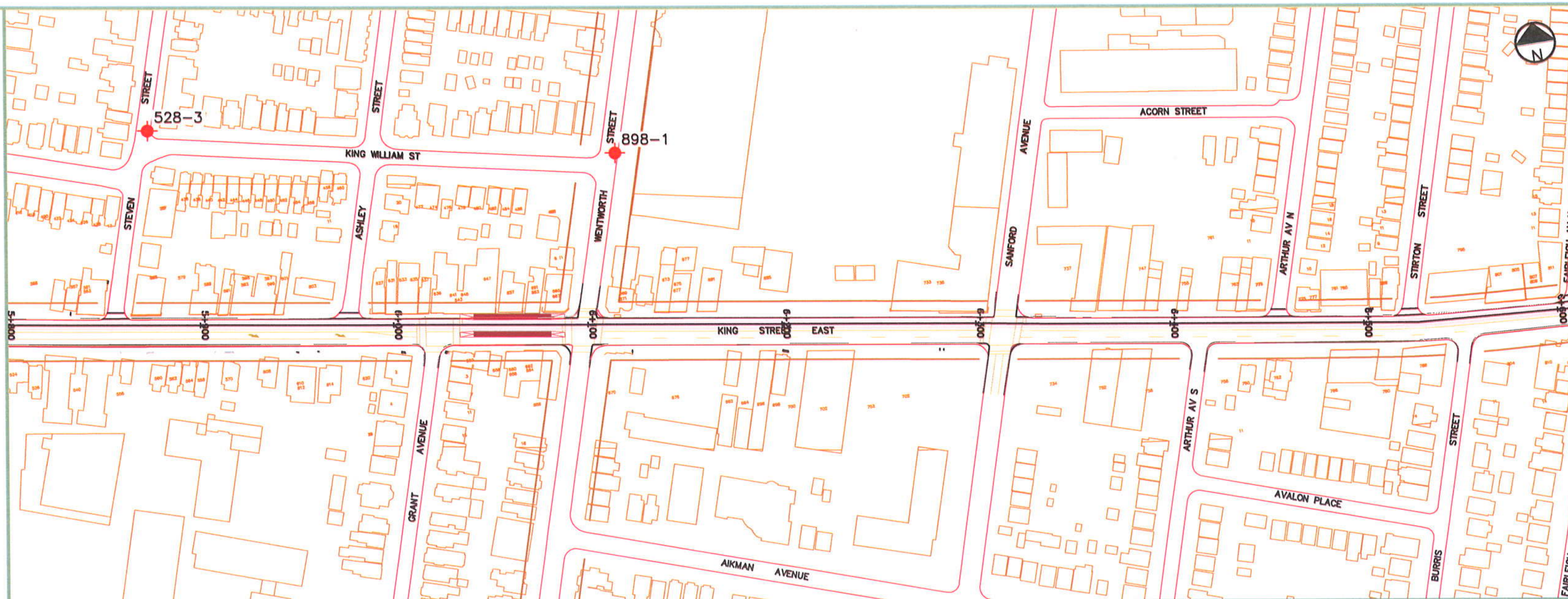
HAMILTON LRT 'B' LINE BOREHOLE PLAN AND STRATIGRAPHIC PROFILE

SHEET 7 OF 17

FILE No.	CONTRACT No. PW 00-00 (-)	SHEET No.

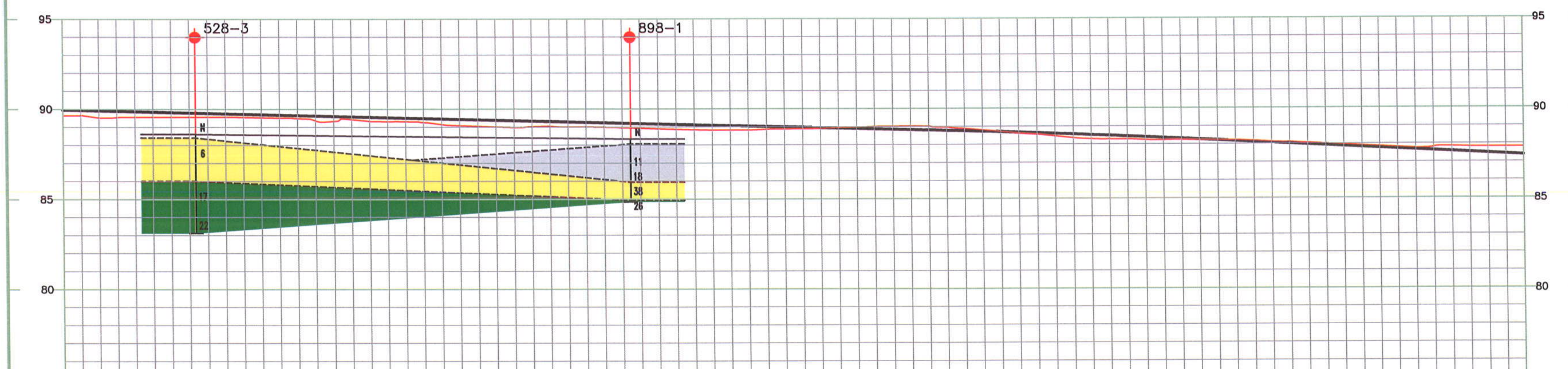
DIMENSIONS SHOWN ON THIS PLAN ARE IN METRES UNLESS OTHERWISE NOTED



LEGEND

- NEW CONSTRUCTION
- EXISTING
- PROPERTY LINE (ROAD ALLOWANCE)
- EXISTING BOREHOLE LOCATION
- FILL
- CLAY
- SILT
- SAND
- TILL
- SHALE

DRAFT



PROPOSED TOP OF RAIL PROFILE	EXISTING GROUND ELEVATION	CONSTRUCTION ℄ CHAINAGE
[illegible]	[illegible]	[illegible]
89.892	89.520	
89.832	89.566	
89.772	89.565	
89.711	89.558	5+900
89.651	89.509	
89.591	89.301	
89.531	89.317	
89.471	89.268	6+000
89.411	89.077	
89.350	88.974	
89.290	89.016	
89.230	88.988	6+100
89.170	88.920	
89.110	88.849	
89.050	88.831	
88.990	88.876	6+200
88.929	88.920	
88.869	89.001	
88.809	89.025	
88.746	88.884	6+300
88.673	88.647	
88.589	88.459	
88.496	88.288	
88.392	88.236	6+400
88.277	88.225	
88.156	88.207	
88.034	88.101	
87.912	88.003	6+500
87.790	87.889	
87.668	87.769	
87.546	87.834	
87.424	87.817	6+600

No.	REVISIONS	INITIAL	DATE	DRAWN BY: Initials	DATE:
				REFERENCE MATERIAL: Surveyed By : Sewer Plans : Water Plans : Survey Plan :	
				Geodetic Bench Mark Index Elevation= Borehole Report –	

SCALES
0 12.5m 25m 50m HORIZONTAL 1:2500
0 1.25m 2.5m 5m VERTICAL 1:250

Project Manager (Design)
NAME
Manager of Design
NAME

steer davies gleave
SNC·LAVALIN
DIALOG
THURBER ENGINEERING LTD.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

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CHECKED . . . . .
APPROVED . . . . .

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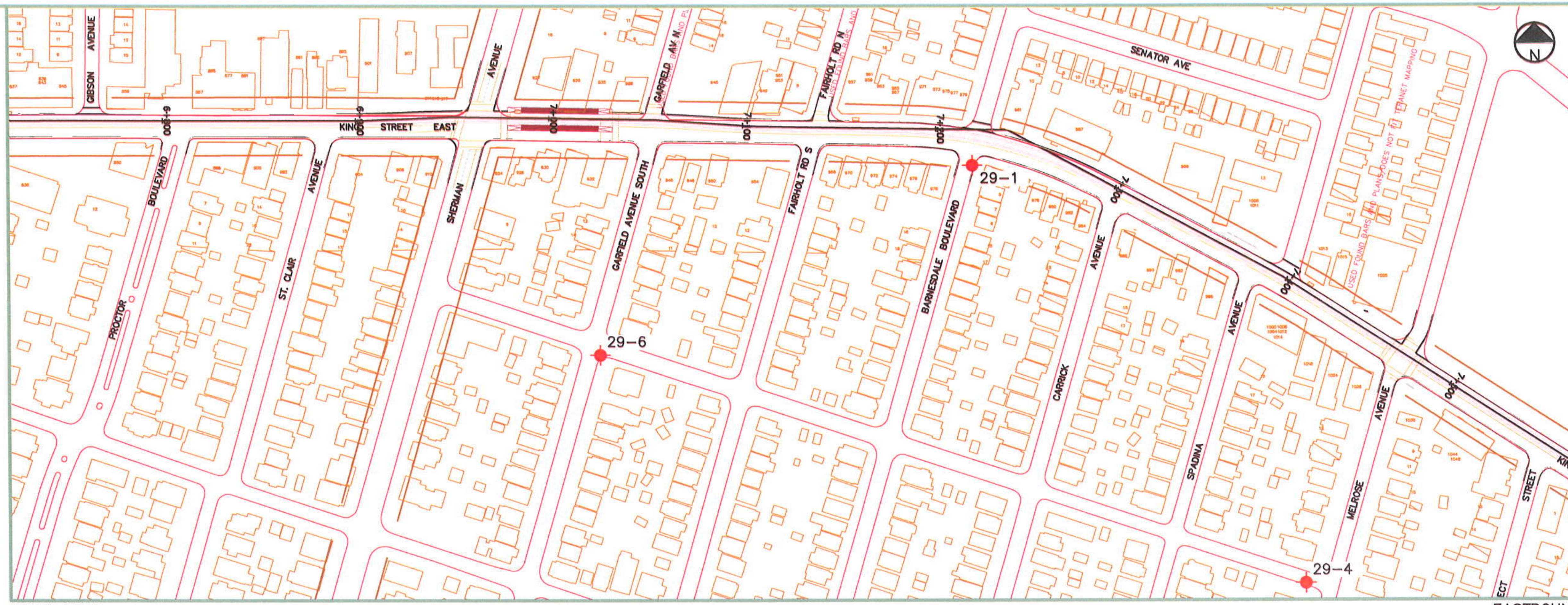
METROLINX An agency of the Government of Ontario

HAMILTON LRT 'B' LINE BOREHOLE PLAN AND STRATIGRAPHIC PROFILE

SHEET 8 OF 17

FILE No.	CONTRACT No. PW 00-00 (-)	SHEET No.

DIMENSIONS SHOWN ON THIS PLAN ARE IN METRES UNLESS OTHERWISE NOTED

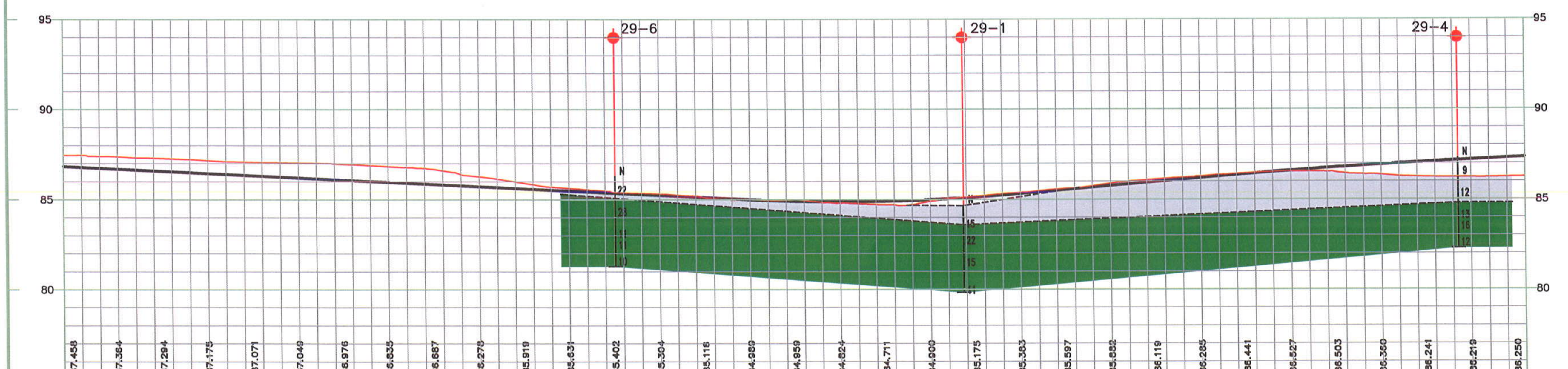


WESTBOUND ← → EASTBOUND

LEGEND

- NEW CONSTRUCTION
- EXISTING
- PROPERTY LINE (ROAD ALLOWANCE)
- EXISTING BOREHOLE LOCATION
- FILL
- CLAY
- SILT
- SAND
- TILL
- SHALE

DRAFT



PROPOSED TOP OF RAIL PROFILE	86.814	86.693	86.571	86.449	86.327	86.205	86.083	85.961	85.839	85.717	85.595
EXISTING GROUND ELEVATION	87.458	87.364	87.294	87.175	87.071	87.049	86.976	86.835	86.687	86.278	85.919
CONSTRUCTION ℄ CHAINAGE				6+800				6+900			

PROPOSED TOP OF RAIL PROFILE	85.473	85.351	85.229	85.107	84.986	84.899	84.869	84.895	84.978	85.118	85.314
EXISTING GROUND ELEVATION	85.631	85.402	85.304	85.116	84.989	84.959	84.824	84.711	84.900	85.175	85.383
CONSTRUCTION ℄ CHAINAGE	7+000				7+100				7+200		

PROPOSED TOP OF RAIL PROFILE	85.532	85.749	85.967	86.185	86.391	86.582	86.757	86.916	87.059	87.187	87.309
EXISTING GROUND ELEVATION	85.597	85.882	86.119	86.285	86.441	86.527	86.503	86.360	86.241	86.219	86.250
CONSTRUCTION ℄ CHAINAGE		7+300				7+400				7+500	

No.	REVISIONS	INITIAL	DATE

DRAWN BY: Initials DATE:

REFERENCE MATERIAL:
Surveyed By :
Sewer Plans :
Water Plans :
Survey Plan :

Geodetic Bench Mark Index Elevation=
Borehole Report —

SCALES
HORIZONTAL 1:2500 (0 12.5m 25m 50m)
VERTICAL 1:250 (0 1.25m 2.5m 5m)

Project Manager (Design)
NAME
Manager of Design
NAME

SNC·LAVALIN — steer davies gleave — DIALOG — THURBER ENGINEERING LTD. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

DRAWN . . . . .
CHECKED . . . . .
APPROVED . . . . .

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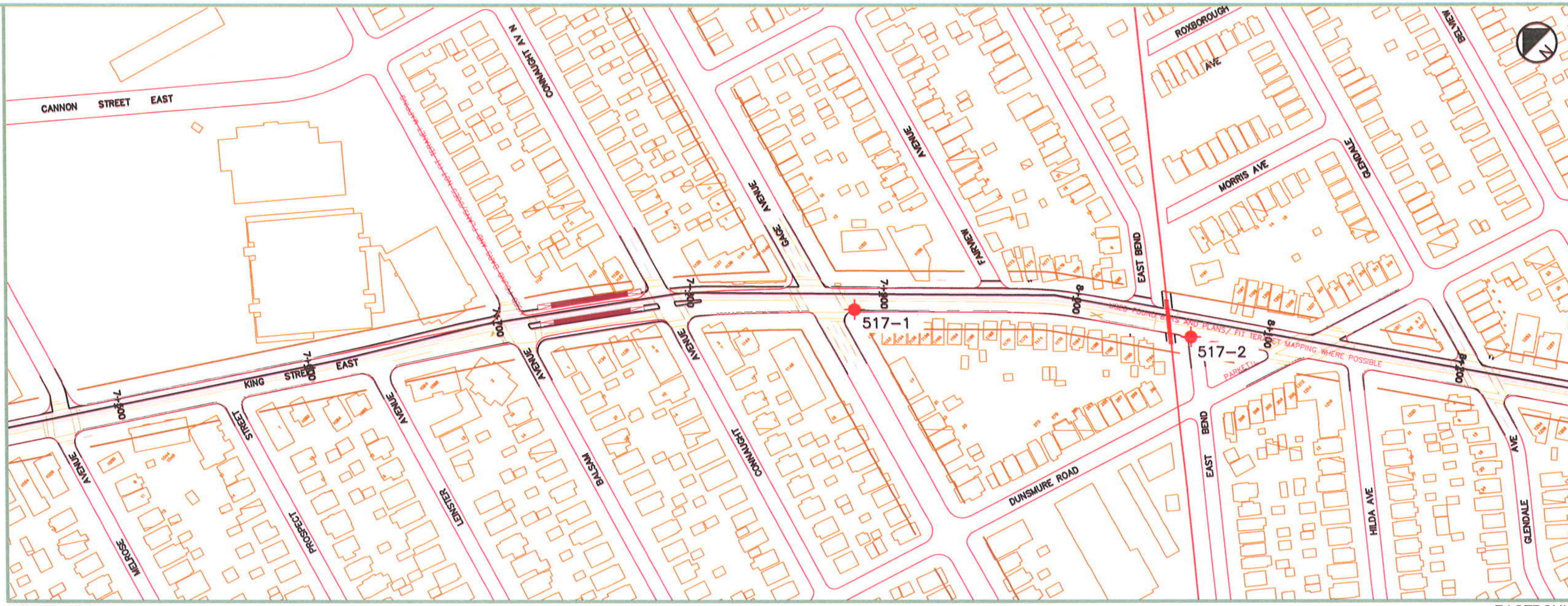
HAMILTON LRT 'B' LINE BOREHOLE PLAN AND STRATIGRAPHIC PROFILE

SHEET 9 OF 17

FILE No.	CONTRACT No. PW 00-00 (-)	SHEET No.

DIMENSIONS SHOWN ON THIS PLAN ARE IN METRES UNLESS OTHERWISE NOTED



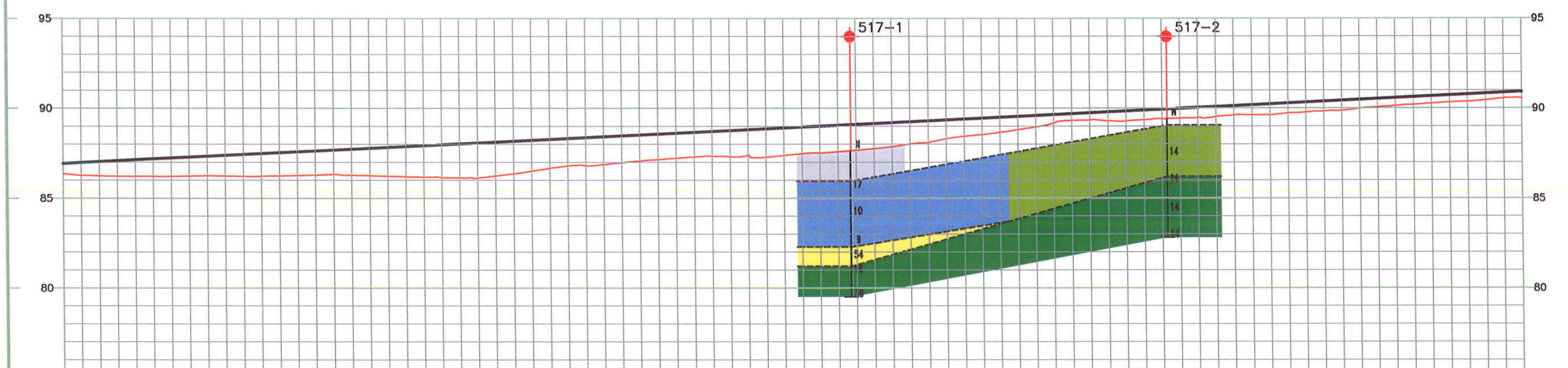
WESTBOUND

EASTBOUND

LEGEND

- NEW CONSTRUCTION
- EXISTING
- PROPERTY LINE (ROAD ALLOWANCE)
- EXISTING BOREHOLE LOCATION
- FILL
- CLAY
- SILT
- SAND
- TILL
- SHALE

DRAFT



CONSTRUCTION ℄ CHAINAGE	PROPOSED TOP OF RAIL PROFILE	EXISTING GROUND ELEVATION
	[illegible]	[illegible]
	87.059	86.241
7+500	87.187	86.219
	87.309	86.250
	87.432	86.228
	87.555	86.256
7+600	87.677	86.296
	87.800	86.246
	87.922	86.185
	88.045	86.145
7+700	88.167	86.372
	88.290	86.740
	88.412	86.885
	88.535	87.121
7+800	88.657	87.301
	88.780	87.302
	88.902	87.384
	89.025	87.552
7+900	89.147	87.763
	89.270	88.078
	89.393	88.444
	89.515	88.738
8+000	89.638	89.175
	89.760	89.318
	89.883	89.368
	90.005	89.463
8+100	90.128	89.622
	90.250	89.667
	90.373	89.833
	90.495	90.035
8+200	90.618	90.204
	90.740	90.360
	90.863	90.557

No.	REVISIONS	INITIAL	DATE

DRAWN BY: Initials DATE:

REFERENCE MATERIAL:
Surveyed By :
Sewer Plans :
Water Plans :
Survey Plan :

Geodetic Bench Mark Index Elevation=
Borehole Report —

SCALES
0 12.5m 25m 50m
HORIZONTAL 1:2500
0 1.25m 2.5m 5m
VERTICAL 1:250

Project Manager (Design)
NAME
Manager of Design
NAME

steer davies gleave
SNC·LAVALIN
DIALOG
THURBER ENGINEERING LTD.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

DRAWN
CHECKED
APPROVED

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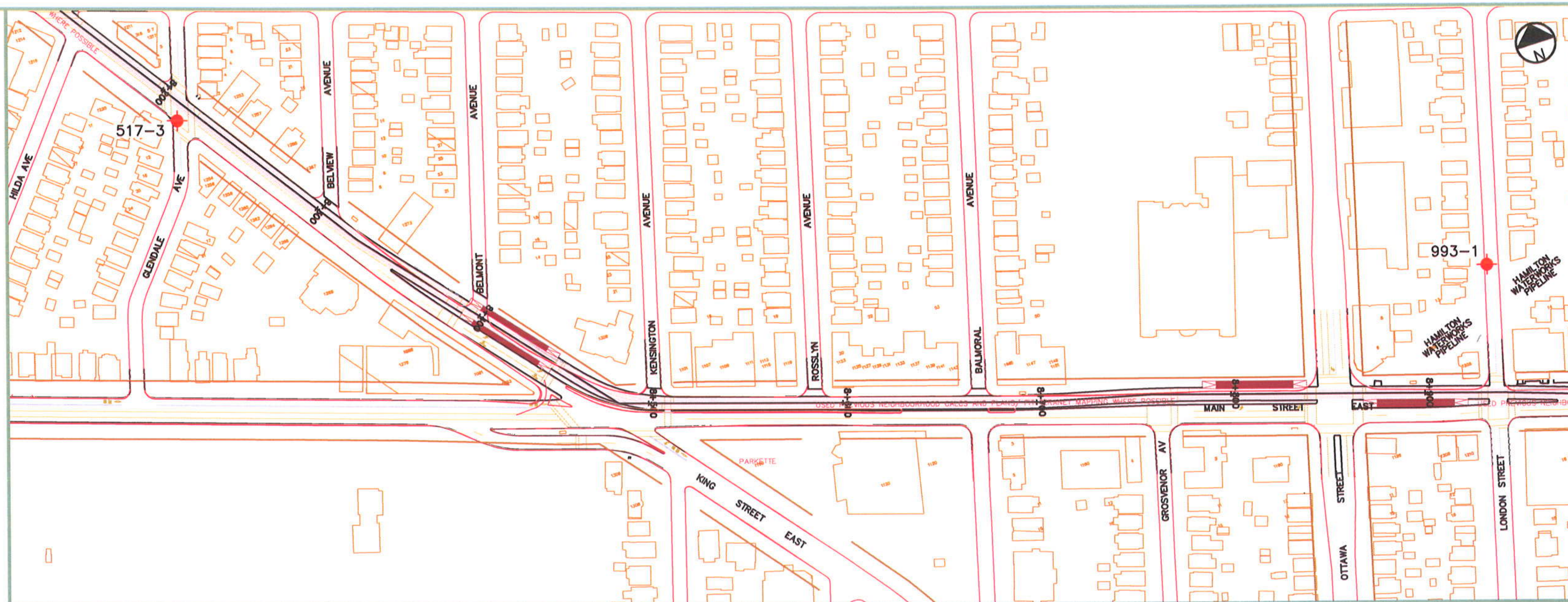
RAPIDTransit moving HAMILTON forward
METROLINX An agency of the Government of Ontario

HAMILTON LRT 'B' LINE BOREHOLE PLAN AND STRATIGRAPHIC PROFILE

SHEET 10 OF 17

FILE No.	CONTRACT No. PW 00-00 (-)	SHEET No.

DIMENSIONS SHOWN ON THIS PLAN ARE IN METRES UNLESS OTHERWISE NOTED

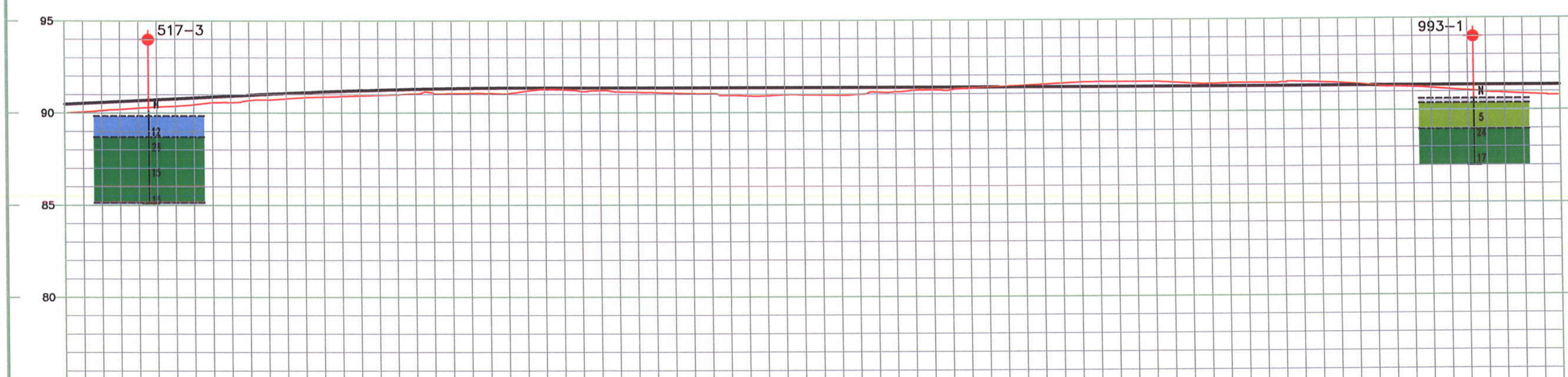


LEGEND

- NEW CONSTRUCTION
- EXISTING
- PROPERTY LINE (ROAD ALLOWANCE)
- EXISTING BOREHOLE LOCATION
- FILL
- CLAY
- SILT
- SAND
- TILL
- SHALE

WESTBOUND ← → EASTBOUND

DRAFT



CONSTRUCTION ℄ CHAINAGE	PROPOSED TOP OF RAIL PROFILE	EXISTING GROUND ELEVATION
	90.495	90.035
8+200	90.618	90.204
	90.740	90.360
	90.863	90.557
	90.985	90.711
8+300	91.096	90.842
	91.186	90.921
	91.256	90.986
	91.306	91.031
8+400	91.335	91.066
	91.343	91.234
	91.343	91.175
	91.343	91.139
8+500	91.343	91.074
	91.343	90.947
	91.343	90.916
	91.343	90.964
8+600	91.343	90.982
	91.343	91.149
	91.343	91.217
	91.343	91.371
8+700	91.343	91.505
	91.343	91.620
	91.343	91.625
	91.343	91.557
8+800	91.343	91.529
	91.343	91.531
	91.343	91.563
	91.343	91.397
8+900	91.343	91.260
	91.343	91.100
	91.343	90.922
	91.343	90.797

No.	REVISIONS	INITIAL	DATE

DRAWN BY: Initials DATE:

REFERENCE MATERIAL:
Surveyed By :
Sewer Plans :
Water Plans :
Survey Plan :

Geodetic Bench Mark Index Elevation=
Borehole Report –

SCALES
0 12.5m 25m 50m HORIZONTAL 1:2500
0 1.25m 2.5m 5m VERTICAL 1:250

Project Manager (Design)
NAME
Manager of Design
NAME

steer davies gleave
SNC·LAVALIN
DIALOG
THURBER ENGINEERING LTD.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

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CHECKED . . . . .
APPROVED . . . . .

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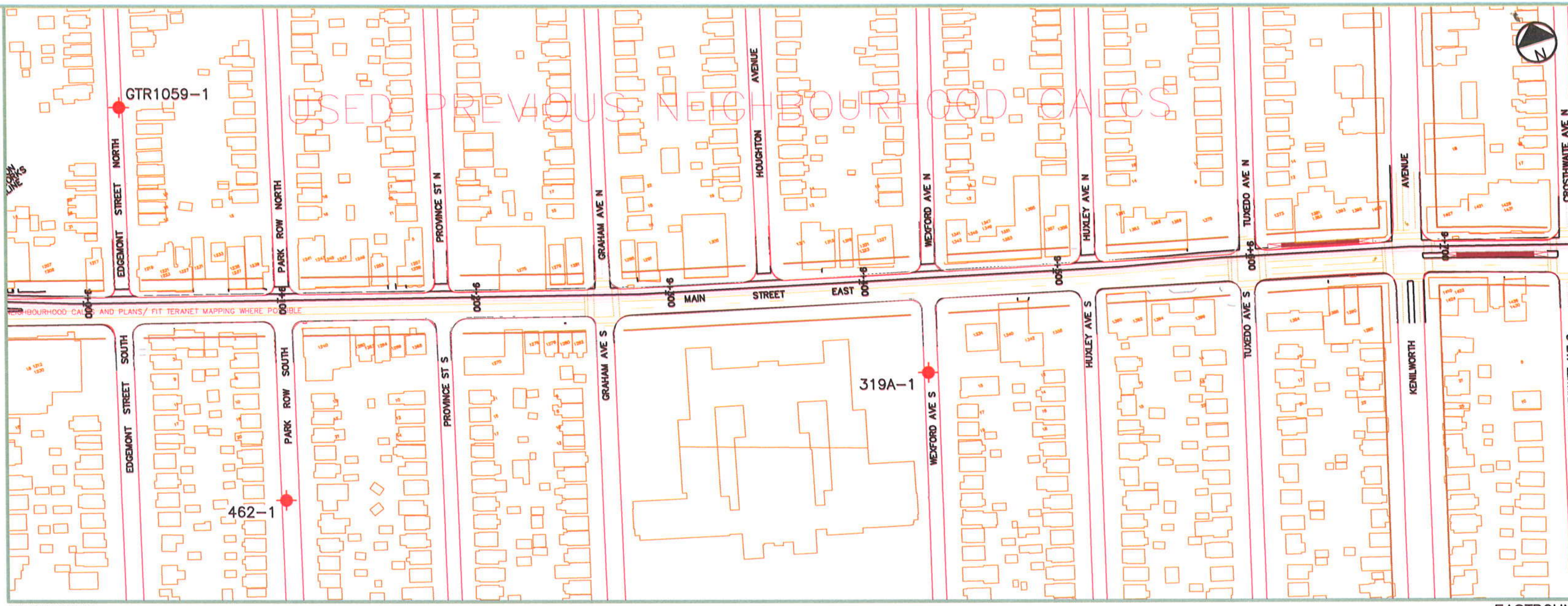
RAPIDTransit moving HAMILTON forward
METROLINX An agency of the Government of Ontario

HAMILTON LRT 'B' LINE BOREHOLE PLAN AND STRATIGRAPHIC PROFILE

SHEET 11 OF 17

FILE No.	CONTRACT No. PW 00-00 (-)	SHEET No.

DIMENSIONS SHOWN ON THIS PLAN ARE IN METRES UNLESS OTHERWISE NOTED



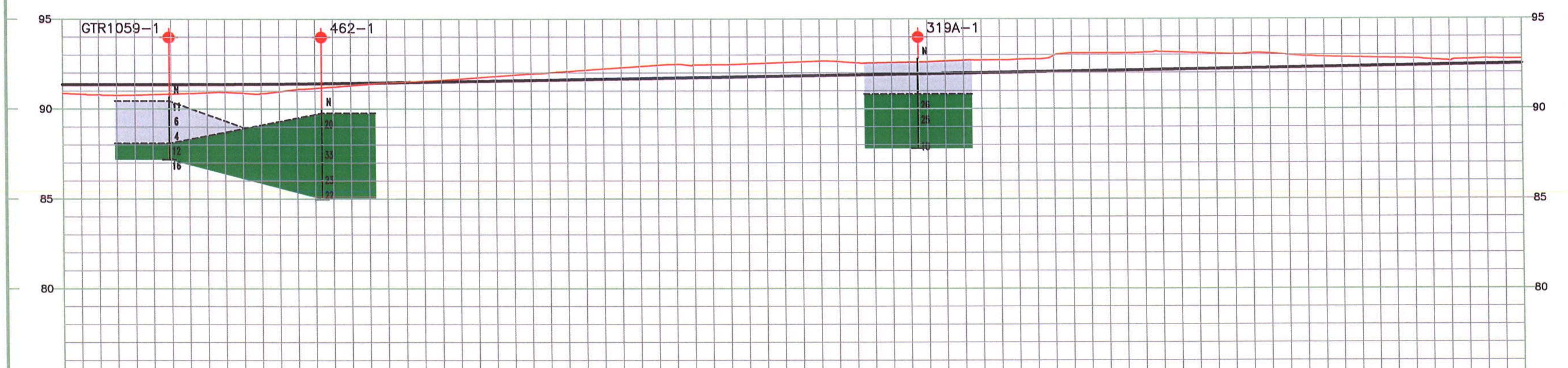
WESTBOUND

EASTBOUND

LEGEND

- NEW CONSTRUCTION
- EXISTING
- PROPERTY LINE (ROAD ALLOWANCE)
- EXISTING BOREHOLE LOCATION
- FILL
- CLAY
- SILT
- SAND
- TILL
- SHALE

DRAFT



CONSTRUCTION ℄ CHAINAGE	PROPOSED TOP OF RAIL PROFILE	EXISTING GROUND ELEVATION
	91.343	90.797
9+000	91.343	90.783
	91.346	90.852
	91.356	90.934
	91.372	90.909
9+100	91.396	91.156
	91.426	91.337
	91.463	91.484
	91.504	91.641
9+200	91.545	91.820
	91.586	91.972
	91.628	92.165
	91.669	92.338
9+300	91.710	92.486
	91.751	92.479
	91.792	92.514
	91.833	92.634
9+400	91.874	92.563
	91.915	92.600
	91.956	92.658
	91.997	92.725
9+500	92.039	92.773
	92.080	93.100
	92.121	93.098
	92.162	93.155
9+600	92.203	93.071
	92.244	93.102
	92.285	92.921
	92.326	92.857
9+700	92.367	92.805
	92.408	92.693
	92.449	92.775

No.	REVISIONS	INITIAL	DATE

DRAWN BY: Initials DATE:

REFERENCE MATERIAL:
Surveyed By :
Sewer Plans :
Water Plans :
Survey Plan :

Geodetic Bench Mark Index Elevation=
Borehole Report –

SCALES
0 12.5m 25m 50m
HORIZONTAL 1:2500
0 1.25m 2.5m 5m
VERTICAL 1:250

Project Manager (Design)
NAME
Manager of Design
NAME

SNC·LAVALIN steer davies gleave DIALOG
THURBER ENGINEERING LTD. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

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CHECKED . . . .
APPROVED . . . .

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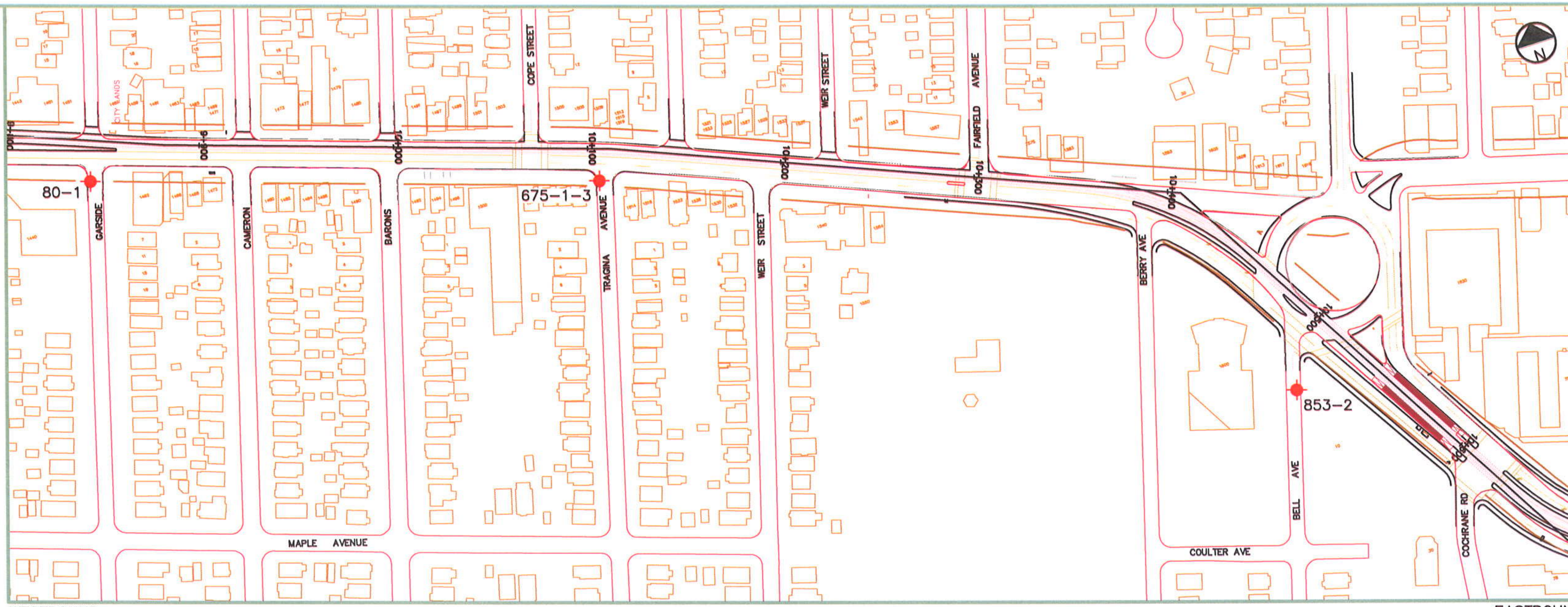
HAMILTON LRT 'B' LINE BOREHOLE PLAN AND STRATIGRAPHIC PROFILE

SHEET 12 OF 17

FILE No. | CONTRACT No. PW 00-00 (-) | SHEET No.

DIMENSIONS SHOWN ON THIS PLAN ARE IN METRES UNLESS OTHERWISE NOTED

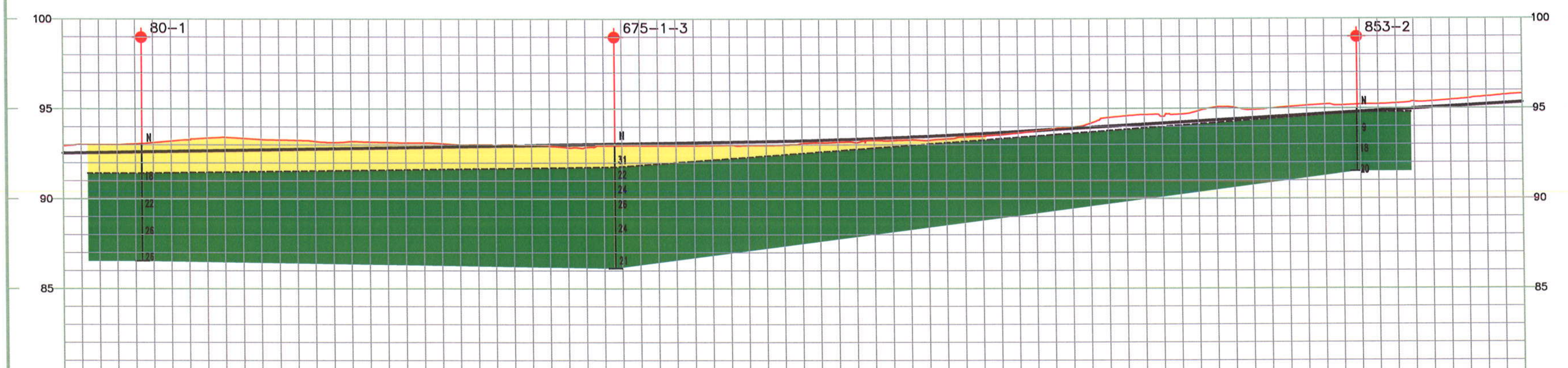


WESTBOUND ← → EASTBOUND

LEGEND

- NEW CONSTRUCTION
- EXISTING
- PROPERTY LINE (ROAD ALLOWANCE)
- EXISTING BOREHOLE LOCATION
- FILL
- CLAY
- SILT
- SAND
- TILL
- SHALE

DRAFT



CONSTRUCTION ℄ CHAINAGE	PROPOSED TOP OF RAIL PROFILE	EXISTING GROUND ELEVATION
[illegible]	[illegible]	[illegible]
	92.573	93.008
	92.614	93.130
	92.655	93.360
9+900	92.696	93.370
	92.737	93.265
	92.778	93.140
	92.819	93.151
10+000	92.860	93.121
	92.901	93.011
	92.943	93.012
	92.984	92.896
10+100	93.025	92.955
	93.066	92.965
	93.107	92.954
	93.148	92.947
10+200	93.196	93.019
	93.260	93.123
	93.342	93.241
	93.440	93.250
10+300	93.556	93.438
	93.689	93.597
	93.832	93.881
	93.975	94.356
10+400	94.118	94.660
	94.261	94.728
	94.405	95.059
	94.548	95.050
10+500	94.691	95.217
	94.834	95.227
	94.977	95.379
	95.120	95.507
10+600	95.264	95.740

No.	REVISIONS	INITIAL	DATE

DRAWN BY: Initials | DATE:

REFERENCE MATERIAL:
Surveyed By :
Sewer Plans :
Water Plans :
Survey Plan :

Geodetic Bench Mark Index Elevation=
Borehole Report –

SCALES
0 12.5m 25m 50m
HORIZONTAL 1:2500
0 1.25m 2.5m 5m
VERTICAL 1:250

Project Manager (Design)
NAME
Manager of Design
NAME

SNC·LAVALIN | steer davies gleave | DIALOG | THURBER ENGINEERING LTD. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

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CHECKED . . . . .
APPROVED . . . . .

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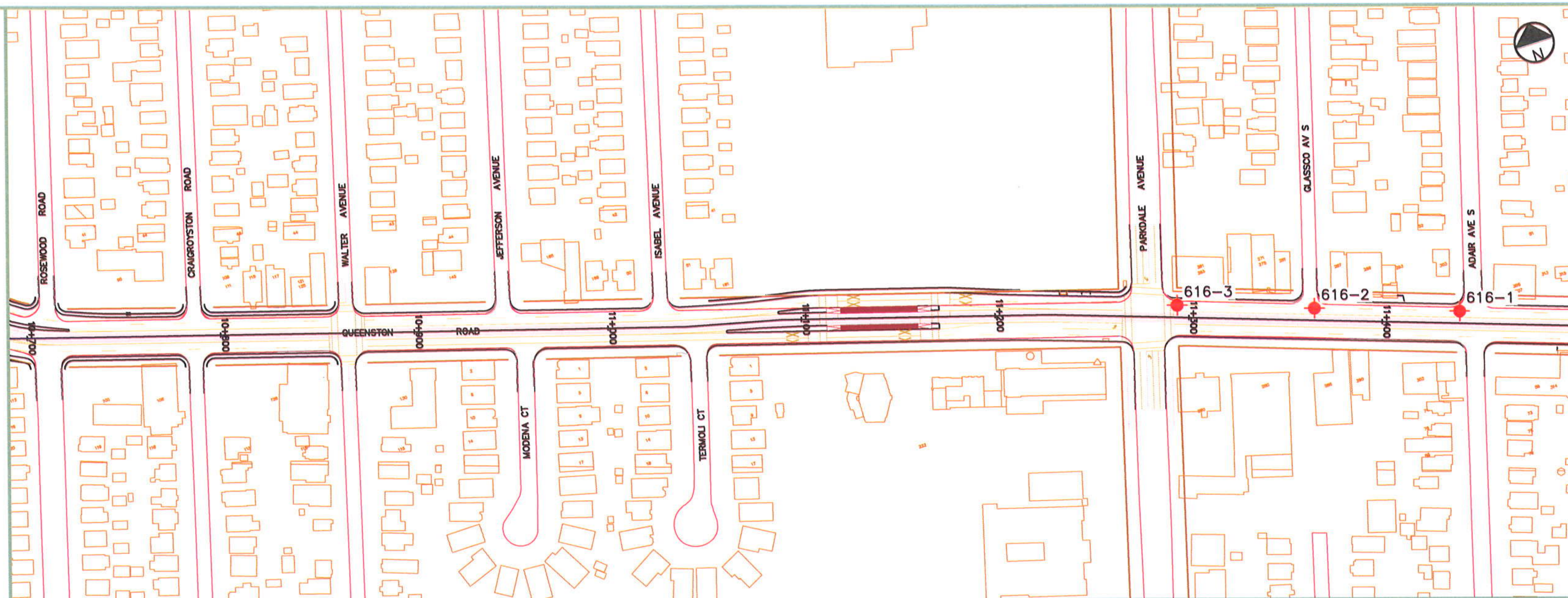
HAMILTON LRT 'B' LINE BOREHOLE PLAN AND STRATIGRAPHIC PROFILE

SHEET 13 OF 17

FILE No.	CONTRACT No. PW 00-00 (-)	SHEET No.

DIMENSIONS SHOWN ON THIS PLAN ARE IN METRES UNLESS OTHERWISE NOTED



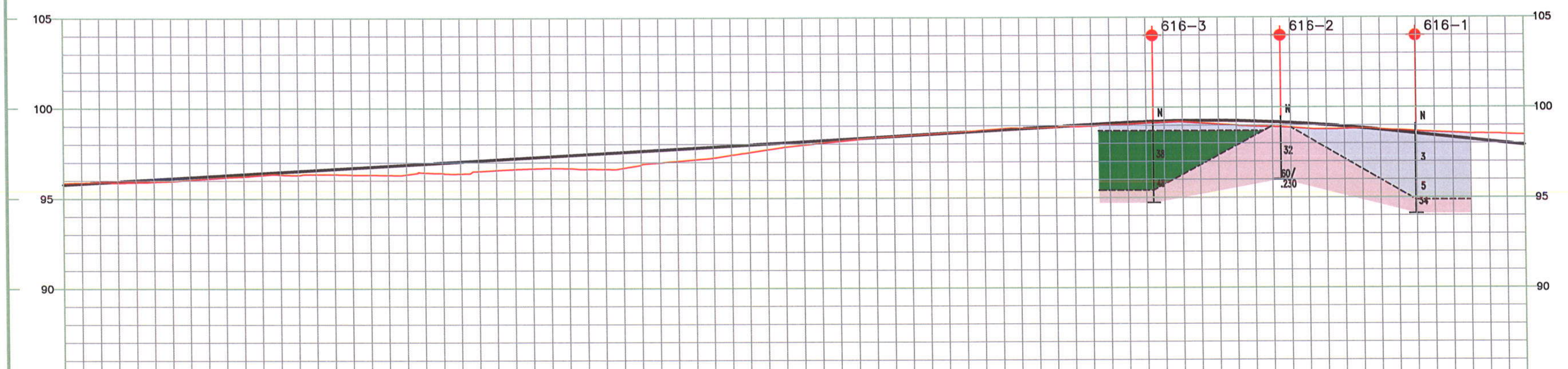
WESTBOUND ←

EASTBOUND →

LEGEND

- NEW CONSTRUCTION
- EXISTING
- PROPERTY LINE (ROAD ALLOWANCE)
- EXISTING BOREHOLE LOCATION
- FILL
- CLAY
- SILT
- SAND
- TILL
- SHALE

DRAFT



CONSTRUCTION ℄ CHAINAGE	EXISTING GROUND ELEVATION	PROPOSED TOP OF RAIL PROFILE
10+700	95.889	95.836
	95.907	95.979
	95.973	96.123
	96.150	96.266
10+800	96.304	96.409
	96.357	96.552
	96.335	96.695
	96.297	96.839
10+900	96.412	96.982
	96.546	97.125
	96.659	97.268
	96.643	97.411
11+000	96.678	97.554
	97.019	97.698
	97.241	97.841
	97.620	97.984
11+100	97.945	98.127
	98.199	98.270
	98.402	98.413
	98.565	98.557
11+200	98.757	98.700
	98.848	98.843
	98.942	98.986
	99.041	99.128
11+300	99.163	99.224
	99.092	99.251
	98.953	99.211
	98.845	99.103
11+400	98.810	98.927
	98.744	98.684
	98.626	98.420
	98.541	98.155
[illegible]	[illegible]	[illegible]

No.	REVISIONS	INITIAL	DATE

DRAWN BY: Initials DATE:

REFERENCE MATERIAL:
Surveyed By :
Sewer Plans :
Water Plans :
Survey Plan :

Geodetic Bench Mark Index Elevation=
Borehole Report –

SCALES
0 12.5m 25m 50m HORIZONTAL 1:2500
0 1.25m 2.5m 5m VERTICAL 1:250

Project Manager (Design)
NAME
Manager of Design
NAME

SNC·LAVALIN DIALOG steer davies gleave THURBER ENGINEERING LTD. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

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CHECKED . . . .
APPROVED . . . .

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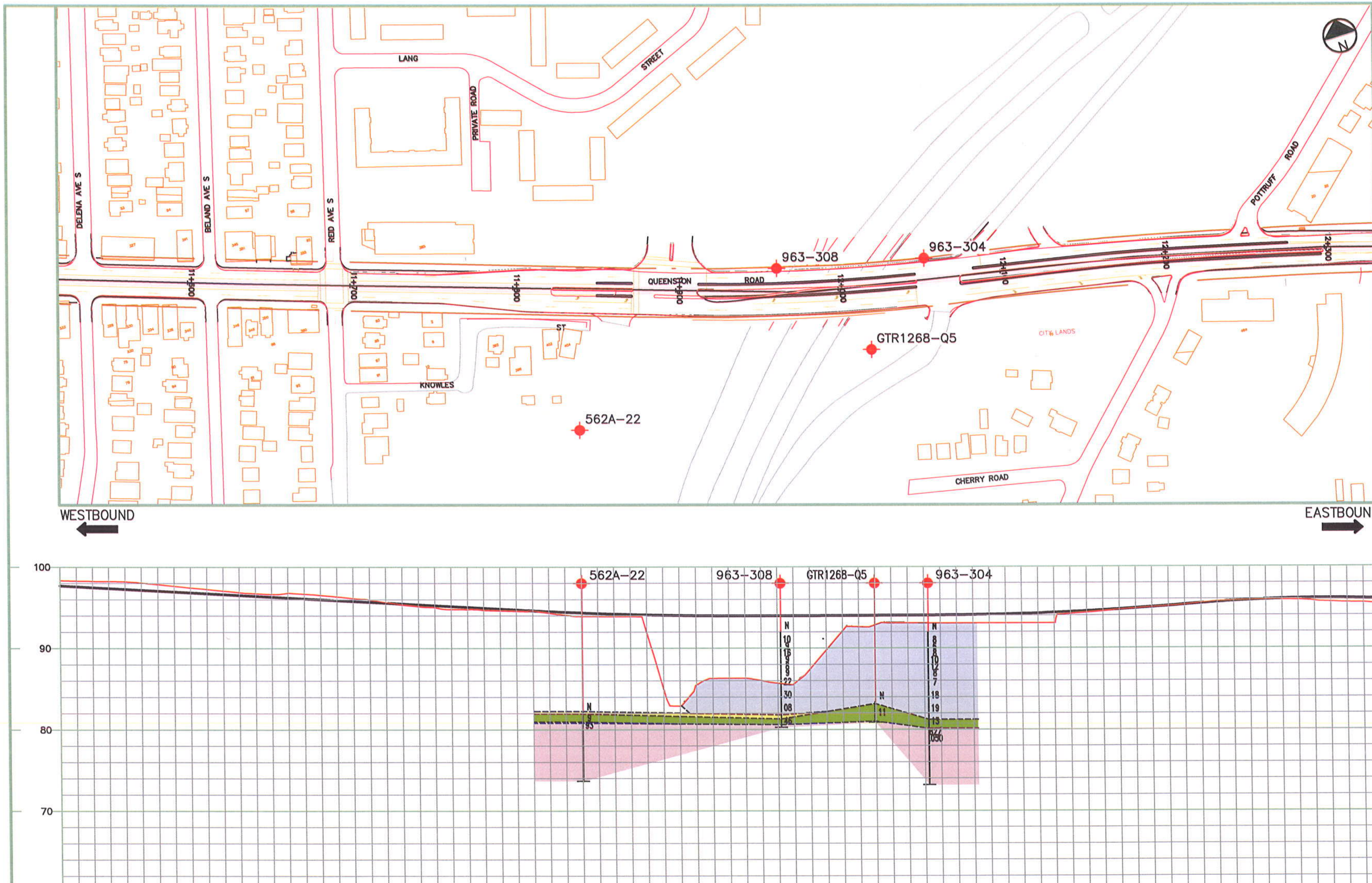
HAMILTON LRT 'B' LINE BOREHOLE PLAN AND STRATIGRAPHIC PROFILE

SHEET 14 OF 17

FILE No.	CONTRACT No. PW 00-00 (-)	SHEET No.

DIMENSIONS SHOWN ON THIS PLAN ARE IN METRES UNLESS OTHERWISE NOTED



LEGEND

- NEW CONSTRUCTION
- EXISTING
- PROPERTY LINE (ROAD ALLOWANCE)
- EXISTING BOREHOLE LOCATION
- FILL
- CLAY
- SILT
- SAND
- TILL
- SHALE

DRAFT

PROPOSED TOP OF RAIL PROFILE	EXISTING GROUND ELEVATION	CONSTRUCTION ℄ CHAINAGE
97.626	98.347	
97.362	98.263	
97.097	97.980	
96.833	97.481	11+600
96.568	97.014	
96.304	96.672	
96.040	96.651	
95.775	96.176	11+700
95.511	95.507	
95.246	95.040	
94.982	94.784	
94.717	94.573	11+800
94.473	94.195	
94.275	93.926	
94.124	93.905	
94.020	82.935	11+900
93.963	86.308	
93.953	86.040	
93.970	86.445	
93.988	92.689	12+000
94.005	93.133	
94.022	93.083	
94.055	93.082	
94.148	93.055	12+100
94.302	93.071	
94.518	94.355	
94.795	94.759	
95.135	95.099	12+200
95.518	95.600	
95.823	95.824	
96.001	95.890	
96.054	95.638	12+300
95.983	95.491	

No.	REVISIONS	INITIAL	DATE

DRAWN BY: Initials DATE:

REFERENCE MATERIAL:
Surveyed By :
Sewer Plans :
Water Plans :
Survey Plan :

Geodetic Bench Mark Index Elevation=
Borehole Report –

SCALES
HORIZONTAL 0 12.5m 25m 50m 1:2500
VERTICAL 0 2.5m 5m 10m 1:500

Project Manager (Design)
NAME
Manager of Design
NAME

SNC·LAVALIN DIALOG steer davies gleave THURBER ENGINEERING LTD. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

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APPROVED

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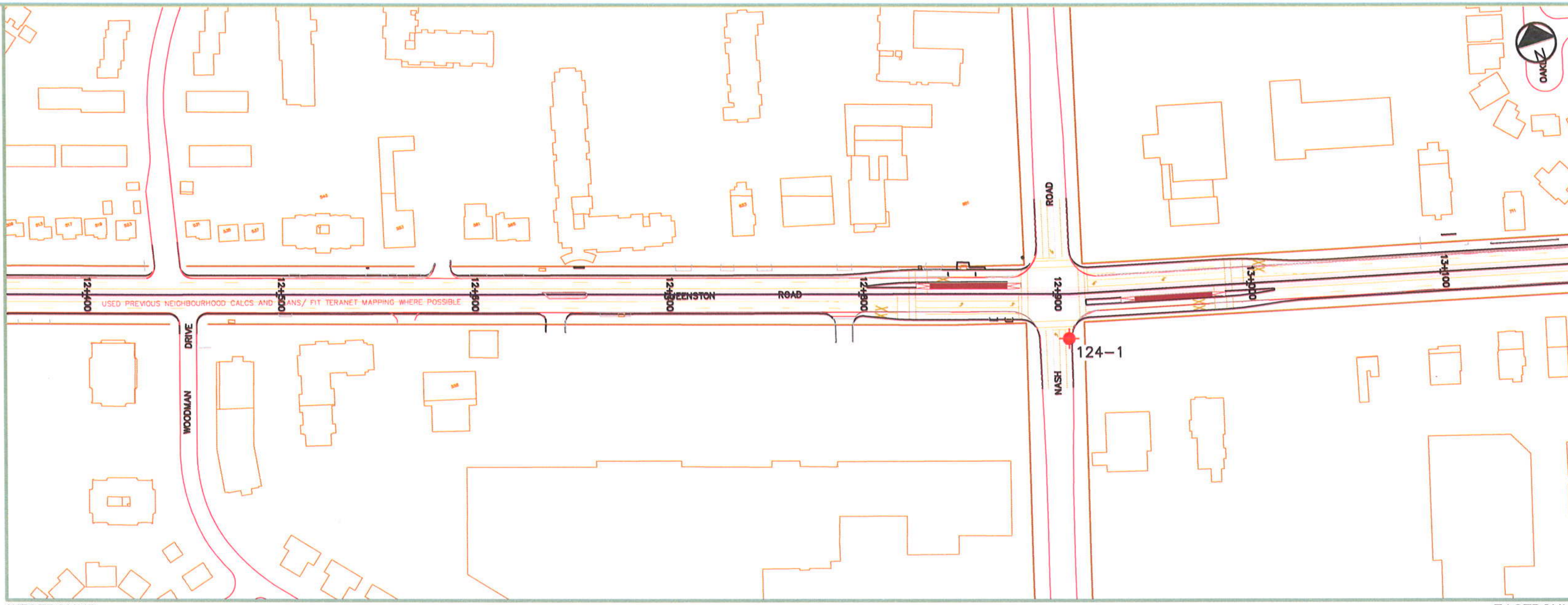
HAMILTON LRT 'B' LINE BOREHOLE PLAN AND STRATIGRAPHIC PROFILE

SHEET 15 OF 17

FILE No.	CONTRACT No. PW 00-00 (-)	SHEET No.

DIMENSIONS SHOWN ON THIS PLAN ARE IN METRES UNLESS OTHERWISE NOTED



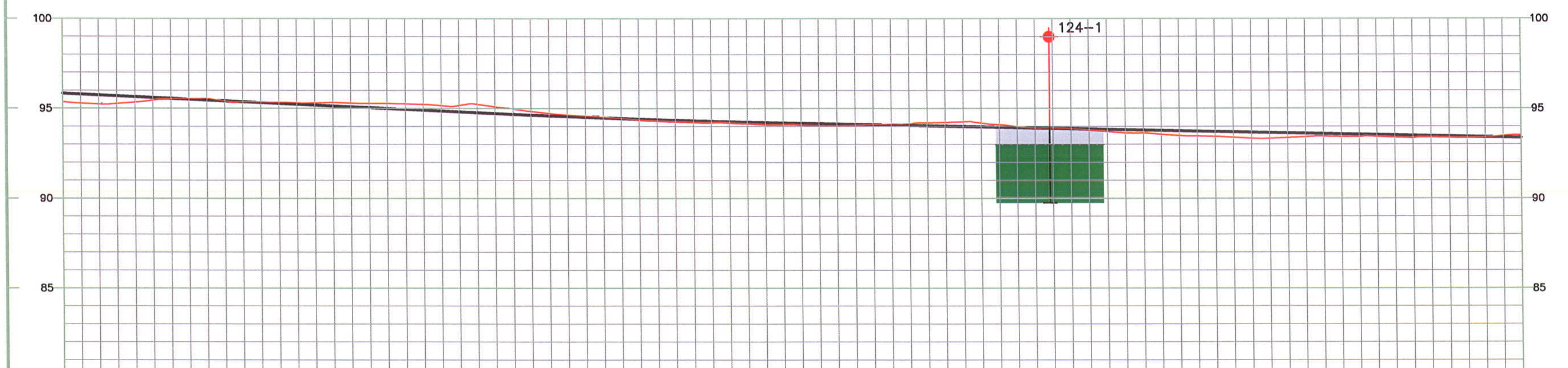
WESTBOUND

EASTBOUND

LEGEND

- NEW CONSTRUCTION
- EXISTING
- PROPERTY LINE (ROAD ALLOWANCE)
- EXISTING BOREHOLE LOCATION
- FILL
- CLAY
- SILT
- SAND
- TILL
- SHALE

DRAFT



CONSTRUCTION ℄ CHAINAGE	PROPOSED TOP OF RAIL PROFILE	EXISTING GROUND ELEVATION
	95.752	95.278
12+400	95.637	95.354
	95.521	95.537
	95.406	95.400
	95.290	95.347
12+500	95.174	95.313
	95.059	95.284
	94.943	95.263
	94.828	95.127
12+600	94.712	95.084
	94.601	94.779
	94.501	94.579
	94.412	94.384
12+700	94.333	94.256
	94.266	94.224
	94.209	94.100
	94.158	94.048
12+800	94.108	94.042
	94.057	94.121
	94.007	94.234
	93.956	94.125
12+900	93.906	93.905
	93.855	93.825
	93.805	93.649
	93.754	93.529
13+000	93.704	93.430
	93.653	93.330
	93.602	93.433
	93.552	93.428
13+100	93.501	93.391
	93.451	93.389
	93.400	93.389

No.	REVISIONS	INITIAL	DATE

DRAWN BY: Initials DATE:

REFERENCE MATERIAL:
Surveyed By :
Sewer Plans :
Water Plans :
Survey Plan :

Geodetic Bench Mark Index Elevation=
Borehole Report –

SCALES
0 12.5m 25m 50m HORIZONTAL 1:2500
0 1.25m 2.5m 5m VERTICAL 1:250

Project Manager (Design)
NAME
Manager of Design
NAME

SNC·LAVALIN
steer davies gleave
DIALOG
THURBER ENGINEERING LTD. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

DRAWN . . . . . .
CHECKED . . . . .
APPROVED . . . . .

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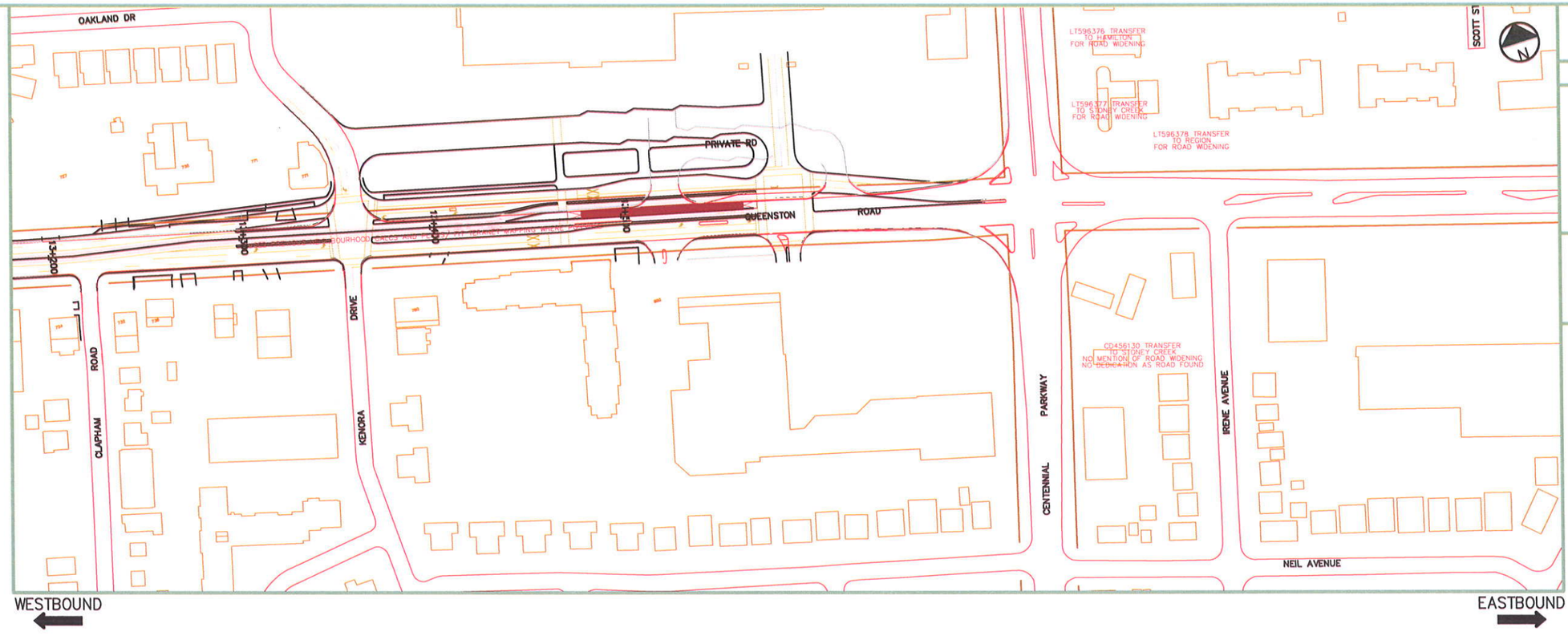
HAMILTON LRT 'B' LINE BOREHOLE PLAN AND STRATIGRAPHIC PROFILE

SHEET 16 OF 17

FILE No.	CONTRACT No. PW 00-00 (-)	SHEET No.

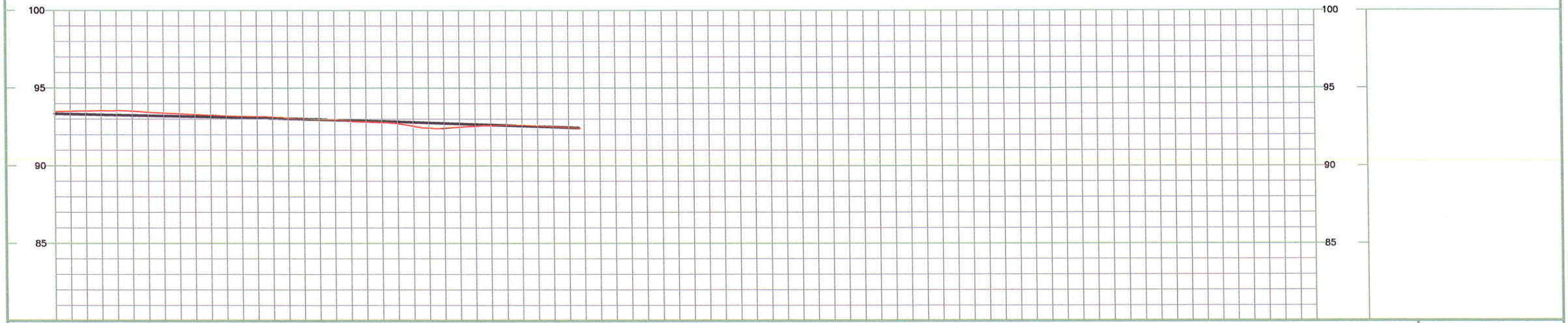
DIMENSIONS SHOWN ON THIS PLAN ARE IN METRES UNLESS OTHERWISE NOTED



LEGEND

- NEW CONSTRUCTION
- EXISTING
- PROPERTY LINE (ROAD ALLOWANCE)
- EXISTING BOREHOLE LOCATION
- FILL
- CLAY
- SILT
- SAND
- TILL
- SHALE

DRAFT



	13+200	13+300	13+400	13+500	13+600
PROPOSED TOP OF RAIL PROFILE	93.299 93.249 93.198 93.148	93.085 93.036 92.971 92.900	92.823 92.740 92.653 92.567	92.481	
EXISTING GROUND ELEVATION	93.531 93.539 93.399 93.289	93.116 92.979 92.832	92.715 92.403 92.544 92.597	92.503	
CONSTRUCTION ℄ CHAINAGE					

No.	REVISIONS	INITIAL	DATE

DRAWN BY: Initials DATE:

REFERENCE MATERIAL:
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Geodetic Bench Mark Index Elevation=
Borehole Report –

SCALES
HORIZONTAL 0 12.5m 25m 50m 1:2500
VERTICAL 0 1.25m 2.5m 5m 1:250

Project Manager (Design)
NAME
Manager of Design
NAME

steer davies gleave
SNC·LAVALIN DIALOG
THURBER ENGINEERING LTD. GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

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HAMILTON LRT 'B' LINE BOREHOLE PLAN AND STRATIGRAPHIC PROFILE

SHEET 17 OF 17

APPENDIX D

STATEMENT OF GENERAL CONDITIONS

THURBER ENGINEERING LTD.

STATEMENT OF GENERAL CONDITIONS

1. STANDARD OF CARE

This study and Report have been prepared in accordance with generally accepted engineering or environmental consulting practices in this area. No other warranty, expressed or implied, is made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report which is of a summary nature and is not intended to stand alone without reference to the instructions given to us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document, subject to the limitations provided herein, are only valid to the extent that this Report expressly addresses proposed development, design objectives and purposes, and then only to the extent there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation or to consider such representations, information and instructions.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS WE MAY EXPRESSLY APPROVE. The contents of the Report remain our copyright property. The Client may not give, lend or, sell the Report, or otherwise make the Report, or any portion thereof, available to any person without our prior written permission. Any use which a third party makes of the Report, are the sole responsibility of such third parties. Unless expressly permitted by us, no person other than the Client is entitled to rely on this Report. We accept no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without our express written permission.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and this report is delivered on the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by us. We are entitled to rely on such representations, information and instructions and are not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

(see over . . . .)

INTERPRETATION OF THE REPORT *(continued . . . .)*

c) Design Services: The Report may form part of the design and construction documents for information purposes even though it may have been issued prior to the final design being completed. We should be retained to review the final design, project plans and documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the report recommendations and the final design detailed in the contract documents should be reported to us immediately so that we can address potential conflicts.

d) Construction Services: During construction we must be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RISK LIMITATION

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause an accidental release of those substances. In consideration of the provision of the services by us, which are for the Client's benefit, the Client agrees to hold harmless and to indemnify and defend us and our directors, officers, servants, agents, employees, workmen and contractors (hereinafter referred to as the "Company") from and against any and all claims, losses, damages, demands, disputes, liability and legal investigative costs of defence, whether for personal injury including death, or any other loss whatsoever, regardless of any action or omission on the part of the Company, that result from an accidental release of pollutants or hazardous substances occurring as a result of carrying out this Project. This indemnification shall extend to all Claims brought or threatened against the Company under any federal or provincial statute as a result of conducting work on this Project. In addition to the above indemnification, the Client further agrees not to bring any claims against the Company in connection with any of the aforementioned causes.

7. SERVICES OF SUBCONSULTANTS AND CONTRACTORS

The conduct of engineering and environmental studies frequently requires hiring the services of individuals and companies with special expertise and/or services which we do not provide. We may arrange the hiring of these services as a convenience to our Clients. As these services are for the Client's benefit, the Client agrees to hold the Company harmless and to indemnify and defend us from and against all claims arising through such hirings to the extent that the Client would incur had he hired those services directly. This includes responsibility for payment for services rendered and pursuit of damages for errors, omissions or negligence by those parties in carrying out their work. In particular, these conditions apply to the use of drilling, excavation and laboratory testing services.

8. CONTROL OF WORK AND JOBSITE SAFETY

We are responsible only for the activities of our employees on the jobsite. The presence of our personnel on the site shall not be construed in any way to relieve the Client or any contractors on site from their responsibilities for site safety. The Client acknowledges that he, his representatives, contractors or others retain control of the site and that we never occupy a position of control of the site. The Client undertakes to inform us of all hazardous conditions, or other relevant conditions of which the Client is aware. The Client also recognizes that our activities may uncover previously unknown hazardous conditions or materials and that such a discovery may result in the necessity to undertake emergency procedures to protect our employees as well as the public at large and the environment in general. These procedures may well involve additional costs outside of any budgets previously agreed to. The Client agrees to pay us for any expenses incurred as the result of such discoveries and to compensate us through payment of additional fees and expenses for time spent by us to deal with the consequences of such discoveries. The Client also acknowledges that in some cases the discovery of hazardous conditions and materials will require that certain regulatory bodies be informed and the Client agrees that notification to such bodies by us will not be a cause of action or dispute.

9. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on our interpretation of conditions revealed through limited investigation conducted within a defined scope of services. We cannot accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.