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GEOCREP'S No:  
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# **FOUNDATION INVESTIGATION REPORT**

**CONTRACT NO. 2001- 3011**



**FOUNDATION INVESTIGATION [REDACTED] REPORT  
PROPOSED KING STREET RETAINING WALL  
AND FRANKLIN STREET BRIDGE  
STRUCTURE 33-221  
W.P. 363-94-00, AGREEMENT NO. 9730-7411-3178  
HWY8/CONESTOGA PARKWAY INTERCHANGE AND  
HWY 8 FROM CONESTOGA PARKWAY TO FERGUS AVENUE**

40P8-117

**Submitted to:**

**Mr. Doug Hoffman, Principal  
Morrison Hershfield Limited  
4 Lansing Square  
North York, Ontario  
M2J 1T1**

**Distribution:**

**4 Copies - Morrison Hershfield Limited  
2 Copies - AGRA Earth & Environmental Limited, Waterloo**

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### Explanation of Terms Used in Report

|                     |                                  |
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| Drawings A, B and C | Borehole Locations and Soil Data |
| Appendix "A"        | Record of Borehole Sheets        |
| Appendix "B"        | Laboratory Test Results          |
| Appendix "C"        | Chemical Test Results            |



## 1. INTRODUCTION

This report presents the results of a foundation investigation carried out by AGRA Earth & Environmental Limited (AGRA) on behalf of Morrison Hershfield Limited at the site of the proposed widening of Highway 8 from Fergus Avenue north to Dellroy Avenue (Structure 33-221).

The purpose of the investigation was to obtain information about the subsurface conditions at the site by means of boreholes and, based on this information, to provide geotechnical recommendations for the foundation elements of the new retaining wall along the east limit of Highway 8 and the proposed reconstruction of Franklin Street Bridge.

The existing east retaining wall will be demolished and relocated approximately 6 to 8 m to the east to accommodate the proposed S-E Ramp. The new retaining wall will have approximately the same length as that of the existing retaining wall, approximately 660 m from Station 11+060 north to Station 10+400 (Highway 8 stations). King Street will be cut some 1 to 6 m and the finished grade of the new pavement will match that of Highway 8 north bound. The deepest cut will be in the area of Franklin Street. The west retaining wall will not be reconstructed except near the west abutment of Franklin Street Bridge.

The Franklin Street Bridge will be demolished and reconstructed. The new bridge will be a two span post-tensioned structure, each span measuring 23.3 m long. The new bridge will be 5 m wider than the existing structure.

The work presented herein was undertaken under MTO W.P. 363-94-00, Agreement No. 9730-7411-3178, and authorized by Morrison Hershfield Limited, in a letter dated November 2, 1998.

E.M. Peto and Associates undertook previous investigation work at this site in 1964 for the existing retaining wall and Franklin Street Bridge. This information was reviewed to supplement the present investigation.

## 2. SITE DESCRIPTION

### 2.1 Site Location

The site is located in the City of Kitchener along Highway 8 from Fergus Avenue north to Dellroy Avenue including the Franklin Street Bridge (underpass) structure, which was constructed in 1966-1967. This section of Highway 8 is depressed due to the level crossing of Franklin Street between Kingsway and King Street. The existing grade along King Street slopes downwards in a northerly direction from Elevation 327.5 to 324.3 m within the 660 m long limits of the proposed retaining wall. At Franklin Street Bridge, the pavement grade on Highway 8 is near Elevation 321.0 m that is approximately 6 m below the grades of King Street and Kingsway. The existing retaining walls, which are 1 to 6 m high, were constructed to provide the grade separation.



Based on available drawings, the existing retaining walls were supported on spread footings. Franklin Street Bridge was also supported on spread footings with the bridge abutments incorporated into the retaining walls.

## 2.2 Physiography and Topography

The site is located within the Physiographic Region known as the Waterloo Sandhills. The area is characterized by a flat topography, heavy textured soil and poor drainage (Chapman and Putnam, 1984). The area also has a preponderance of fine sand, particularly on the surface. The hilly region is an extensive area of alluvial terraces of the Grand River spillway system which, although more nearly horizontal, contains similar but more uniform sandy and gravelly materials. Several till sheets underlie the area and are, in order from oldest to youngest, the Catfish Creek Till, Maryhill Till, and Port Stanley Till.

The elevation of the subject site ranges from 321 to 327 m above mean sea level and slopes gently to the north locally in the vicinity of the site, with the exception of an area of depressed pavement on Highway 8 underneath the Franklin Street Bridge.

## 3. INVESTIGATION PROCEDURES

### 3.1 Field Investigation

Between November 16, 1998 and February 11, 1999, a CME 75 truck mounted drill rig was used on site for drilling and Standard Penetration Testing (SPT, following the procedures of ASTM D 1586). The initial drilling involved twenty-two (22) boreholes drilled along King Street for the proposed retaining wall and at the Franklin Street Bridge. Subsequently, three (3) deep boreholes were drilled and sampled to obtain data for foundation design of the proposed reconstruction of the Franklin Street Bridge foundations resulted from the widening of the bridge by 5 m. The locations of the boreholes are shown on Drawings A, B and C.

The boreholes were numbered 98-01 through 98-22. The three (3) deep boreholes drilled at the Franklin Street Bridge were numbered 98-10A, 98-11A and 98-12A. The stations and depths of the boreholes are as follows:

| Borehole No. | Station No.      | Depth of Borehole (m) |
|--------------|------------------|-----------------------|
| 98-01        | 11 + 055 22.0 LT | 5.1                   |
| 98-02        | 10 + 997 22.4 LT | 5.1                   |
| 98-03        | 10 + 979 22.4 LT | 5.8                   |
| 98-04        | 10 + 943 22.4 LT | 6.6                   |
| 98-05        | 10 + 895 22.4 LT | 8.1                   |
| 98-06        | 10 + 873 22.4 LT | 8.1                   |
| 98-07        | 10 + 839 22.4 LT | 8.9                   |
| 98-08        | 10 + 800 23.2 LT | 9.6                   |
| 98-09        | 10 + 774 21.6 LT | 10.7                  |



|        |                  |      |
|--------|------------------|------|
| 98-10  | 10 + 760 20.8 LT | 17.2 |
| 98-10A | 10 + 721 21.5 LT | 32.2 |
| 98-11  | 10 + 747 4.0 RT  | 11.1 |
| 98-11A | 10 + 745 4.1 RT  | 27.7 |
| 98-12  | 10 + 710 25.0 RT | 8.1  |
| 98-12A | 10 + 761 26.0 RT | 21.8 |
| 98-13  | 10 + 702 20.8 LT | 11.1 |
| 98-14  | 10 + 678 20.8 LT | 12.7 |
| 98-15  | 10 + 634 20.8 LT | 10.7 |
| 98-16  | 10 + 618 20.0 LT | 11.1 |
| 98-17  | 10 + 591 19.6 LT | 9.6  |
| 98-18  | 10 + 548 18.4 LT | 9.2  |
| 98-19  | 10 + 525 18.4 LT | 8.1  |
| 98-20  | 10 + 482 19.2 LT | 7.3  |
| 98-21  | 10 + 455 19.6 LT | 7.3  |
| 98-22  | 10 + 402 19.2 LT | 5.1  |

The boreholes were drilled using hollow stem augers. Water and/or drilling mud were used to counter-balance the hydrostatic pressure within the hollow stem augers to prevent "blow back" of sands and silts during the borehole advancement and sampling operations.

Soil samples were retrieved at selected intervals of depths throughout the boreholes in conjunction with Standard Penetration Tests (SPT). Samples were generally taken at intervals of 0.75 m in the upper 6 m and thereafter at intervals of 1.5 m to the maximum depth of exploration.

Seepage and water levels were noted in each borehole during and at the completion of drilling and sampling. Standpipe piezometers were installed in Boreholes 98-05, 98-10, 98-11, 98-15, 98-19 and 98-21 for future monitoring of the groundwater levels. All boreholes were grouted with bentonite mix at completion of sampling.

The fieldwork was supervised by a member of our field engineering staff under the direction of the project engineer. Our field staff cleared the location of buried utilities and logged the boreholes. The soil samples obtained were placed in labeled containers and transported to our Waterloo Office for further examination and laboratory testing.

The stations, offsets and ground surface elevations at the as drilled borehole locations were surveyed by Morrison Hershfield Limited and provided to AGRA for the purpose of this report.

The results of the drilling, sampling, in-situ testing and water level measurements are summarized on the Record of Borehole sheets and are enclosed in Appendix "A".



### 3.2 Laboratory Analysis

Geotechnical laboratory testing consisted of natural moisture content determinations and visual classifications of all retrieved soil samples. In addition, grain size analyses, Atterberg Limits and laboratory standard Proctor tests were performed on selected samples. Several soil samples were submitted to AGRA Mississauga Laboratory to test the electro-chemical properties that include resistivity, pH, Chlorides and Sulphates.

The results of the laboratory testing are presented on the borehole logs enclosed in Appendix "A", and in Figures 1 to 15 in Appendix "B".

The electro-chemical test results are included in Appendix "C".

## 4. SUBSURFACE CONDITIONS

### 4.1 General Subsurface Conditions

In general, the subsurface deposits at the site consist of fine sand to silty fine sand, to depths of about 8 to 14 m depths below the ground surface. Several boreholes also contacted silt till underlying the sand deposits.

The six (6) deep boreholes for the Franklin Street Bridge contacted fine sand to silty sand underlain by silt, silt till and silty clay which are in turn underlain by a basal silt till at approximate Elevation 298 m. It appears that the upper silt till layer extends across the entire site, underlying the sand deposits. In the vicinity of the Franklin Street bridge, the till layer was interbedded by sand, silt and silty clay layers.

Surficial pavement structures, topsoil and fills were also contacted in the upper 2.5 to 4.0 m zone along King Street.

#### 4.1.1 Pavement, Fill, Topsoil

All boreholes, with the exception of Boreholes 98-11 and 98-11A, were drilled within the pavement of King Street and Kingsway. Boreholes 98-11 and 98-11A were drilled in the median area of Highway 8 underneath Franklin Street Bridge.

The pavement structure consists of 80 to 120 mm of asphalt over typically 180 to 300 mm of crushed granular base. The crushed granular base is underlain by a discontinuous sand and gravel fill, which is assessed to be the granular sub-base course. This material extends typically to about 0.7 to 1.0 m below ground surface.

Fill materials were encountered underneath the pavement and consisted of generally silty sand with a trace of gravel. The fill materials are assumed to be related to the buried utility construction or backfill to the existing retaining walls. Five (5) typical grain size distributions of the silty sand fill are shown in Figure 1 of Appendix "B". Laboratory Standard Proctor test results of three (3) fill materials are provided on Figures 7, 8 and 9 of Appendix "B".



The fill was very loose to compact as indicated by "N" values in the range of 3 to 28 blows per 0.3 m. The upper portion of the fill (immediately underneath the pavement) is generally in compact condition while the lower portion is loose to very loose.

Locally at Borehole 98-12 and 98-12A (Franklin & Kingsway) the fill encountered was compact to dense, as indicated by "N" values of 12 to 32 blows per 0.3 m. This fill is the compacted backfill behind the west retaining wall.

There was a 180 mm thick topsoil layer contacted at the ground surface of Boreholes 98-11 and 98-11A, and then crushed granular fill to 0.7 m below grade.

The fill materials were generally in damp to moist condition with natural moisture contents measured between 5 and 15 %.

#### **4.1.2 Sand to Silty Sand**

The major native soil deposit underlying the site is a sand deposit, which is predominantly fine sand with traces to some silt. It is frequently bedded with silt to sandy silt layers and occasional sand and gravel seams/layers. The thickness and sequence of occurrence of the various minor inter-bedded deposits do not appear to follow any pattern. The deposit extends to depths of  $\pm 8$  to 14 m below the King Street grade, corresponding to Elevations  $\pm 313$  to 319 m.

Twenty-two (22) grain size analyses were performed and the results are shown in Figures 2, 3, 4 and 5 of Appendix "B". The majority of this deposit does not meet OPSS Granular "B" Type 1 specification. Laboratory Standard Proctor test results of four (4) sand materials are provided on Figures 10 to 13 of Appendix "B".

Standard penetration tests yielded "N" values from 7 to in excess of 100 blows per 0.3 m. The majority of the "N" values are in the range of 20 to 50, indicative of a compact to dense condition. There are however occasional loose layers in the upper stratum of the deposit, generally immediately below the fill soils.

The sand deposit was in damp to moist condition above the water table with moisture contents recorded in the range of 5 to 10 %. Below the water table, the material was wet to saturated with moisture contents measured between 15 and 25 %.

The electro-chemical properties of the sand deposit including resistivity, pH, Chlorides and Sulphates were tested and the results are provided on Appendix "C".

#### **4.1.3 Silt**

Immediately underlying the sand to silty sand in the deep boreholes, there is a discontinuous layer of grey silt contacted in Boreholes 98-10, 98-11, 98-11A and 98-12A. This layer was encountered below elevations ranging from 314.9 to 310.9 m and was 1.5 to 3.7 m thick. Standard penetration tests yielded "N" values from 18 to 80 blows per 0.3 m indicating a compact to very dense condition.



The silt layer was saturated with moisture contents measured between 12 and 18 %.

#### **4.1.4 Upper Silt Till**

A heterogeneous mixture of sand, silt, gravel and clay (glacial till) was encountered below the upper sand to silty sand or silt deposits in Boreholes 98-10, 98-10A, 98-11, 98-11A, 98-12, 98-14, 98-18 and 98-21. This upper till layer was underlain by sand, silt and silty clay deposits at Boreholes 98-10, 98-10A, 98-11 and 98-11A. In Borehole 98-12A, this till deposit continued to at least Elevation 305 m. This silt till deposit was also contacted in the previous boreholes that were drilled for the existing retaining walls and Franklin Street Bridge in 1964.

The grain size distribution of a sample from Borehole 98-21 is shown on Figure 6 of Appendix "B".

Standard penetration tests yielded "N" values from 33 to over 100 blows per 0.3 m. The silt till is classified as dense to very dense. Natural moisture contents were between 8 and 15 %.

Boulders and/or cobbles are frequently embedded within glacial till deposits. The very high blow counts and augering resistance within the silt till may infer the presence of cobbles and boulders.

#### **4.1.5 Silty Clay**

A major stratum of grey silty clay was contacted below the upper till layer and above the basal till layer in the deep boreholes (Boreholes 98-10A and 98-11A) at Franklin Street Bridge.

This deposit was encountered at Elevation  $\pm 307$  m and extended to Elevation  $\pm 298$  m, and was approximately 9 m thick. It was not contacted in Borehole 98-12A.

Standard penetration tests yielded "N" values from 61 to over 100 blows per 0.3 m, indicating a hard consistency. The natural moisture contents were in the range of 12 to 19 %, indicative of damp to dry condition. The Liquid Limit and Plastic Limit were determined on one sample (see Figure 14 of Appendix "B") to be 38 and 18 %, respectively. Therefore, this deposit is considered to be pre-consolidated and has a hard consistency.

#### **4.1.6 Lower Silt Till**

A heterogeneous mixture of sand, silt, gravel and clay (glacial till) was found in the three (3) deep boreholes (98-10A, 98-11A and 98-12A) and contacted at Elevations 297.8, 297.9 and 312.6 m at Boreholes 98-10A, 98-11A and 98-12A, respectively.



The silt till was penetrated 3.3 to 7.4 m where boreholes were terminated. Standard penetration tests yielded "N" values from 85 to over 100 blows per 0.3 m. Based on these test results, the silt till is classified as very dense. Natural moisture contents were between 8 and 16 %. The Liquid Limit and Plastic Limit were determined on one sample (see Figure 15 of Appendix "B") to be 25 and 14 %, respectively.

Boulders and/or cobbles are frequently embedded within glacial till deposits. The very high blow counts and augering resistance within the silt till may infer the presence of cobbles and boulders.

#### 4.2 Groundwater Conditions

On completion of drilling, the following observations of groundwater levels were made:

| Borehole No. | Depth of Borehole (m) | Station No.      | Observation  |
|--------------|-----------------------|------------------|--|
| 98-01        | 5.1                   | 11 + 055 22.0 LT | No free water upon completion                              |
| 98-02        | 5.1                   | 10 + 997 22.4 LT | No free water upon completion                              |
| 98-03        | 5.8                   | 10 + 979 22.4 LT | No free water upon completion                              |
| 98-04        | 6.6                   | 10 + 943 22.4 LT | Free water at 4.8 m, Elevation 322.3 m upon completion     |
| 98-05        | 8.1                   | 10 + 895 22.4 LT | Water at 7.3 m, Elevation 319.7 m on 3/3/99, in standpipe  |
| 98-06        | 8.1                   | 10 + 873 22.4 LT | Free water at 7.6 m, Elevation 319.4 m upon completion     |
| 98-07        | 8.9                   | 10 + 839 22.4 LT | Free water at 8.3 m, Elevation 318.7 m upon completion     |
| 98-08        | 9.6                   | 10 + 800 23.2 LT | Free water at 5.9 m, Elevation 321.2 m upon completion     |
| 98-09        | 10.7                  | 10 + 774 21.6 LT | Free water at 7.0 m, Elevation 319.9 m upon completion     |
| 98-10        | 17.2                  | 10 + 760 20.8 LT | Water at 9.6 m, Elevation 317.2 m on 1/26/99, in standpipe |
| 98-10A       | 32.2                  | 10 + 721 21.5 LT | Free water at 7.9 m, Elevation 318.8 m upon completion     |
| 98-11        | 11.1                  | 10 + 747 4.0 RT  | Water at 1.9 m, Elevation 319.0 m on 1/26/99, in standpipe |
| 98-11A       | 27.7                  | 10 + 745 4.1 RT  | Free water at 1.9 m, Elevation 319.0 m upon completion     |
| 98-12        | 8.1                   | 10 + 710 25.0 RT | Free water at 7.8 m, Elevation 319.1 m upon completion     |
| 98-12A       | 21.8                  | 10 + 761 26.0 RT | Free water at 8.5 m, Elevation 318.4 m upon completion     |
| 98-13        | 11.1                  | 10 + 702 20.8 LT | Free water at 7.3 m, Elevation 319.4 m upon completion     |
| 98-14        | 12.7                  | 10 + 678 20.8 LT | Free water at 7.4 m, Elevation 319.2 m upon completion     |



|       |      |                  |  |
|-------|------|------------------|--|
| 98-15 | 10.7 | 10 + 634 20.8 LT | Water at 7.2 m, Elevation 319.4 m on 3/3/99, in standpipe  |
| 98-16 | 11.1 | 10 + 618 20.0 LT | Free water at 7.0 m, Elevation 319.4 m upon completion     |
| 98-17 | 9.6  | 10 + 591 19.6 LT | Free water at 6.8 m, Elevation 319.3 m upon completion     |
| 98-18 | 9.2  | 10 + 548 18.4 LT | Free water at 6.4 m, Elevation 319.4 m upon completion     |
| 98-19 | 8.1  | 10 + 525 18.4 LT | Water at 6.3 m, Elevation 319.3 m on 3/3/99, in standpipe  |
| 98-20 | 7.3  | 10 + 482 19.2 LT | Free water at 5.9 m, Elevation 319.4 m upon completion     |
| 98-21 | 7.3  | 10 + 455 19.6 LT | Water at 5.6 m, Elevation 319.4 m on 1/26/99, in standpipe |
| 98-22 | 5.1  | 10 + 402 19.2 LT | Free water at 4.7 m, Elevation 319.7 m upon completion     |

The water table was some 5 to 9 m below the King Street grade, corresponding to Elevations 322.3 to 317.2 m. The water level at the depressed Highway 8 underneath the Franklin Street Bridge was 1.9 m below grade, corresponding to Elevation 319.0 m. These water levels indicate that the groundwater flows in a north-west direction towards Montgomery Creek. It may also flow locally towards the depressed Highway 8 and/or to the storm water system under Highway 8.

It is noted that the water table was measured at Elevation 320.0 m (1050 ft) in 1964 prior to construction of the retaining walls and the depressed Highway 8.

The water levels recorded indicate the static water level of the shallow water table. Fluctuation in the groundwater table can be expected seasonally and in response to major weather events.



## 5. MISCELLANEOUS

The field work for this investigation was carried out between November 16, 1998 and February 11, 1999 under the supervision of Scott Watling, Senior Technologist of AGRA Earth & Environmental Limited under the direction of Eric Y. Chung, P.Eng. This report was prepared by Eric Y. Chung and reviewed by Zuhtu S. Ozden, P.Eng.

Yours truly,  
AGRA Earth & Environmental Limited

Eric Y. Chung, M.Eng., P.Eng.  
Kitchener-Waterloo Branch Manager



Zuhtu S. Ozden, P.Eng.  
Designated MTO Contact





## EXPLANATION OF TERMS USED IN REPORT

**N VALUE:** THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS  $\bar{N}$ .

**DYNAMIC CONE PENETRATION TEST:** CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

**CONSISTENCY:** COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH ( $c_u$ ) AS FOLLOWS:

| $c_u$ (kPa) | 0 - 12    | 12 - 25 | 25 - 50 | 50 - 100 | 100 - 200  | > 200 |
|-------------|-----------|---------|---------|----------|------------|-------|
|             | VERY SOFT | SOFT    | FIRM    | STIFF    | VERY STIFF | HARD  |

**DENSENESS:** COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

| N (BLOWS/0.3m) | 0 - 5      | 5 - 10 | 10 - 30 | 30 - 50 | > 50       |
|----------------|------------|--------|---------|---------|------------|
|                | VERY LOOSE | LOOSE  | COMPACT | DENSE   | VERY DENSE |

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND / OR STRENGTH.

**RECOVERY:** SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

**MODIFIED RECOVERY:** SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY, IS:

| RQD (%) | 0 - 25    | 25 - 50 | 50 - 75 | 75 - 90 | 90 - 100  |
|---------|-----------|---------|---------|---------|-----------|
|         | VERY POOR | POOR    | FAIR    | GOOD    | EXCELLENT |

**JOINTING AND BEDDING:**

| SPACING  | 50mm       | 50 - 300mm | 0.3m - 1m  | 1m - 3m | > 3m       |
|----------|------------|------------|------------|---------|------------|
| JOINTING | VERY CLOSE | CLOSE      | MOD. CLOSE | WIDE    | VERY WIDE  |
| BEDDING  | VERY THIN  | THIN       | MEDIUM     | THICK   | VERY THICK |

## ABBREVIATIONS AND SYMBOLS

### FIELD SAMPLING

|    |                     |    |                           |
|----|---------------------|----|---------------------------|
| SS | SPLIT SPOON         | TP | THINWALL PISTON           |
| WS | WASH SAMPLE         | OS | OSTERBERG SAMPLE          |
| ST | SLOTTED TUBE SAMPLE | RC | ROCK CORE                 |
| BS | BLOCK SAMPLE        | PH | TW ADVANCED HYDRAULICALLY |
| CS | CHUNK SAMPLE        | PM | TW ADVANCED MANUALLY      |
| TW | THINWALL OPEN       | FS | FOIL SAMPLE               |

### STRESS AND STRAIN

|                                      |     |                               |
|--------------------------------------|-----|-------------------------------|
| $u_w$                                | kPa | PORE WATER PRESSURE           |
| $u$                                  | l   | PORE PRESSURE RATIO           |
| $\sigma$                             | kPa | TOTAL NORMAL STRESS           |
| $\sigma'$                            | kPa | EFFECTIVE NORMAL STRESS       |
| $\tau$                               | kPa | SHEAR STRESS                  |
| $\sigma_1, \sigma_2, \sigma_3$       | kPa | PRINCIPAL STRESSES            |
| $\epsilon$                           | %   | LINEAR STRAIN                 |
| $\epsilon_1, \epsilon_2, \epsilon_3$ | %   | PRINCIPAL STRAINS             |
| E                                    | kPa | MODULUS OF LINEAR DEFORMATION |
| G                                    | kPa | MODULUS OF SHEAR DEFORMATION  |
| $\mu$                                | 1   | COEFFICIENT OF FRICTION       |

### MECHANICAL PROPERTIES OF SOIL

|                |                   |                                      |
|----------------|-------------------|--------------------------------------|
| $m_v$          | kPa <sup>-1</sup> | COEFFICIENT OF VOLUME CHANGE         |
| $C_c$          | 1                 | COMPRESSION INDEX                    |
| $C_s$          | 1                 | SWELLING INDEX                       |
| $C_\alpha$     | 1                 | RATE OF SECONDARY CONSOLIDATION      |
| $c_v$          | m <sup>2</sup> /s | COEFFICIENT OF CONSOLIDATION         |
| H              | m                 | DRAINAGE PATH                        |
| $T_v$          | 1                 | TIME FACTOR                          |
| U              | %                 | DEGREE OF CONSOLIDATION              |
| $\sigma'_{vo}$ | kPa               | EFFECTIVE OVERBURDEN PRESSURE        |
| $\sigma'_p$    | kPa               | PRECONSOLIDATION PRESSURE            |
| $\tau_f$       | kPa               | SHEAR STRENGTH                       |
| $c'_f$         | kPa               | EFFECTIVE COHESION INTERCEPT         |
| $\phi'$        | -°                | EFFECTIVE ANGLE OF INTERNAL FRICTION |
| $c_u$          | kPa               | APPARENT COHESION INTERCEPT          |
| $\phi_u$       | -°                | APPARENT ANGLE OF INTERNAL FRICTION  |
| $\tau_R$       | kPa               | RESIDUAL SHEAR STRENGTH              |
| $\tau_r$       | kPa               | REMOULDED SHEAR STRENGTH             |
| $S_t$          | 1                 | SENSITIVITY = $\frac{c_u}{\tau_r}$   |

### PHYSICAL PROPERTIES OF SOIL

|                |                   |                                |           |      |  |           |                   |   |
|----------------|-------------------|--------------------------------|-----------|------|--|-----------|-------------------|---|
| $\rho_s$       | kg/m <sup>3</sup> | DENSITY OF SOLID PARTICLES     | e         | 1, % | VOID RATIO                                 | $e_{min}$ | 1, %              | VOID RATIO IN DENSEST STATE                             |
| $\gamma_s$     | kN/m <sup>3</sup> | UNIT WEIGHT OF SOLID PARTICLES | n         | 1, % | POROSITY                                   | $I_D$     | 1                 | DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$ |
| $\rho_w$       | kg/m <sup>3</sup> | DENSITY OF WATER               | w         | 1, % | WATER CONTENT                              | D         | mm                | GRAIN DIAMETER  |
| $\gamma_w$     | kN/m <sup>3</sup> | UNIT WEIGHT OF WATER           | $S_r$     | %    | DEGREE OF SATURATION                       | $D_n$     | mm                | n PERCENT - DIAMETER                                    |
| $\rho$         | kg/m <sup>3</sup> | DENSITY OF SOIL                | $w_L$     | %    | LIQUID LIMIT                               | $C_u$     | 1                 | UNIFORMITY COEFFICIENT                                  |
| $\gamma$       | kN/m <sup>3</sup> | UNIT WEIGHT OF SOIL            | $w_p$     | %    | PLASTIC LIMIT                              | h         | m                 | HYDRAULIC HEAD OR POTENTIAL                             |
| $\rho_d$       | kg/m <sup>3</sup> | DENSITY OF DRY SOIL            | $w_s$     | %    | SHRINKAGE LIMIT                            | q         | m <sup>3</sup> /s | RATE OF DISCHARGE                                       |
| $\gamma_d$     | kN/m <sup>3</sup> | UNIT WEIGHT OF DRY SOIL        | $I_p$     | %    | PLASTICITY INDEX = $\frac{w_L - w_p}{I_p}$ | v         | m/s               | DISCHARGE VELOCITY                                      |
| $\rho_{sat}$   | kg/m <sup>3</sup> | DENSITY OF SATURATED SOIL      | $I_L$     | 1    | LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$    | i         | 1                 | HYDRAULIC GRADIENT                                      |
| $\gamma_{sat}$ | kN/m <sup>3</sup> | UNIT WEIGHT OF SATURATED SOIL  | $I_C$     | 1    | CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$  | k         | m/s               | HYDRAULIC CONDUCTIVITY                                  |
| $\rho'$        | kg/m <sup>3</sup> | DENSITY OF SUBMERGED SOIL      | $e_{max}$ | 1, % | VOID RATIO IN LOOSEST STATE                | j         | kN/m <sup>3</sup> | SEEPAGE FORCE   |
| $\gamma'$      | kN/m <sup>3</sup> | UNIT WEIGHT OF SUBMERGED SOIL  |           |      |  |           |                   |   |

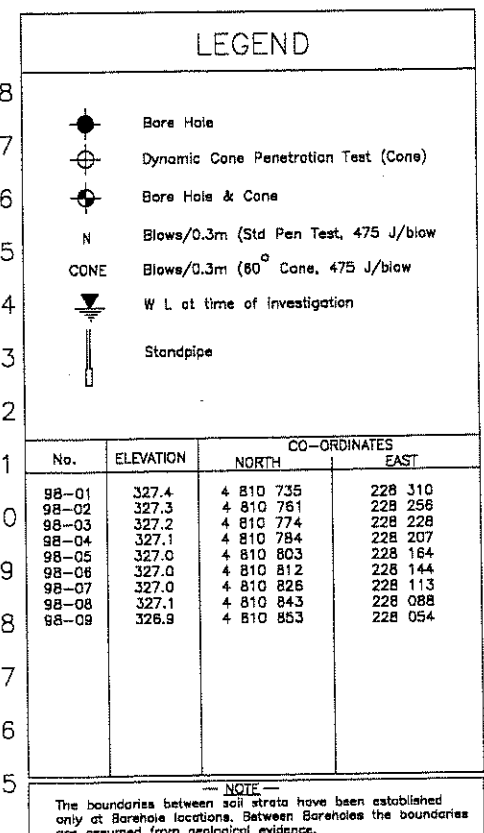
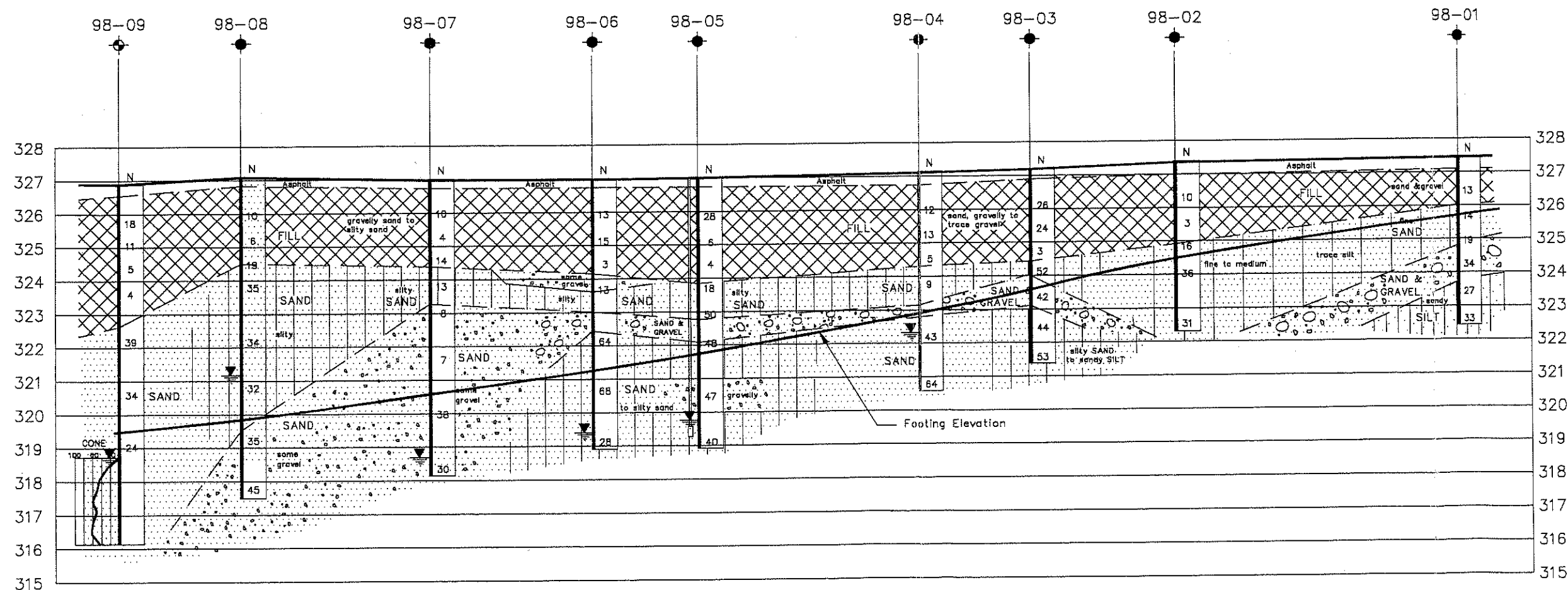
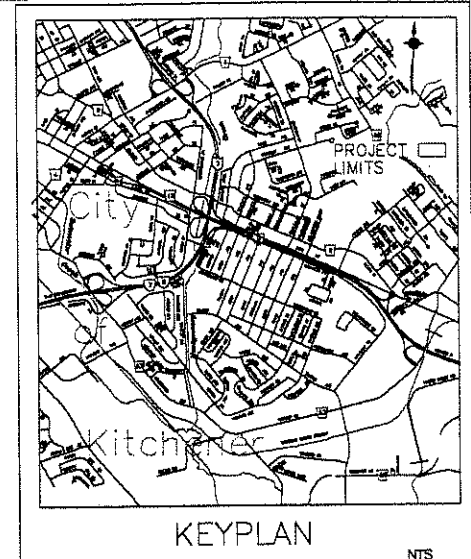
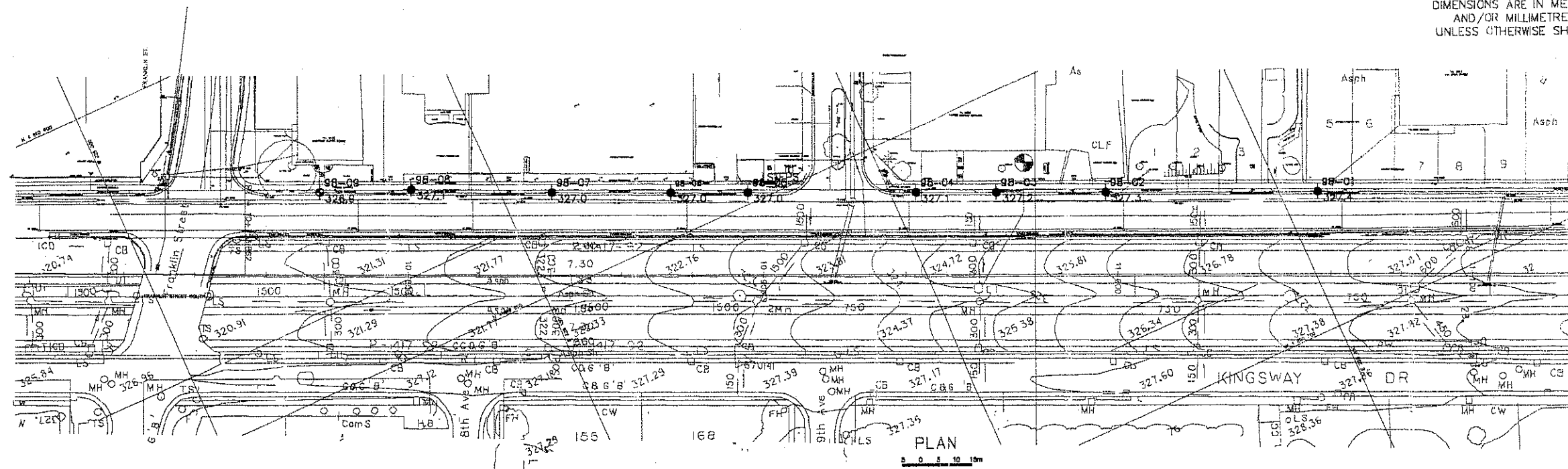


DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

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**AGRA Earth & Environmental**  
ENGINEERING GLOBAL SOLUTIONS



|                  |  |             |  |             |  |
|------------------|--|-------------|--|-------------|--|
| REVIEWS          |  |             |  |             |  |
|                  |  |             |  |             |  |
|                  |  |             |  |             |  |
| DATE             |  | BY          |  | DISCRPTION  |  |
| GEOCREs 40P8-118 |  |             |  |             |  |
| HWY No.          |  | HWY 7 & 8   |  | DIST 2      |  |
| SUBM'D DO        |  | CHECKED EYC |  | SITE 33-221 |  |
| DRAWN LWM        |  | CHECKED     |  | APPROVED    |  |
|                  |  |             |  | DWG A       |  |

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section GC2.01 of OPS Gen. Cond.



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DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

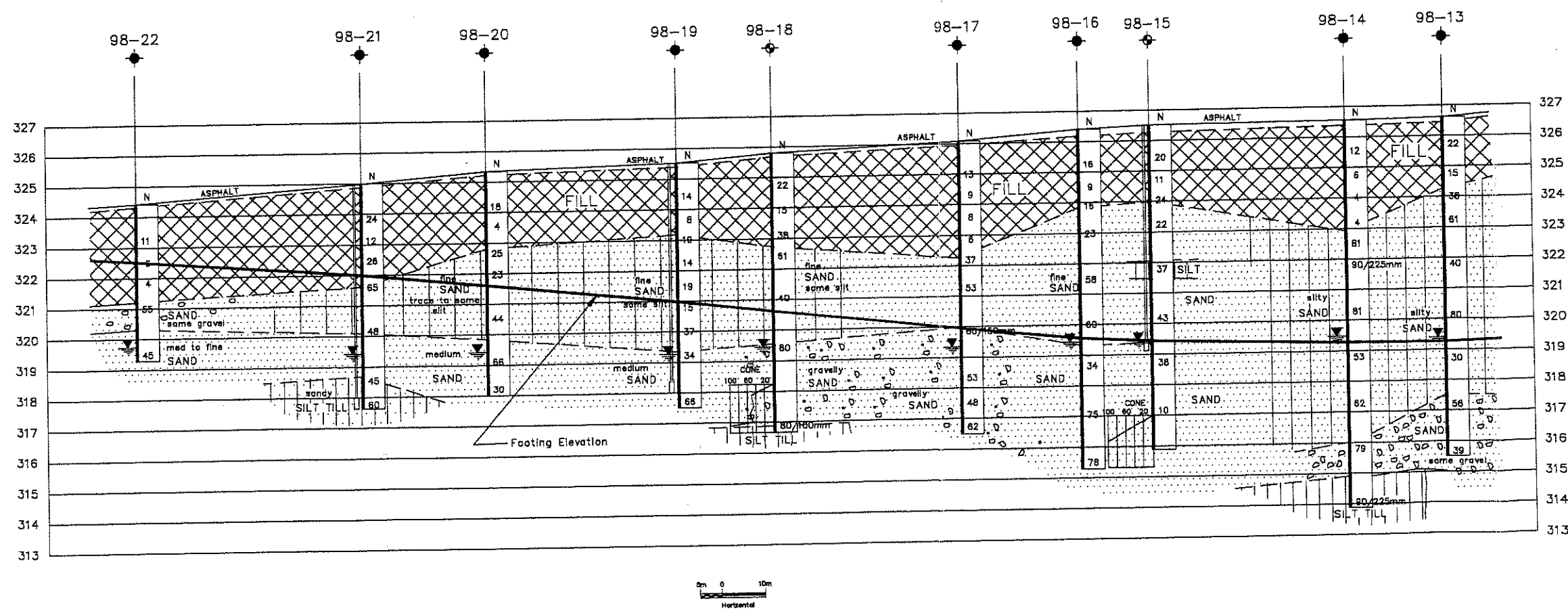
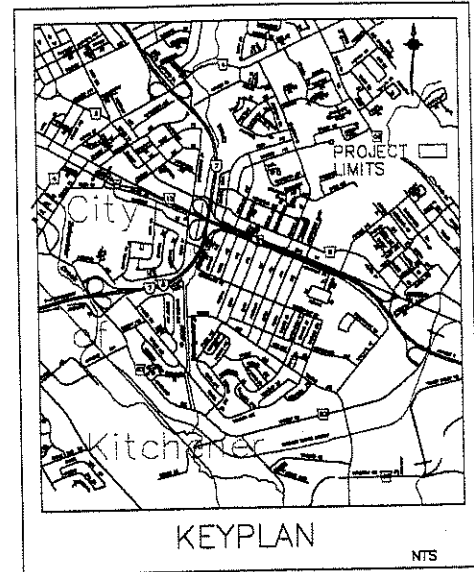
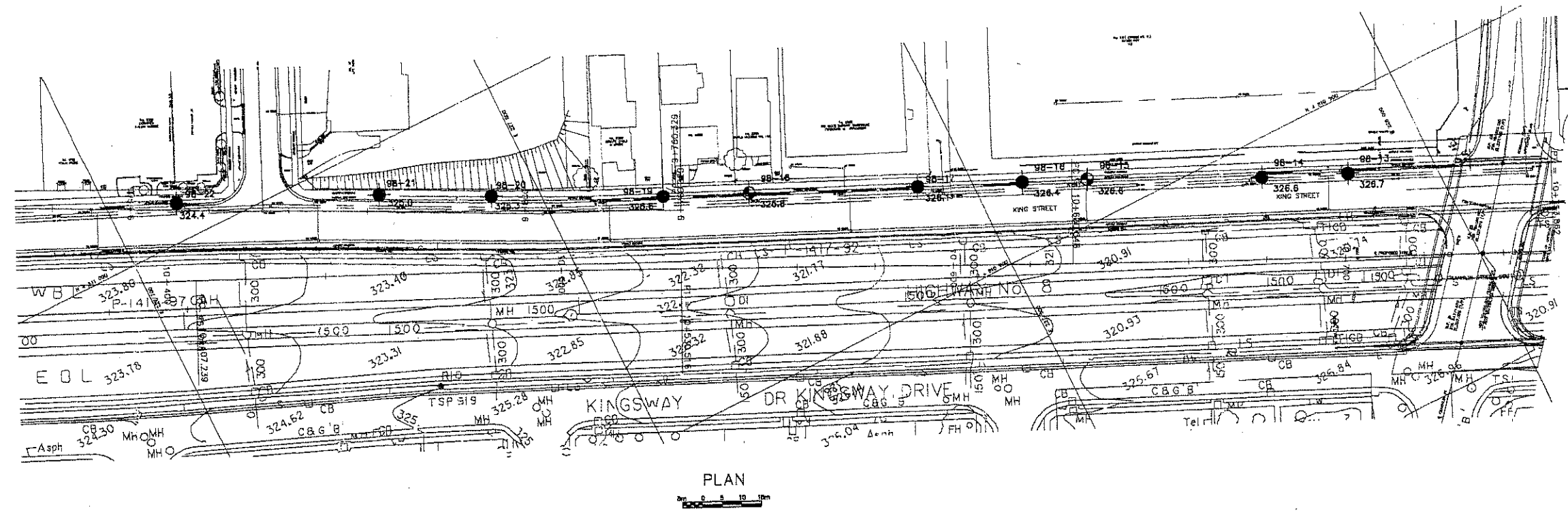
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WP No 363-94-00



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BORE HOLE LOCATIONS & SOIL STRATA

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**AGRA Earth & Environmental**  
ENGINEERING GLOBAL SOLUTIONS



LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊙ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CON Blows/0.3m (80° Cone, 475 J/blow)
- W L at time of investigation
- Standpipe

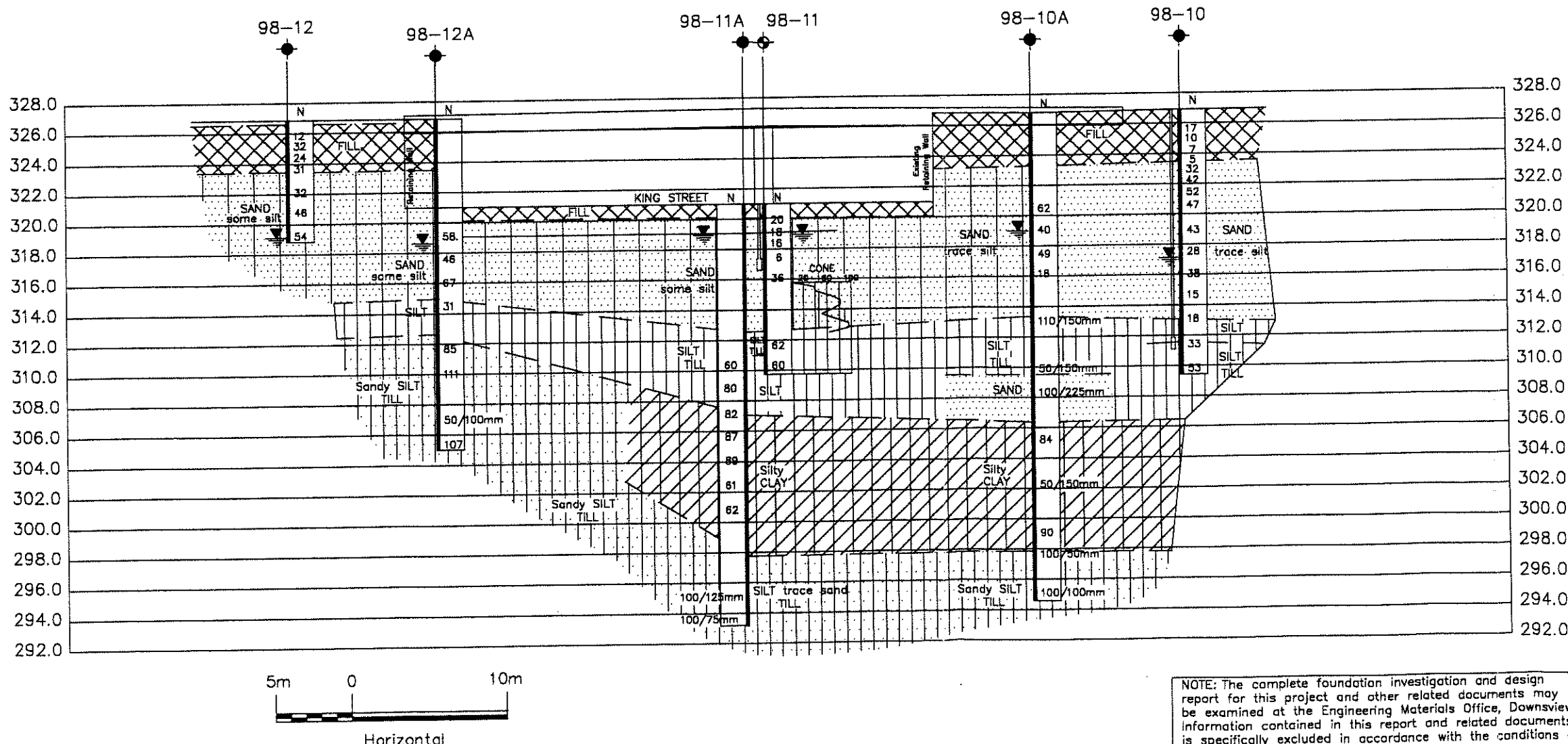
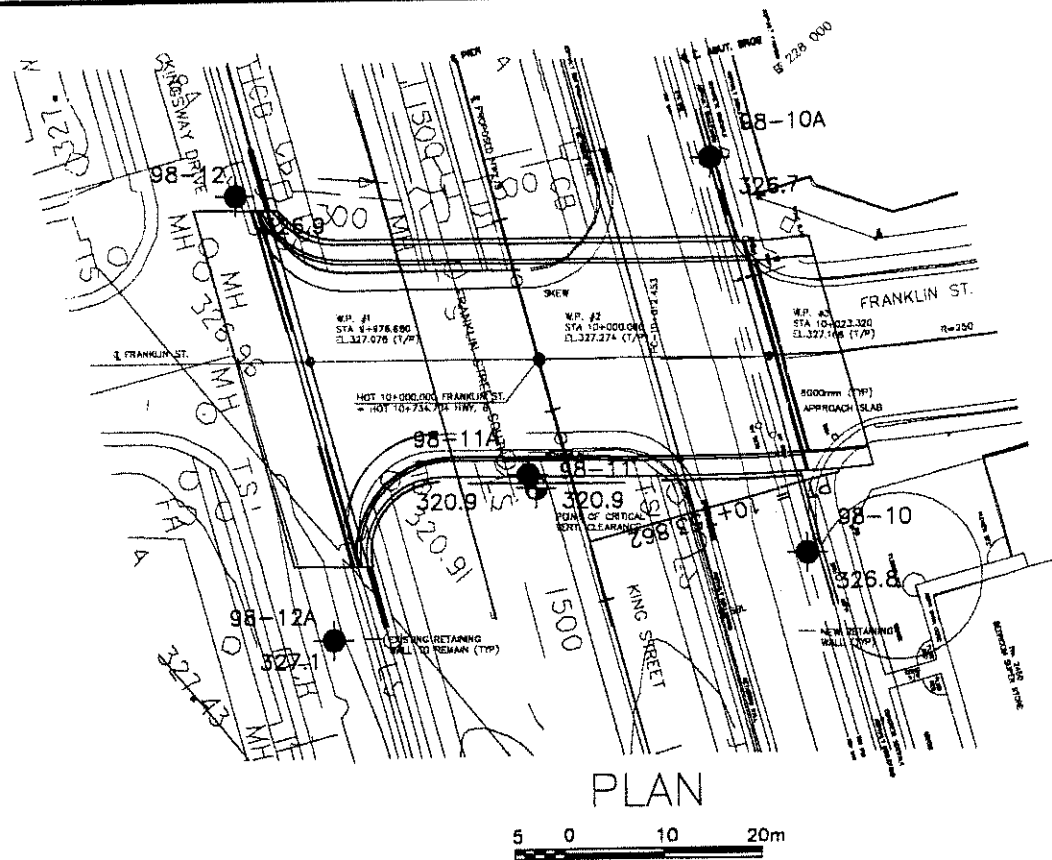
| No.   | ELEVATION | CO-ORDINATES |         |
|-------|-----------|--------------|---------|
|       |           | NORTH        | EAST    |
| 98-13 | 326.7     | 4 810 882    | 227 986 |
| 98-14 | 326.6     | 4 810 890    | 227 987 |
| 98-15 | 326.6     | 4 810 911    | 227 926 |
| 98-16 | 326.4     | 4 810 917    | 227 911 |
| 98-17 | 326.1     | 4 810 929    | 227 887 |
| 98-18 | 325.8     | 4 810 948    | 227 848 |
| 98-19 | 325.6     | 4 810 955    | 227 828 |
| 98-20 | 325.3     | 4 810 975    | 227 788 |
| 98-21 | 325.0     | 4 810 888    | 227 763 |
| 98-22 | 324.4     | 4 811 009    | 227 717 |

NOTE:  
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section GC2.01 of OPS Gen. Cond.

|                 |             |                |             |
|-----------------|-------------|----------------|-------------|
| REVISIONS       |             |                |             |
|                 |             |                |             |
|                 |             |                |             |
|                 |             |                |             |
|                 |             |                |             |
| DATE            | BY          | DISCRPTION     |             |
| GEOCRE 40PB-118 |             |                |             |
| HWY No.         | HWY 7 & B   |                | DIST 2      |
| SUBM'D 00       | CHECKED EYC | DATE June 1999 | SITE 33-221 |
| DRAWN LWM       | CHECKED     | APPROVED       | DWG B       |





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DIMENSIONS ARE IN METRES  
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UNLESS OTHERWISE SHOWN

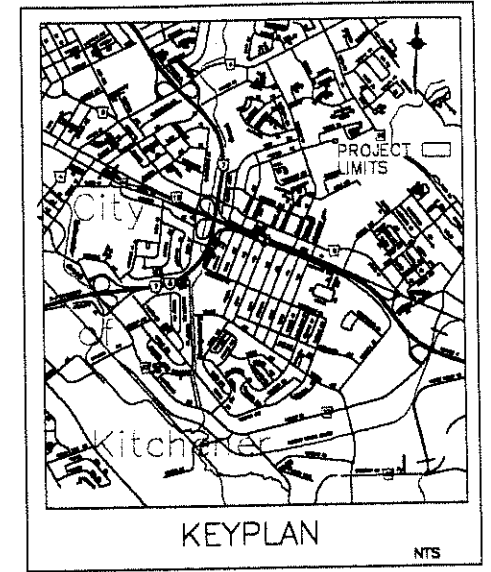
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WP No 363-94-00

FRANKLIN STREET  
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BORE HOLE LOCATIONS & SOIL STRATA

SHEET  
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**AGRA Earth & Environmental**  
ENGINEERING GLOBAL SOLUTIONS



LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W L at time of investigation
- Standpipe

| No.    | ELEVATION | CO-ORDINATES |         |
|--------|-----------|--------------|---------|
|        |           | NORTH        | EAST    |
| 98-10  | 326.8     | 4 810 857    | 228 040 |
| 98-10A | 326.7     | 4 810 875    | 228 003 |
| 98-11  | 320.9     | 4 810 840    | 228 018 |
| 98-11A | 320.9     | 4 810 840    | 228 018 |
| 98-12  | 326.9     | 4 810 836    | 227 975 |
| 98-12A | 326.9     | 4 810 814    | 228 018 |

NOTE:  
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

|                 |             |               |             |
|-----------------|-------------|---------------|-------------|
| REVISIONS       |             |               |             |
|                 |             |               |             |
|                 |             |               |             |
| DATE            | BY          | DISCUSSION    |             |
|                 |             |               |             |
| GEOCRE 40P8-118 |             |               |             |
| HWY No.         | HWY NO      | DIST          | DIST?       |
| SUBM'D 00       | CHECKED EYC | DATE June1999 | SITE 33-221 |
| DRAWN LWM       | CHECKED     | APPROVED      | DWG C       |

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section GC2.01 of OPS Gen. Cond.



## APPENDIX "A"

### Record of Borehole Sheets


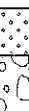
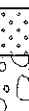
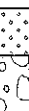
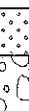
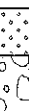
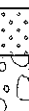


# RECORD OF BOREHOLE No 98-01

1 OF 1

METRIC

W.P. 363-94-00 SITE:33-221 LOCATION King St. E. South of Arlington Blvd., 4810735N, 228310E ORIGINATED BY S.W.  
 DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
 DATUM GEODETIC DATE 18.11.98 - 18.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |  |   | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT                                    |  |  |  |  | PLASTIC<br>LIMIT<br>w <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>w | LIQUID<br>LIMIT<br>w <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|--|---|---------|------|------------|----------------------------|-----------------|--|--|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT  | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa<br>○ UNCONFINED + FIELD VANE<br>● QUICK TRIAXIAL × LAB VANE |  |  |  |  |                                    |                                     |                                   |  |  |
| 327.4<br>0.0  | ASPHALT 100mm<br>CRUSHED GRANULAR 200mm<br>Compact, dark brown fine sand to<br>silty sand FILL<br>damp |  |         |      |            |                            | 327             |  |  |  |  |  |                                    |                                     |                                   |  |  |
| 326.0<br>1.4  | Compact, brown fine SAND, some<br>silt<br>damp   |  | 1       | SS   | 13         |                            | 326             |  |  |  |  |  |                                    |                                     |                                   |  | 3 78 19 0  |
| 324.8<br>2.6  | Compact, brown medium to coarse<br>SAND<br>damp  |  | 2       | SS   | 14         |                            | 325             |  |  |  |  |  |                                    |                                     |                                   |  | 1 88 11 0  |
| 324.3<br>3.1  | Dense, brown SAND and GRAVEL<br>damp   |  | 3       | SS   | 19         |                            | 324             |  |  |  |  |  |                                    |                                     |                                   |  |  |
| 323.8<br>3.8  | Compact to dense, brown SANDY<br>SILT<br>damp  |  | 4       | SS   | 34         |                            | 323             |  |  |  |  |  |                                    |                                     |                                   |  | 0 40 60 0  |
| 322.4<br>5.1  | END OF BOREHOLE @ 5.1m<br>NOTE: Borehole dry upon<br>completion  |  | 5       | SS   | 27         |                            |                 |  |  |  |  |  |                                    |                                     |                                   |  |  |
|               |  |  | 6       | SS   | 33         |                            |                 |  |  |  |  |  |                                    |                                     |                                   |  |  |



# RECORD OF BOREHOLE No 98-02

1 OF 1

METRIC

W.P. 363-94-00 SITE 33-221 LOCATION King St. E. South of Arlington Blvd., 4810761N, 228256E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 18.11.98 - 18.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |   | SAMPLES    |        |      | GROUND WATER<br>CONDITIONS | ELEVATION SCALE  | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |                    |    |     |                   | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|---|------------|--------|------|----------------------------|--|---|--------------------|----|-----|-------------------|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER | TYPE |                            |  | "N" VALUES                                  | SHEAR STRENGTH kPa |    |     |                   |                                    |                                     |                                   |  |  |
|               |   |            |        |      |                            | 20   | 40  | 60                 | 80 | 100 | WATER CONTENT (%) |                                    |                                     |                                   |  |  |
|               |   |            |        |      |                            | ○ UNCONFINED + FIELD VANE<br>● QUICK TRIAXIAL × LAB VANE |   |                    |    |     |                   |                                    |                                     |                                   |  |  |
|               |   |            |        |      |                            | 20   | 40  | 60                 | 80 | 100 | 10                | 20                                 | 30                                  |                                   |  |  |
| 327.3<br>0.0  | ASPHALT 120mm<br>CRUSHED GRANULAR 200mm<br>Compact, dark brown silty sand<br>and gravel FILL<br>moist |            |        |      |                            | 327  |   |                    |    |     |                   |                                    |                                     |                                   |  | 3 87 10 0  |
| 326.1<br>1.2  | Loose, dark brown silty sand, trace<br>to some gravel FILL<br>some asphalt inclusions<br>moist        |            | 1      | SS   | 10                         | 326  |   |                    |    |     |                   |                                    |                                     |                                   |  |  |
| 324.9<br>2.4  | Compact to dense, brown fine to<br>medium SAND, trace thin gravelly<br>seams<br>damp                  |            | 2      | SS   | 3                          | 325  |   |                    |    |     |                   |                                    |                                     |                                   |  |  |
|               |   |            | 3      | SS   | 16                         | 324  |   |                    |    |     |                   |                                    |                                     |                                   |  |  |
|               |   |            | 4      | SS   | 36                         | 323  |   |                    |    |     |                   |                                    |                                     |                                   |  |  |
| 322.3<br>5.1  | END OF BOREHOLE @ 5.1m<br>NOTE: Borehole dry upon<br>completion                                       |            | 5      | SS   | 31                         |  |   |                    |    |     |                   |                                    |                                     |                                   |  |  |



RECORD OF BOREHOLE No 98-03

1 OF 1

METRIC

W.P. 363-94-00 SITE:33-221 LOCATION King St. E. South of Arlington Blvd., 4810774N, 228228E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 18.11.98 - 18.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 327.2<br>0.0  | ASPHALT 120mm<br>CRUSHED GRANULAR 200mm<br>Compact, dark brown silty sand<br>and gravel FILL<br>moist |            |         |      |            |                            | 327             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 325.9<br>1.3  | Compact, dark brown silty sand<br>FILL<br>moist   |            | 1       | SS   | 26         |                            | 326             |   |    |    |    |     |                                    |                                     |                                   |                     | 6 63 31 0   |
| 325.2<br>2.0  | Very loose, dark brown sand and<br>gravel FILL<br>moist   |            | 2       | SS   | 24         |                            | 325             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 324.4<br>2.8  | Compact, brown fine to medium<br>SAND<br>damp   |            | 3       | SS   | 3          |                            | 324             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 324.0<br>3.2  | Dense to very dense, brown<br>GRAVELLY SAND, trace silt<br>damp                                       |            | 4       | SS   | 52         |                            | 323             |   |    |    |    |     |                                    |                                     |                                   |                     | 23 67 10 0  |
| 323.1<br>4.1  | Dense to very dense, light brown<br>SILTY FINE SAND to SANDY SILT<br>damp to moist                    |            | 5       | SS   | 42         |                            | 322             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 321.4<br>5.8  | END OF BOREHOLE @ 5.8m<br>NOTE: Borehole dry upon<br>completion                                       |            | 6       | SS   | 44         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 7       | SS   | 53         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |



# RECORD OF BOREHOLE No 98-04

1 OF 1

METRIC

W.P. 363-94-00 SITE:33-221 LOCATION King St. E. South of Arlington Blvd., 4810784N,228207E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 18.11.98 - 18.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |                   |  |  |  |  |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|--|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|-------------------|--|--|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |  |                                    |                                     |                                   |  |  | WATER CONTENT (%) |  |  |  |  |
|               |   |            |         |      |            |                            |                 |   |  |  |                                    |                                     |                                   |  |  |                   |  |  |  |  |
|               |   |            |         |      |            |                            |                 |   |  |  |                                    |                                     |                                   |  |  |                   |  |  |  |  |
| 327.1         |   |            |         |      |            |                            | 20 40 60 80 100 |   |  |  |                                    |                                     |                                   |  |  |                   |  |  |  |  |
| 0.0           | ASPHALT 120mm<br>CRUSHED GRANULAR 250mm<br>Compact, dark brown gravelly sand<br>FILL<br>moist |            |         |      |            |                            |                 |   |  |  |                                    |                                     |                                   |  |  |                   |  |  |  |  |
| 325.6         |   |            | 1       | SS   | 12         |                            |                 |   |  |  |                                    |                                     |                                   |  |  |                   |  |  |  |  |
| 1.5           | Compact, dark brown fine sand,<br>some silt FILL<br>moist                                     |            | 2       | SS   | 13         |                            |                 |   |  |  |                                    |                                     |                                   | 5 69 26 0                                |  |                   |  |  |  |  |
| 324.8         |   |            |         |      |            |                            |                 |   |  |  |                                    |                                     |                                   |  |  |                   |  |  |  |  |
| 2.3           | Loose, brown sand, trace to some<br>gravel FILL<br>moist                                      |            | 3       | SS   | 5          |                            |                 |   |  |  |                                    |                                     |                                   |  |  |                   |  |  |  |  |
| 324.3         |   |            |         |      |            |                            |                 |   |  |  |                                    |                                     |                                   |  |  |                   |  |  |  |  |
| 2.8           | Loose to compact, brown fine<br>SAND and SILT<br>moist to wet                                 |            | 4       | SS   | 9          |                            |                 |   |  |  |                                    |                                     |                                   | 0 55 45 0                                |  |                   |  |  |  |  |
| 323.1         |   |            |         |      |            |                            |                 |   |  |  |                                    |                                     |                                   |  |  |                   |  |  |  |  |
| 4.0           | Dense, brown SAND and GRAVEL  |            |         |      |            |                            |                 |   |  |  |                                    |                                     |                                   |  |  |                   |  |  |  |  |
| 322.8         |   |            |         |      |            |                            |                 |   |  |  |                                    |                                     |                                   |  |  |                   |  |  |  |  |
| 4.3           | Dense to very dense, brown fine<br>SAND<br>wet  |            | 5       | SS   | 43         |                            |                 |   |  |  |                                    |                                     |                                   |  |  |                   |  |  |  |  |
| 322.3         |   |            |         |      |            |                            |                 |   |  |  |                                    |                                     |                                   |  |  |                   |  |  |  |  |
| 4.8           | saturated   |            |         |      |            |                            |                 |   |  |  |                                    |                                     |                                   |  |  |                   |  |  |  |  |
| 320.5         |   |            | 6       | SS   | 64         |                            |                 |   |  |  |                                    |                                     |                                   |  |  |                   |  |  |  |  |
| 6.6           | END OF BOREHOLE @ 6.6m<br>NOTE: Water level recorded @<br>4.8m upon completion                |            |         |      |            |                            |                 |   |  |  |                                    |                                     |                                   |  |  |                   |  |  |  |  |



# RECORD OF BOREHOLE No 98-05

1 OF 1

METRIC

W.P. 363-94-00 SITE 33-221 LOCATION King St. E. North of Arlington Blvd., 4810803N, 228164E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 17.11.98 - 17.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |             |  | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |            |                  |    | PLASTIC<br>LIMIT<br>w <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>w | LIQUID<br>LIMIT<br>w <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |                   |  |  |
|---------------|-------------|--|---------|------|------------|----------------------------|-----------------|---|----|------------|------------------|----|------------------------------------|-------------------------------------|-----------------------------------|--|--|-------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION | STRAT PLOT   | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |    |            |                  |    |                                    |                                     |                                   |  |  | WATER CONTENT (%) |  |  |
|               |             |  |         |      |            |                            |                 |   |    |            |                  |    |                                    |                                     |                                   |  |  |                   |  |  |
|               |             |  |         |      |            |                            |                 | ○ UNCONFINED                                | +  | FIELD VANE | ● QUICK TRIAXIAL | ×  |                                    |                                     |                                   |  |  | LAB VANE          |  |  |
| 327.0         | 0.0         | ASPHALT 80mm<br>CRUSHED GRANULAR 200mm<br>Compact, dark brown gravelly sand<br>FILL    |         |      |            |                            | 20              | 40  | 60 | 80         | 100              | 10 | 20                                 | 30                                  |                                   |  |  |                   |  |  |
| 326.2         | 0.8         | Compact, dark brown silty sand<br>FILL<br>moist  | 1       | SS   | 28         |                            |                 |   |    |            |                  |    |                                    |                                     |                                   |  |  |                   |  |  |
| 325.0         | 2.0         | Very loose, brown gravelly sand<br>FILL<br>moist                                       | 2       | SS   | 6          |                            |                 |   |    |            |                  |    |                                    |                                     |                                   |  |  |                   |  |  |
|               |             |  | 3       | SS   | 4          |                            |                 |   |    |            |                  |    |                                    |                                     |                                   |  |  |                   |  |  |
| 323.8         | 3.2         | Compact, brown fine SAND to<br>SILTY SAND<br>moist to wet                              | 4       | SS   | 18         |                            |                 |   |    |            |                  |    |                                    |                                     |                                   |  |  |                   |  |  |
|               |             |  | 5       | SS   | 50         |                            |                 |   |    |            |                  |    |                                    |                                     |                                   |  |  |                   |  |  |
| 322.7         | 4.3         | Compact to dense, brown<br>GRAVELLY SAND   | 6       | SS   | 48         |                            |                 |   |    |            |                  |    |                                    |                                     |                                   |  |  |                   |  |  |
| 322.1         | 4.9         | Dense, brown fine SAND to SILTY<br>SAND<br>damp  |         |      |            |                            |                 |   |    |            |                  |    |                                    |                                     |                                   |  |  |                   |  |  |
|               |             |  | 7       | SS   | 47         |                            |                 |   |    |            |                  |    |                                    |                                     |                                   |  |  |                   |  |  |
| 320.7         | 6.3         | Dense to very dense, brown<br>GRAVELLY SAND<br>damp                                    |         |      |            |                            |                 |   |    |            |                  |    |                                    |                                     |                                   |  |  |                   |  |  |
| 320.0         | 7.0         | Compact to dense, brown fine<br>SAND to SILTY SAND<br>wet to saturated<br>trace gravel | 8       | SS   | 40         |                            |                 |   |    |            |                  |    |                                    |                                     |                                   |  |  |                   |  |  |
| 318.9         | 8.1         | END OF BOREHOLE @ 8.1m<br>NOTE: Water level recorded @ 7.3<br>m (3/3/99)               |         |      |            |                            |                 |   |    |            |                  |    |                                    |                                     |                                   |  |  |                   |  |  |



## 1 OF 1

METRIC

| SOIL PROFILE |  |            | SAMPLES |      |            | GROUND WATER CONDITIONS | DYNAMIC CONE PENETRATION RESISTANCE PLOT               | PLASTIC LIMIT<br>w <sub>p</sub> | NATURAL MOISTURE CONTENT<br>w | LQUID LIMIT<br>w <sub>L</sub> | UNIT WEIGHT<br>$\gamma$<br>kN/m³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |    |
|--------------|--|------------|---------|------|------------|-------------------------|--|---------------------------------|-------------------------------|-------------------------------|----------------------------------|---------------------------------------|----|
| ELEV DEPTH   | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                         | SHEAR STRENGTH kPa                                     |                                 | WATER CONTENT (%)             |                               |                                  |                                       |    |
|              |  |            |         |      |            |                         | UNCONFINED + FIELD VANE<br>● QUICK TRIAXIAL × LAB VANE |                                 | 20                            | 40                            |                                  |                                       | 60 |
| 327.0        | ASPHALT 80mm CRUSHED GRANULAR 200mm Compact, dark brown gravelly sand FILL | [Pattern]  |         |      |            |                         |  |                                 |                               |                               |                                  |                                       |    |
| 326.2        | Compact, dark brown fine sand FILL moist                                   | [Pattern]  | 1       | SS   | 13         |                         |  | ( )                             |                               |                               |                                  |                                       |    |
| 325.5        | Loose, brown fine sand, trace gravel FILL moist                            | [Pattern]  | 2       | SS   | 15         |                         |  | ( )                             |                               |                               |                                  |                                       |    |
| 324.2        | Compact, brown SAND, some gravel, some silt damp                           | [Pattern]  | 3       | SS   | 3          |                         |  | ( )                             |                               |                               |                                  |                                       |    |
| 323.6        | Compact, brown fine SAND to SILTY SAND damp                                | [Pattern]  | 4       | SS   | 13         |                         |  | ( )                             |                               |                               |                                  |                                       |    |
| 323.0        | brown SAND and GRAVEL damp   | [Pattern]  |         |      |            |                         |  |                                 |                               |                               |                                  |                                       |    |
| 322.4        | Very dense, light brown fine SAND to SILTY SAND damp                       | [Pattern]  | 5       | SS   | 64         |                         |  | ( )                             |                               |                               |                                  |                                       |    |
| 319.4        | saturated  | [Pattern]  | 6       | SS   | 68         |                         |  | ( )                             |                               |                               |                                  |                                       |    |
| 318.9        | END OF BOREHOLE @ 8.1m NOTE: Water level recorded @ 7.6m upon completion   | [Pattern]  | 7       | SS   | 28         |                         |  | ( )                             |                               |                               |                                  |                                       |    |




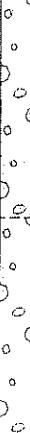




# RECORD OF BOREHOLE No 98-07

1 OF 1

METRIC

W.P. 363-94-00 SITE:33-221 LOCATION King St. E. North of Arlington Blvd., 4810826N, 228113E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 17.11.98 - 17.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |  |   | SAMPLES |      |            | GROUND WATER<br>CONDITIONS  | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT                    |     | PLASTIC<br>LIMIT<br>w <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>w | LIQUID<br>LIMIT<br>w <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |                   |    |    |    |   |  |  |  |
|---------------|--|---|---------|------|------------|---|-----------------|--|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|-------------------|----|----|----|---|--|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT  | NUMBER  | TYPE | "N" VALUES |   |                 | SHEAR STRENGTH kPa   |     |                                    |                                     |                                   |                     |   | WATER CONTENT (%) |    |    |    |   |  |  |  |
|               |  |   |         |      |            |   |                 | ○ UNCONFINED    + FIELD VANE<br>● QUICK TRIAXIAL    × LAB VANE |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
|               |  |   |         |      |            |   | 20              | 40   | 60  | 80                                 | 100                                 | 10                                | 20                  | 30  | GR                | SA | SI | C  |   |  |  |  |
| 327.0         | ASPHALT 80mm<br>CRUSHED GRANULAR 200mm<br>Compact to loose, dark brown<br>gravelly sand and silty sand FILL<br>moist |    |         |      |            |  | 326             |  |     |                                    |                                     |                                   |                     |   |                   | 0  | 73 | 27 | 0 |  |  |  |
| 0.0           |  |   | 1       | SS   | 10         |   |                 |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
|               | 2  | SS  | 4       |      |            |   |                 |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
| 324.7         |  |   |         |      |            |   |                 | 325  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
| 324.4         | wet  |   |         |      |            |   |                 |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
|               | 3  | SS  | 14      |      |            |   |                 |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
| 2.6           | Compact, brown fine SAND to<br>SILTY SAND<br>wet   |    |         |      |            |   |                 |  | 324 |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
|               | 4  |   | SS      | 13   |            |   |                 |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
| 323.3         |  |   |         |      |            |   |                 |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
| 3.7           | Loose, brown SAND, some gravel,<br>trace silt<br>damp  |   |         |      |            | 323   |                 |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
|               | 5  |   | SS      | 8    |            |   |                 |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
|               |  |   |         |      |            |   |                 |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
|               | 6  | SS  | 7       |      |            |   | 322             |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
| 321.0         |  |   |         |      |            |   |                 |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
| 6.0           | dense<br>damp  |  |         |      |            |   |                 | 321  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
|               | 7  |   | SS      | 38   |            |   |                 |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
|               |  |   |         |      |            |   |                 |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
| 318.7         |  |   |         |      |            | 320   |                 |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
| 8.3           | saturated  |  |         |      |            |   |                 |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
| 318.2         |  |   |         |      |            |   |                 |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
| 8.9           | END OF BOREHOLE @ 8.9m<br>NOTE: Water level recorded @<br>8.3m upon completion                                       |   |         |      |            |   | 319             |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
|               |  |   |         |      |            |   |                 |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
|               |  |   |         |      |            |   |                 |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
|               |  |   |         |      |            |   |                 |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
|               |  |   |         |      |            |   |                 |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
|               |  |   |         |      |            |   |                 |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
|               |  |   |         |      |            |   |                 |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |
|               |  |   |         |      |            |   |                 |  |     |                                    |                                     |                                   |                     |   |                   |    |    |    |   |  |  |  |






# RECORD OF BOREHOLE No 98-08

1 OF 1

METRIC

W.P. 363-94-00 SITE 33-221 LOCATION King St. E., South of Franklin St., 4810843N, 226088E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETTIC DATE 17.11.98 - 17.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |   |   | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |              | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |                   |  |  |  |  |  |  |
|---------------|---|---|---------|------|------------|----------------------------|-----------------|---|----|--------------|------------------------------------|-------------------------------------|-----------------------------------|--|--|-------------------|--|--|--|--|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT  | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |    |              |                                    |                                     |                                   |  |  | WATER CONTENT (%) |  |  |  |  |  |  |
|               |   |   |         |      |            |                            |                 | ○ UNCONFINED                                |    | + FIELD VANE |                                    |                                     |                                   |  |  |                   |  |  |  |  |  |  |
|               |   |   |         |      |            |                            |                 | ● QUICK TRIAXIAL                            |    | × LAB VANE   |                                    |                                     |                                   |  |  |                   |  |  |  |  |  |  |
| 327.1         |   |   |         |      |            |                            | 20              | 40  | 60 | 80           | 100                                |                                     |                                   |  |  |                   |  |  |  |  |  |  |
| 0.0           | ASPHALT 80mm  |    |         |      |            |                            | 327             |   |    |              |                                    |                                     |                                   |  |  |                   |  |  |  |  |  |  |
| 326.4         | CRUSHED GRANULAR 200mm  |   |         |      |            |                            |                 |   |    |              |                                    |                                     |                                   |  |  |                   |  |  |  |  |  |  |
|               | Compact, dark brown gravelly sand   |   |         |      |            |                            |                 |   |    |              |                                    |                                     |                                   |  |  |                   |  |  |  |  |  |  |
| 0.7           | FILL  |   | 1       | SS   | 10         |                            | 326             |   |    |              |                                    |                                     |                                   |  |  |                   |  |  |  |  |  |  |
|               | Loose, dark brown fine sand to silty sand                                   |   | 2       | SS   | 6          |                            |                 |   |    |              |                                    |                                     |                                   |  |  |                   |  |  |  |  |  |  |
|               | moist   |   |         |      |            |                            |                 |   |    |              |                                    |                                     |                                   |  |  |                   |  |  |  |  |  |  |
| 324.8         |   |   |         |      |            |                            | 325             |   |    |              |                                    |                                     |                                   |  |  | 10 54 36 0        |  |  |  |  |  |  |
| 2.3           | wet sandy silt seam   |   | 3       | SS   | 19         |                            |                 |   |    |              |                                    |                                     |                                   |  |  |                   |  |  |  |  |  |  |
| 324.5         |   |   |         |      |            |                            |                 |   |    |              |                                    |                                     |                                   |  |  |                   |  |  |  |  |  |  |
| 2.6           | Compact to dense, brown fine SAND to SILTY SAND                             |    | 4       | SS   | 35         |                            | 324             |   |    |              |                                    |                                     |                                   |  |  | 0 88 12 0         |  |  |  |  |  |  |
|               | damp  |   |         |      |            |                            |                 |   |    |              |                                    |                                     |                                   |  |  |                   |  |  |  |  |  |  |
|               |   |   |         |      |            |                            |                 | 323   |    |              |                                    |                                     |                                   |  |  |                   |  |  |  |  |  |  |
|               |   |   |         | 5    | SS         | 34                         |                 |   |    |              |                                    |                                     |                                   |  |  |                   |  |  |  |  |  |  |
|               |   |   |         |      |            |                            |                 | 322   |    |              |                                    |                                     |                                   |  |  |                   |  |  |  |  |  |  |
| 321.2         |   |   |         |      |            |                            |                 |   |    |              |                                    |                                     |                                   |  |  |                   |  |  |  |  |  |  |
| 5.9           | saturated   |   | 6       | SS   | 32         |                            | 321             |   |    |              |                                    |                                     |                                   |  |  |                   |  |  |  |  |  |  |
|               |   |   |         |      |            |                            | 320             |   |    |              |                                    |                                     |                                   |  |  |                   |  |  |  |  |  |  |
| 319.5         |   |   |         |      |            |                            |                 |   |    |              |                                    |                                     |                                   |  |  |                   |  |  |  |  |  |  |
| 7.6           | Dense, brown medium to fine SAND, some gravel, trace silt saturated         |  | 7       | SS   | 35         |                            | 319             |   |    |              |                                    |                                     |                                   |  |  |                   |  |  |  |  |  |  |
|               |   |   |         |      |            |                            |                 |   |    |              |                                    |                                     |                                   |  |  |                   |  |  |  |  |  |  |
| 317.5         |   |   | 8       | SS   | 45         |                            | 318             |   |    |              |                                    |                                     |                                   |  |  |                   |  |  |  |  |  |  |
| 9.6           | END OF BOREHOLE @ 9.6m<br>NOTE: Water level recorded @ 5.9m upon completion |   |         |      |            |                            |                 |   |    |              |                                    |                                     |                                   |  |  |                   |  |  |  |  |  |  |



RECORD OF BOREHOLE No 98-09

1 OF 1

METRIC

W.P. 363-94-00 SITE:33-221 LOCATION King St. E., South of Franklin St., 4810853N, 228054E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 16.11.98 - 16.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    | PLASTIC<br>LIMIT | NATURAL<br>MOISTURE<br>CONTENT | LIQUID<br>LIMIT | UNIT<br>WEIGHT<br>$\gamma$<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|------------------|--------------------------------|-----------------|---|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | 20  | 40 |                  |                                |                 |   |   |
| 326.9<br>0.0  | ASPHALT 80mm<br>CRUSHED GRANULAR 200mm<br>Compact, dark brown gravelly sand<br>FILL |            |         |      |            |                            |                 |   |    |                  |                                |                 |   |   |
| 326.1<br>0.8  | Compact, dark brown fine sand to<br>silty sand FILL<br>moist                        |            | 1       | SS   | 18         |                            |                 |   |    |                  |                                |                 |   |   |
| 324.9<br>2.0  | Loose, brown gravelly sand FILL<br>damp   |            | 2       | SS   | 11         |                            |                 |   |    |                  |                                |                 |   |   |
|               |   |            | 3       | SS   | 5          |                            |                 |   |    |                  |                                |                 |   |   |
|               |   |            | 4       | SS   | 4          |                            |                 |   |    |                  |                                |                 |   |   |
| 322.6<br>4.3  | Dense, fine to medium SAND,<br>occasional gravel<br>damp                            |            | 5       | SS   | 39         |                            |                 |   |    |                  |                                |                 |   |   |
|               |   |            | 6       | SS   | 34         |                            |                 |   |    |                  |                                |                 |   |   |
| 319.9<br>7.0  | Dense to very dense, brown fine<br>SAND<br>saturated                                |            | 7       | SS   | 24         |                            |                 |   |    |                  |                                |                 |   |   |
| 316.2<br>10.7 | END OF BOREHOLE @ 10.7m<br>NOTE: Water level recorded @<br>7.0m upon completion     |            |         |      |            |                            |                 |   |    |                  |                                |                 |   |   |



# RECORD OF BOREHOLE No 98-10

1 OF 2

METRIC

W.P. 363-94-00 SITE:33-221 LOCATION King St. E., South of Franklin St. Bridge, 4810857N, 228040E ORIGINATED BY S.W.  
 DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
 DATUM GEODETIC DATE 16.11.98 - 16.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 |   |                                    |                                     |                                   |                     |   |
| 326.8<br>0.0  | ASPHALT 80mm<br>CRUSHED GRANULAR 200mm<br>Compact to loose, brown gravelly<br>sand FILL<br>moist |            | 1       | SS   | 17         |                            | 326             |   |                                    |                                     |                                   |                     |   |
|               |  |            | 2       | SS   | 10         |                            | 325             |   |                                    |                                     |                                   |                     |   |
|               |  |            | 3       | SS   | 7          |                            | 324             |   |                                    |                                     |                                   |                     |   |
| 323.4<br>3.4  | Dense, brown fine to medium<br>SAND, trace silt<br>damp  |            | 4       | SS   | 5          |                            | 323             |   |                                    |                                     |                                   |                     |   |
|               |  |            | 5       | SS   | 32         |                            | 322             |   |                                    |                                     |                                   |                     |   |
|               |  |            | 6       | SS   | 42         |                            | 321             |   |                                    |                                     |                                   |                     |   |
|               |  |            | 7       | SS   | 52         |                            | 320             |   |                                    |                                     |                                   |                     |   |
|               |  |            | 8       | SS   | 47         |                            | 319             |   |                                    |                                     |                                   |                     |   |
| 319.2<br>7.6  | wet  |            | 9       | SS   | 43         |                            | 318             |   |                                    |                                     |                                   |                     |   |
|               |  |            |         |      |            |                            | 317             |   |                                    |                                     |                                   |                     |   |
| 317.2<br>9.6  | saturated  |            | 10      | SS   | 28         |                            | 316             |   |                                    |                                     |                                   |                     |   |
|               |  |            | 11      | SS   | 38         |                            | 315             |   |                                    |                                     |                                   |                     |   |
|               |  |            | 12      | SS   | 15         |                            | 314             |   |                                    |                                     |                                   |                     |   |
| 312.9<br>13.9 | Compact, grey SILT<br>saturated  |            | 13      | SS   | 18         |                            | 313             |   |                                    |                                     |                                   |                     |   |
|               |  |            |         |      |            |                            | 312             |   |                                    |                                     |                                   |                     |   |
| 311.4<br>15.4 | Very dense, grey SILT TILL<br>moist  |            | 14      | SS   | 33         |                            | 311             |   |                                    |                                     |                                   |                     |   |

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+ 3 3. Numbers refer to  
Sensitivity

3% STRAIN AT FAILURE



# RECORD OF BOREHOLE No 98-10

2 OF 2

METRIC

W.P. 363-94-00 SITE: 33-221 LOCATION King St. E., South of Franklin St. Bridge, 4810857N, 228040E ORIGINATED BY S.W.  
 DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
 DATUM GEODETIC DATE 16.11.98 - 16.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC NATURAL LIQUID<br>LIMIT MOISTURE LIMIT<br>CONTENT |   |                | UNIT<br>WEIGHT<br>$\gamma$<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|---|---|----------------|---|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 | W <sub>p</sub>  | W | W <sub>L</sub> |   |  |
| 309.6<br>17.2 | END OF BOREHOLE @ 17.2m<br>NOTE: Water level recorded @<br>9.6m (1/26/99) |            | 15      | SS   | 53         |                            | 310             |   |    |    |    |     |   |   |                |   |  |



## 1 OF 3

METRIC

LOCATION

King St. E. at Franklin St. Bridge, 4810875N, 228003E

ORIGINATED BY S.W.

DIST 2 HWY 7 and 8

BOREHOLE TYPE Hollow Stem Auger

COMPILED BY S.W.

DATUM GEODETIC

DATE 09.02.99 - 10.02.99

CHECKED BY E.Y.C.

| SOIL PROFILE  |  |            | SAMPLES |             |            | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT                 |    |    | PLASTIC LIMIT<br>W <sub>p</sub> | NATURAL MOISTURE CONTENT<br>W | LIQUID LIMIT<br>W <sub>L</sub> | UNIT WEIGHT<br>$\gamma$<br>kN/m <sup>3</sup> | REMARKS & GRAIN SIZE DISTRIBUTION (%) |                   |     |  |  |  |  |
|---------------|--|------------|---------|-------------|------------|-------------------------|-----------------|--|----|----|---------------------------------|-------------------------------|--------------------------------|--|---------------------------------------|-------------------|-----|--|--|--|--|
| ELEV DEPTH    | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE        | "N" VALUES |                         |                 | 20   | 40 | 60 |                                 |                               |                                |  |                                       | 80                | 100 |  |  |  |  |
|               |  |            |         |             |            |                         |                 | SHEAR STRENGTH kPa                                       |    |    |                                 |                               |                                |  |                                       | WATER CONTENT (%) |     |  |  |  |  |
|               |  |            |         |             |            |                         |                 | ○ UNCONFINED + FIELD VANE<br>● QUICK TRIAXIAL × LAB VANE |    |    |                                 |                               |                                |  |                                       |                   |     |  |  |  |  |
| 326.7<br>0.0  | ASPHALT 100 mm<br>CRUSHED GRANULAR 180 mm<br>dark brown gravelly sand FILL<br>moist<br>SOIL STRATIGRAPHY INFERRED FROM BH96-10 | [Pattern]  |         |             |            |                         | 326             |  |    |    |                                 |                               |                                |  |                                       |                   |     |  |  |  |  |
| 323.3<br>3.4  | brown medium to fine SAND, trace silt moist  |            |         |             |            |                         | 325             |  |    |    |                                 |                               |                                |  |                                       |                   |     |  |  |  |  |
|               | Very dense   |            | 1       | SS          | 62         |                         | 324             |  |    |    |                                 |                               |                                |  |                                       |                   |     |  |  |  |  |
|               |  |            |         |             |            |                         | 323             |  |    |    |                                 |                               |                                |  |                                       |                   |     |  |  |  |  |
|               |  |            |         |             |            |                         | 322             |  |    |    |                                 |                               |                                |  |                                       |                   |     |  |  |  |  |
|               |  |            |         |             |            |                         | 321             |  |    |    |                                 |                               |                                |  |                                       |                   |     |  |  |  |  |
| 318.8<br>7.9  | saturated occasional gravelly seam   |            | 2       | SS          | 40         |                         | 320             |  |    |    |                                 |                               |                                |  |                                       |                   |     |  |  |  |  |
|               |  |            |         |             |            |                         | 319             |  |    |    |                                 |                               |                                |  |                                       |                   |     |  |  |  |  |
|               |  |            |         |             |            |                         | 318             |  |    |    |                                 |                               |                                |  |                                       |                   |     |  |  |  |  |
|               |  |            | 3       | SS          | 49         |                         | 317             |  |    |    |                                 |                               |                                |  |                                       |                   |     |  |  |  |  |
|               |  |            |         |             |            |                         | 316             |  |    |    |                                 |                               |                                |  |                                       |                   |     |  |  |  |  |
|               |  |            | 4       | SS          | 18         |                         | 315             |  |    |    |                                 |                               |                                |  |                                       |                   |     |  |  |  |  |
|               |  |            |         |             |            |                         | 314             |  |    |    |                                 |                               |                                |  |                                       |                   |     |  |  |  |  |
| 313.6<br>13.1 | Very Dense, grey SILT TILL, some clay, trace sand and gravel moist   | [Pattern]  |         |             |            |                         | 313             |  |    |    |                                 |                               |                                |  |                                       |                   |     |  |  |  |  |
|               |  |            | 5       | SS110/150mm |            |                         | 312             |  |    |    |                                 |                               |                                |  |                                       |                   |     |  |  |  |  |
|               |  |            |         |             |            |                         | 311             |  |    |    |                                 |                               |                                |  |                                       |                   |     |  |  |  |  |

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+ 3, 3 Numbers refer to Sensitivity      3% STRAIN AT FAILURE



# RECORD OF BOREHOLE No 98-10A

2 OF 3

METRIC

W.P. 363-94-00 SITE 33-221 LOCATION King St. E. at Franklin St. Bridge, 4810875N, 228003E ORIGINATED BY S.W.  
 DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
 DATUM GEODETIC DATE 09.02.99 - 10.02.99 CHECKED BY E.Y.C.

| SOIL PROFILE   |   |            | SAMPLES  |          |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |  |
|----------------|---|------------|--|----------|------------|----------------------------|-----------------|---|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|--|
| ELEV.<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER   | TYPE     | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |                                    |                                     |                                   |  |  |  |
| 309.6<br>17.1  | Very dense, grey medium SAND<br>saturated                 |            | 6  | SS       | 50/150mm   |                            |                 |   |  |                                    |                                     |                                   |  |  |  |
|                |   |            | 7  | SS       | 100/225mm  |                            |                 |   |  |                                    |                                     |                                   |  |  |  |
| 306.6<br>20.1  |   |            | Hard, grey SILTY CLAY, some wet<br>sand seams<br>moist | 8        | SS         | 84                         |                 |   |  |                                    |                                     |                                   |  |  |  |
|                | 9   | SS         |  | 50/150mm |            |                            |                 |   |  |                                    |                                     |                                   |  |  |  |
|                | 10  | SS         |  | 90       |            |                            |                 |   |  |                                    |                                     |                                   |  |  |  |
| 297.8<br>28.9  | Very dense, grey SANDY SILT TILL,<br>trace gravel<br>damp | 11         |  | SS       | 100/50mm   |                            |                 |   |  |                                    |                                     |                                   |  |  |  |
|                |   |            |  |          |            |                            |                 |   |  |                                    |                                     |                                   |  |  |  |
|                |   |            |  |          |            |                            |                 |   |  |                                    |                                     |                                   |  |  |  |
|                |   |            |  |          |            |                            |                 |   |  |                                    |                                     |                                   |  |  |  |
|                |   |            |  |          |            |                            |                 |   |  |                                    |                                     |                                   |  |  |  |

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+ 3 3. Numbers refer to  
Sensitivity ( ) 3% STRAIN AT FAILURE



3 OF 3

METRIC

| SOIL PROFILE  |   |            |        | SAMPLES |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    | PLASTIC<br>LIMIT<br>w <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>w | LIQUID<br>LIMIT<br>w <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|--------|---------|------------|----------------------------|-----------------|---|----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER | TYPE    | "N" VALUES |                            |                 | 20  | 40 |                                    |                                     |                                   |                     |   |
| 294.5<br>32.2 | END OF BOREHOLE @ 32.2m<br>NOTE: Water level recorded @<br>7.9m upon completion |            | 12     | SS      | 100/100mm  |                            |                 |   |    |                                    |                                     |                                   |                     |   |
|               |   |            |        |         |            |                            | 294             |   |    |                                    |                                     |                                   |                     |   |



# RECORD OF BOREHOLE No 98-11

1 OF 1

METRIC

W.P. 363-94-00 SITE:33-221

LOCATION Highway 8, South of Franklin St. Bridge, 4810840N, 228018E

ORIGINATED BY S.W.

DIST 2 HWY 7 and 8

BOREHOLE TYPE Hollow Stem Auger

COMPILED BY S.W.

DATUM GEODETIC

DATE 05.01.99 - 05.01.99

CHECKED BY E.Y.C.

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |                 |                 | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)     |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|-----------------|-----------------|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | 20 40 60 80 100                             | 20 40 60 80 100 | 20 40 60 80 100 |                                    |                                     |                                   |                     |   |
| 320.9<br>0.0  | TOPSOIL 180 mm<br>CRUSHED GRANULAR 520mm                                  |            |         |      |            |                            |                 |   |                 |                 |                                    |                                     |                                   |                     |   |
| 320.2<br>0.7  | Compact, medium SAND<br>moist   |            | 1       | SS   | 20         |                            | 320             |   |                 |                 |                                    |                                     |                                   |                     |   |
| 319.0<br>1.9  | Compact, brown medium SAND,<br>some silt<br>saturated                     |            | 2       | SS   | 18         |                            | 319             |   |                 |                 |                                    |                                     |                                   |                     |   |
|               |   |            | 3       | SS   | 16         |                            | 318             |   |                 |                 |                                    |                                     |                                   |                     | 2 85 13 0   |
|               |   |            | 4       | SS   | 6          |                            | 317             |   |                 |                 |                                    |                                     |                                   |                     | Low 'N' Value<br>due to<br>Hydrostatic<br>Disturbance |
| 316.3<br>4.6  | trace gravel, trace silt  |            | 5       | SS   | 36         |                            | 316             |   |                 |                 |                                    |                                     |                                   |                     | 9 89 2 0  |
| 314.8<br>6.1  | Dense to very dense   |            |         |      |            |                            | 315             |   |                 |                 |                                    |                                     |                                   |                     | Dynamic cone<br>penetration tests<br>carried out      |
| 312.4<br>8.5  | Very dense, grey SILT TILL<br>damp  |            | 6       | SS   | 62         |                            | 312             |   |                 |                 |                                    |                                     |                                   |                     | Standard<br>penetration tests<br>resumed              |
| 310.9<br>10.0 | Very dense, grey SILT, trace fine<br>sand, occasional gravel<br>moist     |            |         |      |            |                            | 311             |   |                 |                 |                                    |                                     |                                   |                     |   |
| 309.8<br>11.1 | END OF BOREHOLE @ 11.1m<br>NOTE: Water level recorded @<br>1.9m (1/26/99) |            | 7       | SS   | 60         |                            | 310             |   |                 |                 |                                    |                                     |                                   |                     |   |

EXPRESS: 3-221 GPJ EXPRESS.GDT 22/07/99







RECORD OF BOREHOLE No 98-11A

2 OF 2

METRIC

W.P. 363-94-00 SITE:33-221 LOCATION Highway 8 at Franklin St. Bridge, 4610840N, 228016E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 08.02.99 - 08.02.99 CHECKED BY E.Y.C.

| SOIL PROFILE  |   |            | SAMPLES |              |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |                 | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|---|------------|---------|--------------|------------|----------------------------|-----------------|---|-----------------|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE         | "N" VALUES |                            |                 | 20 40 60 80 100                             | 20 40 60 80 100 |                                    |                                     |                                   |  |  |
|               |   |            | 5       | SS           | 89         |                            | 304             |   |                 |                                    |                                     |                                   |  |  |
|               |   |            | 6       | SS           | 61         |                            | 303             |   |                 |                                    |                                     |                                   |  |  |
|               |   |            | 7       | SS           | 62         |                            | 301             |   |                 |                                    |                                     |                                   |  |  |
|               |   |            |         |              |            |                            | 300             |   |                 |                                    |                                     |                                   |  |  |
|               |   |            |         |              |            |                            | 299             |   |                 |                                    |                                     |                                   |  |  |
| 297.9         |   |            |         |              |            |                            | 298             |   |                 |                                    |                                     |                                   |  |  |
| 23.1          | Very Dense, grey SILT TILL, some clay, trace sand and gravel damp |            | 8       | SS 100/125mm |            |                            | 295             |   |                 |                                    |                                     |                                   |  | Very hard<br>augering @23.1<br>m                                 |
| 293.2         |   |            | 9       | SS 100/75mm  |            |                            | 294             |   |                 |                                    |                                     |                                   |  |  |
| 27.7          | END OF BOREHOLE @ 27.7m   |            |         |              |            |                            |                 |   |                 |                                    |                                     |                                   |  |  |
|               | NOTE: Water level recorded @ 1.9m upon completion                 |            |         |              |            |                            |                 |   |                 |                                    |                                     |                                   |  |  |

EXPRESS 3-221 GPJ EXPRESS GDT 2007/09





# RECORD OF BOREHOLE No 98-12

1 OF 1

METRIC

W.P. 363-94-00 SITE:33-221 LOCATION Kingsway Ave. North of Franklin St. Bridge, 4810836N,227975E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 21.11.98 - 21.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |  |  | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    | PLASTIC<br>LIMIT<br>w <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>w | LIQUID<br>LIMIT<br>w <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |                   |  |  |
|---------------|--|--|---------|------|------------|----------------------------|-----------------|---|----|----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|-------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT   | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |    |    |                                    |                                     |                                   |                     |   | WATER CONTENT (%) |  |  |
|               |  |  |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |  |
|               |  |  |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |  |
| 326.9         |  |  |         |      |            |                            |                 | 20  | 40 | 60 | 80                                 | 100                                 |                                   |                     |   |                   |  |  |
| 0.0           | ASPHALT 120mm<br>CRUSHED GRANULAR 220mm<br>Compact, dark brown gravelly sand<br>FILL<br>damp |   |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |  |
| 325.7         |  |  | 1       | SS   | 12         |                            | 326             |   |    |    |                                    |                                     |                                   |                     |   |                   |  |  |
| 1.2           | Compact to dense, dark brown fine<br>sand to silty sand FILL                                 |  |         | 2    | SS         | 32                         |                 | 325   |    |    |                                    |                                     |                                   |                     |   |                   |  |  |
|               |  |  |         | 3    | SS         | 24                         |                 | 324   |    |    |                                    |                                     |                                   |                     |   |                   |  |  |
| 324.0         |  |  |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |  |
| 2.9           | wet layer  |  |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |  |
| 323.4         |  |  | 4       | SS   | 31         |                            | 323             |   |    |    |                                    |                                     |                                   |                     |   |                   |  |  |
| 3.5           | Dense to Very dense, brown FINE<br>to MEDIUM SAND, trace to some<br>silt<br>damp             |  |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |  |
|               |  |  |         | 5    | SS         | 32                         |                 | 322   |    |    |                                    |                                     |                                   |                     |   |                   |  |  |
|               |  |  |         |      |            |                            |                 | 321   |    |    |                                    |                                     |                                   |                     |   |                   |  |  |
|               |  |  |         | 6    | SS         | 46                         |                 | 320   |    |    |                                    |                                     |                                   |                     |   |                   |  |  |
|               |  |  |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |  |
| 319.1         |  |  |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |  |
| 318.8         | saturated  |  | 7       | SS   | 54         |                            | 319             |   |    |    |                                    |                                     |                                   |                     |   | 0 86 (14)         |  |  |
| 8.1           | END OF BOREHOLE @ 8.1m<br>NOTE: Water level recorded @<br>7.8m upon completion               |  |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |  |



# RECORD OF BOREHOLE No 98-12A

1 OF 2

METRIC

W.P. 363-94-00 SITE:33-221 LOCATION Kingsway Ave. at Franklin St. Bridge, 4810814N,228016E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 11.02.99 - 11.02.99 CHECKED BY E.Y.C.

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|--|--|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |  |                                    |                                     |                                   |                     |   |
| 326.9         |  |            |         |      |            |                            |                 | 20 40 60 80 100                             |  |  |                                    |                                     |                                   |                     |   |
| 0.0           | ASPHALT 120 mm<br>CRUSHED GRANULAR 220 mm<br>dark brown gravelly sand FILL<br>SOIL STRATIGRAPHY INFERRED<br>FROM BH98-12 |            |         |      |            |                            | 326             |   |  |  |                                    |                                     |                                   |                     | GR SA SI CL                                       |
| 325.7         |  |            |         |      |            |                            | 325             |   |  |  |                                    |                                     |                                   |                     |   |
| 1.2           | Compact to dense, dark brown fine<br>sand to silty sand FILL   |            |         |      |            |                            | 324             |   |  |  |                                    |                                     |                                   |                     |   |
| 323.4         |  |            |         |      |            |                            | 323             |   |  |  |                                    |                                     |                                   |                     |   |
| 3.5           | brown fine to medium SAND, trace<br>to some silt<br>wet  |            |         |      |            |                            | 322             |   |  |  |                                    |                                     |                                   |                     |   |
| 319.1         |  |            |         |      |            |                            | 321             |   |  |  |                                    |                                     |                                   |                     |   |
| 7.8           | saturated  |            | 1       | SS   | 58         |                            | 320             |   |  |  |                                    |                                     |                                   |                     |   |
|               |  |            |         |      |            |                            | 319             |   |  |  |                                    |                                     |                                   |                     |   |
|               |  |            | 2       | SS   | 46         |                            | 318             |   |  |  |                                    |                                     |                                   |                     |   |
| 318.5         |  |            |         |      |            |                            | 317             |   |  |  |                                    |                                     |                                   |                     |   |
| 10.4          | Very dense, brown GRAVELLY<br>SAND<br>saturated  |            | 3       | SS   | 67         |                            | 316             |   |  |  |                                    |                                     |                                   |                     |   |
| 314.9         |  |            |         |      |            |                            | 315             |   |  |  |                                    |                                     |                                   |                     |   |
| 12.0          | Dense, grey SILT<br>wet to saturated   |            | 4       | SS   | 31         |                            | 314             |   |  |  |                                    |                                     |                                   |                     |   |
| 312.6         |  |            |         |      |            |                            | 313             |   |  |  |                                    |                                     |                                   |                     |   |
| 14.4          | Very dense, grey SANDY SILT TILL,<br>some gravel, frequent wet-<br>saturated sand seams<br>damp                          |            | 5       | SS   | 85         |                            | 312             |   |  |  |                                    |                                     |                                   |                     |   |
|               |  |            |         |      |            |                            | 311             |   |  |  |                                    |                                     |                                   |                     |   |

Continued Next Page

3. Numbers refer to Sensitivity 3% STRAIN AT FAILURE



# RECORD OF BOREHOLE No 98-12A

2 OF 2

METRIC

W.P. 363-94-00 SITE:33-221 LOCATION Kingsway Ave. at Franklin St. Bridge, 4810814N, 228016E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 11.02.99 - 11.02.99 CHECKED BY E.Y.C.

| SOIL PROFILE  |   |            | SAMPLES |             |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |                 | PLASTIC<br>LIMIT<br>w <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>w | LIQUID<br>LIMIT<br>w <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|---|------------|---------|-------------|------------|----------------------------|-----------------|---|-----------------|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE        | "N" VALUES |                            |                 | 20 40 60 80 100                             | 20 40 60 80 100 |                                    |                                     |                                   |  |  |
|               |   |            | 6       | SS          | 111        |                            | 310             |   |                 |                                    |                                     |                                   |  |  |
|               |   |            |         |             |            |                            | 309             |   |                 |                                    |                                     |                                   |  |  |
|               |   |            |         |             |            |                            | 308             |   |                 |                                    |                                     |                                   |  |  |
|               |   |            | 7       | SS 50/100mm |            |                            | 307             |   |                 |                                    |                                     |                                   |  |  |
|               |   |            |         |             |            |                            | 306             |   |                 |                                    |                                     |                                   |  |  |
| 305.1<br>21.8 | END OF BOREHOLE @ 21.8m<br>NOTE: Water level recorded @<br>8.5m upon completion |            | 8       | SS          | 107        |                            |                 |   |                 |                                    |                                     |                                   |  |  |



## METRIC

CHECKED BY E.Y.C.

+ 3. 3. Numbers refer to Sensitivity      3% STRAIN AT FAILURE



# RECORD OF BOREHOLE No 98-14

1 OF 1

METRIC

W.P. 363-94-00 SITE:33-221 LOCATION King St. E. North of Franklin St., 4810890N,227967E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 21.11.98 - 21.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |  |            | SAMPLES |             |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |                                    |                                     |                                   | UNIT<br>WEIGHT<br>$\gamma$<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|------------|---------|-------------|------------|----------------------------|-----------------|---|------------------------------------|-------------------------------------|-----------------------------------|---|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE        | "N" VALUES |                            |                 | 20 40 60 80 100                             | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> |   |   |
| 326.6         | ASPHALT 100mm<br>CRUSHED GRANULAR 300mm<br>Compact, brown gravelly sand FILL   |            |         |             |            |                            |                 |   |                                    |                                     |                                   |   |   |
| 325.8         | 0.8 Compact to loose, dark brown fine<br>sand to silty sand FILL<br>moist  |            | 1       | SS          | 12         |                            | 326             |   |                                    |                                     |                                   |   |   |
|               |  |            | 2       | SS          | 6          |                            | 325             |   |                                    |                                     |                                   |   |   |
|               |  |            | 3       | SS          | 4          |                            | 324             |   |                                    |                                     |                                   |   |   |
|               |  |            | 4       | SS          | 4          |                            | 323             |   |                                    |                                     |                                   |   |   |
| 322.9         | 3.7 Very dense, brown fine SAND to<br>SILTY SAND<br>damp   |            | 5       | SS          | 81         |                            | 322             |   |                                    |                                     |                                   |   |   |
|               |  |            | 6       | SS 90/225mm |            |                            | 321             |   |                                    |                                     |                                   |   |   |
|               |  |            | 7       | SS          | 81         |                            | 320             |   |                                    |                                     |                                   |   |   |
| 319.2         | 7.4 saturated  |            | 8       | SS          | 53         |                            | 319             |   |                                    |                                     |                                   |   |   |
|               |  |            | 9       | SS          | 62         |                            | 318             |   |                                    |                                     |                                   |   |   |
| 315.9         | 10.7 Very dense, grey medium to coarse<br>SAND, trace gravel<br>saturated  |            | 10      | SS          | 79         |                            | 317             |   |                                    |                                     |                                   |   |   |
| 314.9         | 11.7 Very dense, grey SILT TILL, some<br>clay, trace sand, occasional gravel,<br>frequent medium sand seams<br>moist |            | 11      | SS 90/225mm |            |                            | 316             |   |                                    |                                     |                                   |   |   |
| 313.9         | 12.7 END OF BOREHOLE @ 12.7m<br>NOTE: Water level recorded @<br>7.4m upon completion                                 |            |         |             |            |                            | 315             |   |                                    |                                     |                                   |   |   |
|               |  |            |         |             |            |                            | 314             |   |                                    |                                     |                                   |   |   |



# RECORD OF BOREHOLE No 98-15

1 OF 1

METRIC

W.P. 363-94-00 SITE 33-221 LOCATION King St. E. North of Franklin St., 4810911N, 227926E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 19.11.98 - 19.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS  | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |                               |  | PLASTIC<br>LIMIT<br>$w_p$ | NATURAL<br>MOISTURE<br>CONTENT<br>$w$ | LIQUID<br>LIMIT<br>$w_L$ | UNIT<br>WEIGHT<br>$\gamma$<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|--|------------|---------|------|------------|---|-----------------|---|--|--|-------------------------------|--|---------------------------|---------------------------------------|--------------------------|---|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |   |                 | SHEAR STRENGTH kPa                          |  |  |                               |  |                           |                                       |                          |   |  |
|               |  |            |         |      |            | ○ UNCONFINED + FIELD VANE<br>● QUICK TRIAXIAL × LAB VANE<br>20 40 60 80 100 |                 |   |  |  | WATER CONTENT (%)<br>10 20 30 |  |                           |                                       |                          |   |  |
| 326.6<br>0.0  | ASPHALT 110mm<br>CRUSHED GRANULAR 350mm<br>Compact, rust to dark brown silty<br>sand and sand FILL, with topsoil<br>inclusions<br>damp |            | 1       | SS   | 20         |   |                 |   |  |  |                               |  |                           |                                       |                          |   |  |
|               |  |            | 2       | SS   | 11         |   |                 |   |  |  |                               |  |                           |                                       |                          |   |  |
| 324.0<br>2.6  | Compact, brown fine SAND,<br>occasional gravel seams, trace silt<br>damp   |            | 3       | SS   | 24         |   |                 |   |  |  |                               |  |                           |                                       |                          |   |  |
|               |  |            | 4       | SS   | 22         |   |                 |   |  |  |                               |  |                           |                                       |                          |   |  |
| 322.0<br>4.6  | Dense, brown SILT<br>wet   |            | 5       | SS   | 37         |   |                 |   |  |  |                               |  |                           |                                       |                          |   |  |
| 321.5<br>5.1  | Dense, brown medium to fine<br>SAND<br>wet   |            | 6       | SS   | 43         |   |                 |   |  |  |                               |  |                           |                                       |                          |   |  |
| 319.4<br>7.2  | Compact, grey<br>saturated   |            | 7       | SS   | 38         |   |                 |   |  |  |                               |  |                           |                                       |                          |   |  |
|               |  |            | 8       | SS   | 10         |   |                 |   |  |  |                               |  |                           |                                       |                          |   |  |
| 315.9<br>10.7 | END OF BOREHOLE @ 10.7m<br>NOTE: Water level recorded @<br>7.2m (3/3/99)   |            |         |      |            |   |                 |   |  |  |                               |  |                           |                                       |                          |   |  |

EXPRESS, 3-221 GPJ EXPRESS GOT 22/07/89



# RECORD OF BOREHOLE No 98-16

1 OF 1

METRIC

W.P. 363-94-00 SITE:33-221

LOCATION King St. E. North of Franklin St., 480917N,227911E

ORIGINATED BY S.W.

DIST 2 HWY 7 and 8

BOREHOLE TYPE Hollow Stem Auger

COMPILED BY S.W.

DATUM GEODETIC

DATE 19.11.98 - 19.11.98

CHECKED BY E.Y.C.

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|---------------------------------|-------------------------------------|--------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                 |                                     |                                |                     |   |
| 326.4<br>0.0  | ASPHALT 100mm<br>CRUSHED GRANULAR 400mm<br>Compact, rust to dark brown silty<br>sand FILL, trace gravel, with topsoil<br>inclusions |            |         |      |            |                            |                 |   |    |    |    |     |                                 |                                     |                                |                     |   |
|               |   |            | 1       | SS   | 16         |                            |                 |   |    |    |    |     |                                 |                                     |                                |                     |   |
|               |   |            | 2       | SS   | 9          |                            |                 |   |    |    |    |     |                                 |                                     |                                |                     |   |
| 323.8<br>2.6  | Compact, brown fine SAND to<br>SILTY SAND   |            | 3       | SS   | 16         |                            |                 |   |    |    |    |     |                                 |                                     |                                |                     |   |
|               |   |            | 4       | SS   | 23         |                            |                 |   |    |    |    |     |                                 |                                     |                                |                     |   |
| 321.8<br>4.6  | very dense  |            | 5       | SS   | 58         |                            |                 |   |    |    |    |     |                                 |                                     |                                |                     |   |
|               |   |            |         |      |            |                            |                 |   |    |    |    |     |                                 |                                     |                                |                     |   |
| 320.3<br>6.1  | trace gravel  |            | 6       | SS   | 60         |                            |                 |   |    |    |    |     |                                 |                                     |                                |                     |   |
| 319.4<br>7.0  | Dense, brown medium to fine<br>SAND<br>saturated  |            | 7       | SS   | 34         |                            |                 |   |    |    |    |     |                                 |                                     |                                |                     |   |
|               |   |            | 8       | SS   | 75         |                            |                 |   |    |    |    |     |                                 |                                     |                                |                     |   |
| 315.3<br>11.1 | END OF BOREHOLE @ 11.1m<br>NOTE: Water level recorded @<br>7.0m upon completion   |            | 9       | SS   | 78         |                            |                 |   |    |    |    |     |                                 |                                     |                                |                     |   |



# RECORD OF BOREHOLE No 98-17

1 OF 1

METRIC

W.P. 363-94-00 SITE:33-221 LOCATION King St. E. North of Franklin St., 4810929N 227887E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 19.11.98 - 19.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |   |            | SAMPLES |             |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|-------------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE        | "N" VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 326.1         |   |            |         |             |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | ASPHALT 120mm<br>CRUSHED GRANULAR 300mm<br>Compact, dark brown gravelly sand<br>and silt FILL |            |         |             |            |                            | 326             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 325.0         |   |            | 1       | SS          | 13         |                            | 325             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 1.1           | Loose, rust to dark brown silty sand<br>FILL<br>damp to moist                                 |            | 2       | SS          | 9          |                            | 324             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 3       | SS          | 8          |                            | 323             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 4       | SS          | 6          |                            | 322             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 322.3         |   |            | 5       | SS          | 37         |                            | 321             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 3.8           | Dense to very dense, brown<br>medium to fine SAND<br>damp                                     |            | 6       | SS          | 53         |                            | 320             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            |         |             |            |                            | 319             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 320.0         |   |            |         |             |            |                            | 318             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 6.1           | Very dense to dense, brown<br>GRAVELLY SAND<br>damp   |            | 7       | SS 60/150mm |            |                            | 317             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 319.3         |   |            |         |             |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 6.8           | saturated   |            | 8       | SS          | 53         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 9       | SS          | 48         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 10      | SS          | 62         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 316.5         |   |            |         |             |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 9.6           | END OF BOREHOLE @ 9.6m<br>NOTE: Water level recorded @ 6.8<br>m upon completion               |            |         |             |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

EXPRESS 3-221 GPJ EXPRESS.GDT 2007/99



# RECORD OF BOREHOLE No 98-18

1 OF 1

METRIC

W.P. 363-94-00 SITE 33-221 LOCATION King St. E. North of Franklin St., 4810946N, 227848E ORIGINATED BY S.W.  
 DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
 DATUM GEODETIC DATE 18.11.98 - 18.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE   |   | SAMPLES    |        |             | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |                    | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |                   |
|----------------|---|------------|--------|-------------|----------------------------|-----------------|---|--------------------|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|-------------------|
| ELEV<br>DEPTH  | DESCRIPTION   | STRAT PLOT | NUMBER | TYPE        |                            |                 | "N" VALUES                                  | SHEAR STRENGTH kPa |                                    |                                     |                                   |                     |   | WATER CONTENT (%) |
|                |   |            |        |             |                            | 20              | 40  | 60                 | 80                                 | 100                                 | 10                                | 20                  | 30  |                   |
| 325.8<br>0.0   | ASPHALT 110mm<br>CRUSHED GRANULAR 350mm<br>Compact, dark brown gravelly sand<br>FILL<br>Compact, dark brown silty sand<br>FILL<br>moist |            | 1      | SS          | 22                         |                 |   |                    |                                    |                                     |                                   |                     |   |                   |
| 324.1<br>1.7   | Compact to very loose, brown fine<br>sand to silty sand FILL<br>damp  |            | 2      | SS          | 15                         |                 |   |                    |                                    |                                     |                                   |                     |   |                   |
|                |   |            | 3      | SS          | 38                         |                 |   |                    |                                    |                                     |                                   |                     |   |                   |
| 322.7<br>3.1   | Compact to very dense, brown<br>medium to fine SAND, trace to<br>some silt<br>damp  |            | 4      | SS          | 61                         |                 |   |                    |                                    |                                     |                                   |                     |   |                   |
|                |   |            | 5      | SS          | 40                         |                 |   |                    |                                    |                                     |                                   |                     |   |                   |
| 319.5<br>6.3   | Very dense, brown GRAVELLY<br>SAND<br>saturated   |            | 6      | SS          | 80                         |                 |   |                    |                                    |                                     |                                   |                     |   |                   |
|                |   |            | 7      | AS          |                            |                 |   |                    |                                    |                                     |                                   |                     |   |                   |
| 316.9<br>318.9 | Very dense, grey Sandy SILT TILL  |            | 8      | SS 80/100mm |                            |                 |   |                    |                                    |                                     |                                   |                     |   |                   |
| 9.2            | END OF BOREHOLE @ 9.2m<br>NOTE: Water level recorded @<br>6.4m upon completion  |            |        |             |                            |                 |   |                    |                                    |                                     |                                   |                     |   |                   |



# RECORD OF BOREHOLE No 98-19

1 OF 1

METRIC

W.P. 363-94-00 SITE:33-221 LOCATION King St. E. North of Franklin St., 4810955N, 227828E ORIGINATED BY S.W.  
 DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
 DATUM GEODETIC DATE 19.11.98 - 19.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT              |    |    |     |  | PLASTIC<br>LIMIT<br>w <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>w | LIQUID<br>LIMIT<br>w <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |                   |  |  |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|--|----|----|-----|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|-------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                                       |    |    |     |  |                                    |                                     |                                   |  |  | WATER CONTENT (%) |  |  |
|               |   |            |         |      |            |                            |                 | ○ UNCONFINED + FIELD VANE<br>● QUICK TRIAXIAL × LAB VANE |    |    |     |  |                                    |                                     |                                   |  |  |                   |  |  |
| 325.6         |   |            |         |      |            |                            | 20              | 40   | 60 | 80 | 100 |  |                                    |                                     |                                   |  |  |                   |  |  |
| 0.0           | ASPHALT 100mm<br>CRUSHED GRANULAR 300mm<br>Compact, dark brown gravelly sand<br>FILL<br>Compact to loose, rust to dark<br>brown silty sand FILL, trace gravel<br>damp |            |         |      |            |                            |                 |  |    |    |     |  |                                    |                                     |                                   |  |  |                   |  |  |
|               |   |            |         | 1    | SS         | 14                         |                 |  |    |    |     |  |                                    |                                     |                                   |  |  |                   |  |  |
|               |   |            |         | 2    | SS         | 8                          |                 |  |    |    |     |  |                                    |                                     |                                   |  |  |                   |  |  |
| 323.2         |   |            |         |      |            |                            |                 |  |    |    |     |  |                                    |                                     |                                   |  |  |                   |  |  |
| 2.4           | Compact to very dense, brown fine<br>SAND, frequent silty sand seams<br>damp  |            | 3       | SS   | 19         |                            |                 |  |    |    |     |  |                                    |                                     |                                   |  |  |                   |  |  |
|               |   |            |         | 4    | SS         | 14                         |                 |  |    |    |     |  |                                    |                                     |                                   |  |  |                   |  |  |
|               |   |            |         | 5    | SS         | 19                         |                 |  |    |    |     |  |                                    |                                     |                                   |  |  |                   |  |  |
|               |   |            |         | 6    | SS         | 15                         |                 |  |    |    |     |  |                                    |                                     |                                   |  |  |                   |  |  |
|               |   |            |         | 7    | SS         | 37                         |                 |  |    |    |     |  |                                    |                                     |                                   |  |  |                   |  |  |
|               |   |            |         |      |            |                            |                 |  |    |    |     |  |                                    |                                     |                                   |  |  |                   |  |  |
|               |   |            |         |      |            |                            |                 |  |    |    |     |  |                                    |                                     |                                   |  |  |                   |  |  |
| 319.3         |   |            | 8       | SS   | 34         |                            |                 |  |    |    |     |  |                                    |                                     |                                   |  |  |                   |  |  |
| 6.3           | Dense to very dense, brown<br>medium to fine SAND<br>saturated  |            |         |      |            |                            |                 |  |    |    |     |  |                                    |                                     |                                   |  |  |                   |  |  |
|               |   |            |         |      |            |                            |                 |  |    |    |     |  |                                    |                                     |                                   |  |  |                   |  |  |
| 317.5         |   |            | 9       | SS   | 66         |                            |                 |  |    |    |     |  |                                    |                                     |                                   |  |  |                   |  |  |
| 8.1           | END OF BOREHOLE @ 8.1m<br>NOTE: Water level recorded @<br>6.3m (3/3/99)   |            |         |      |            |                            |                 |  |    |    |     |  |                                    |                                     |                                   |  |  |                   |  |  |







# RECORD OF BOREHOLE No 98-21

1 OF 1

METRIC

W.P. 363-94-00 SITE 33-221 LOCATION King St. E. at Delroy Ave., 4810988N, 227763E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 18.11.98 - 18.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>w <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>w | LIQUID<br>LIMIT<br>w <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            |         |      |            |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
|               |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 325.0         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | ASPHALT 110mm<br>CRUSHED GRANULAR 280mm<br>Compact, dark brown gravelly sand<br>FILL, some silt<br>damp |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 323.9         |   |            | 1       | SS   | 24         |                            | 324             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 1.1           | Compact, dark brown fine sand<br>FILL, some silt<br>damp  |            | 2       | SS   | 12         |                            | 323             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 3       | SS   | 26         |                            | 322             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 321.6         |   |            | 4       | SS   | 65         |                            | 321             |   |    |    |    |     |                                    |                                     |                                   |                     | 3 80 17 0   |
| 3.4           | Very dense, brown fine SAND,<br>trace to some silt<br>damp  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 320.4         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 4.6           | Dense, grey SILT<br>damp  |            | 5       | SS   | 48         |                            | 320             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 4.9           | Dense to very dense, brown<br>Medium to fine SAND<br>wet  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 319.4         |   |            |         |      |            |                            | 319             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 5.6           | saturated, trace gravel   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 318.7         |   |            | 6       | SS   | 45         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     | 3 25 55 17  |
| 6.3           | Very dense, grey SANDY SILT TILL,<br>some clay, trace gravel<br>moist                                   |            | 7       | SS   | 60         |                            | 318             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 317.7         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 7.3           | END OF BOREHOLE @ 7.3m<br>NOTE: Water level recorded @<br>5.6m (1/26/99)                                |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

EXPRESS 3-221.GPJ EXPRESS.GDT 22/07/99



# RECORD OF BOREHOLE No 98-22

1 OF 1

METRIC

W.P. 363-94-00 SITE 33-221 LOCATION King St. E. North of Delroy Ave., 4811009N, 227717E ORIGINATED BY S.W.  
 DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
 DATUM GEODETIC DATE 18.11.98 - 18.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |                                    |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|------------------------------------|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION                        | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 324.4         | ASPHALT 100mm                      |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | CRUSHED GRANULAR 300mm             |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 323.7         | Compact, dark brown gravelly sand  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.7           | FILL                               |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 323.2         | Compact, dark brown sand FILL      |            | 1       | SS   | 11         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 1.2           | Loose, dark brown sand FILL, trace |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               | gravel moist                       |            | 2       | SS   | 6          |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |                                    |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |                                    |            | 3       | SS   | 4          |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 321.2         |                                    |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 3.2           | Very dense, brown fine SAND,       |            | 4       | SS   | 55         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     | 4 87 9 0  |
|               | some gravel damp                   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 320.3         |                                    |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 4.1           | Dense, brown medium to fine        |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               | SAND, trace gravel                 |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 319.7         | wet                                |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 4.7           | saturated                          |            | 5       | SS   | 45         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     | 2 85 13 0   |
| 319.3         |                                    |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 5.1           | END OF BOREHOLE @ 5.1m             |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               | NOTE: Water level recorded @       |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               | 4.7m upon completion               |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |



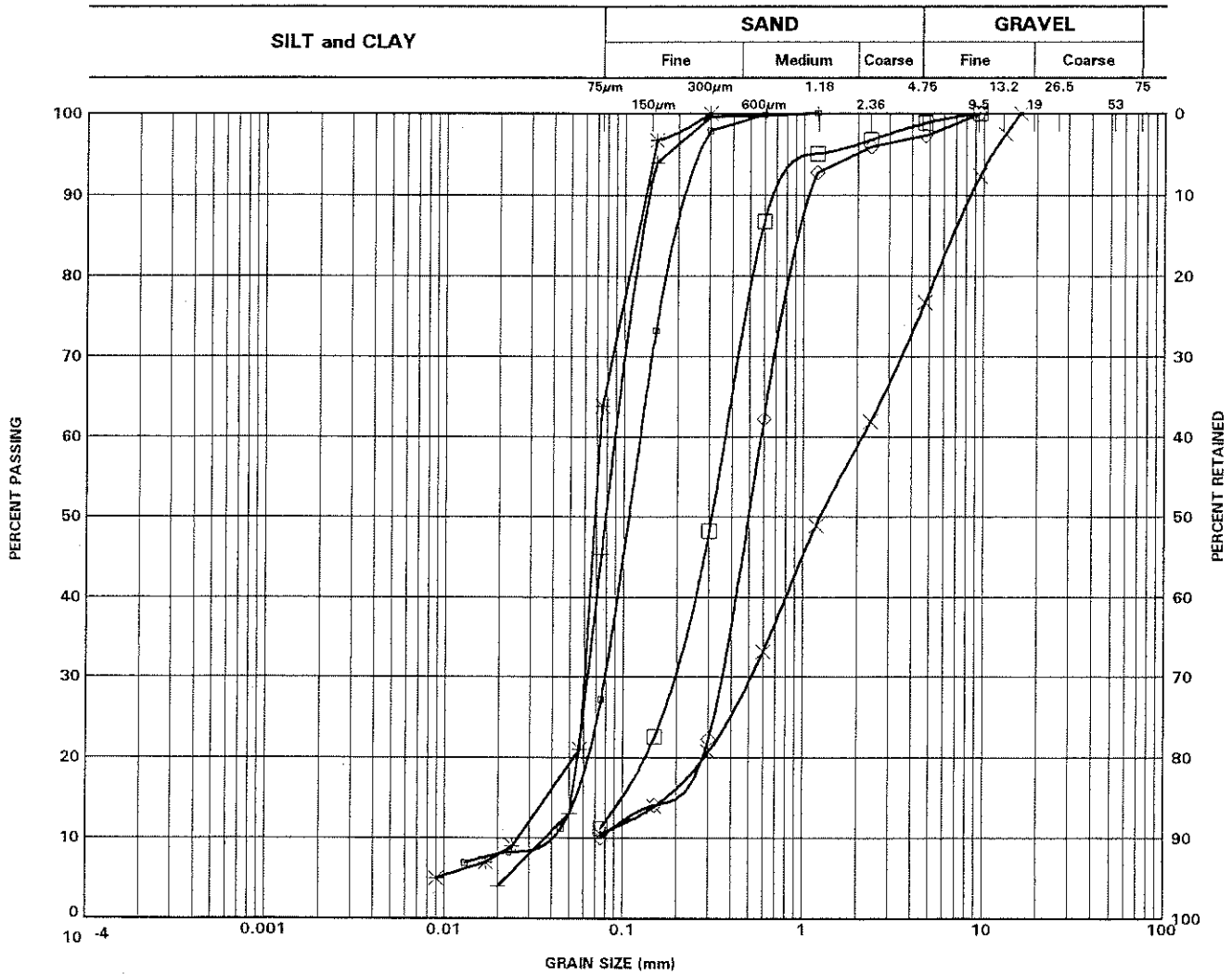
# APPENDIX “B”

## Laboratory Test Results



# GRAIN SIZE DISTRIBUTION

UNIFIED SOIL CLASSIFICATION SYSTEM



| LEGEND |          |           |
|--------|----------|-----------|
| SYMBOL | BOREHOLE | DEPTH (m) |
| □      | 98-01    | 3.1       |
| ✱      | 98-01    | 3.8       |
| ◇      | 98-02    | 3.1       |
| ✕      | 98-03    | 3.8       |
| +      | 98-04    | 3.1       |
| ◻      | 98-07    | 3.1       |

**SAND to SILTY SAND**

WP 363-94-00

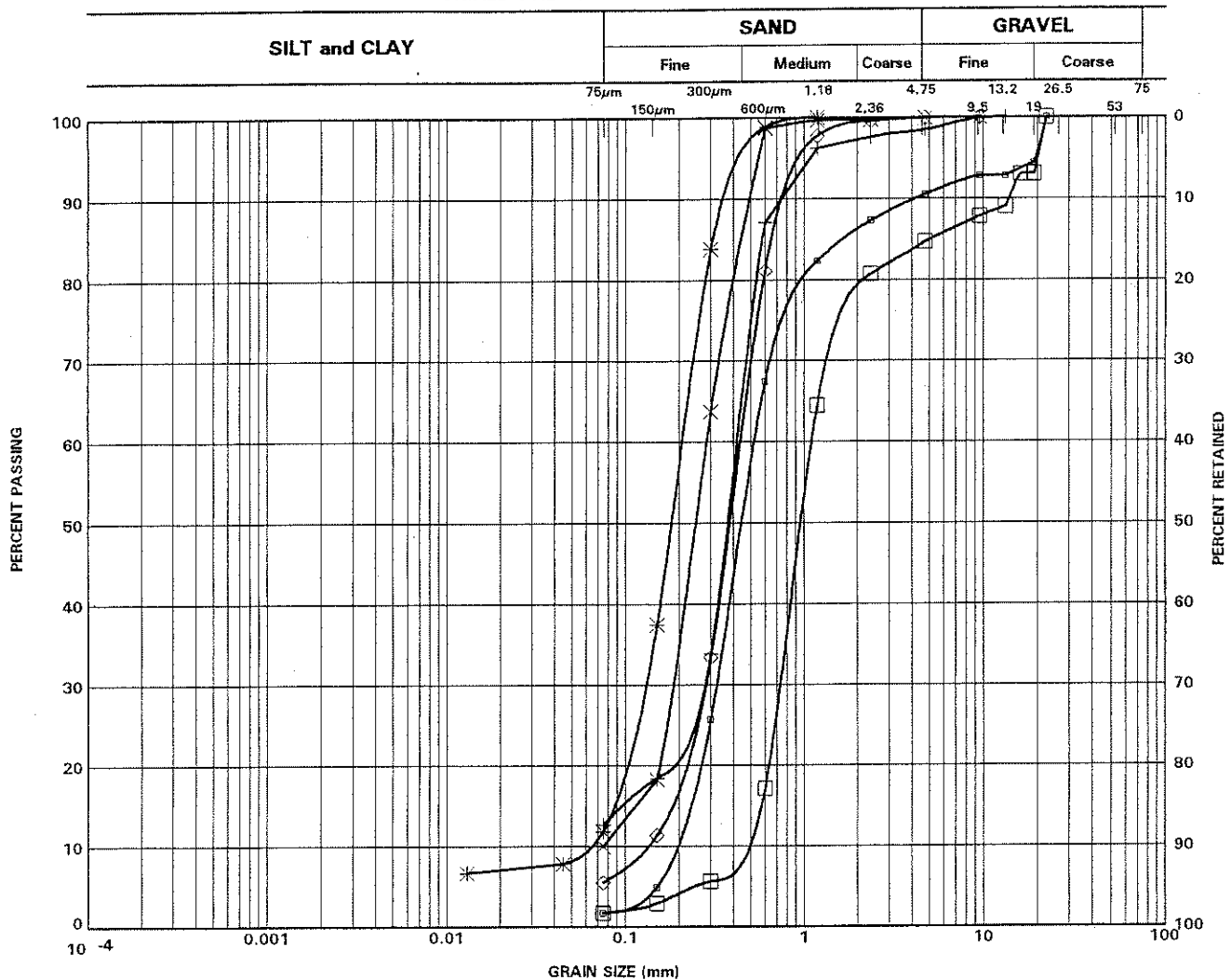
SITE 33-221

Figure No. 2



# GRAIN SIZE DISTRIBUTION

UNIFIED SOIL CLASSIFICATION SYSTEM



## LEGEND

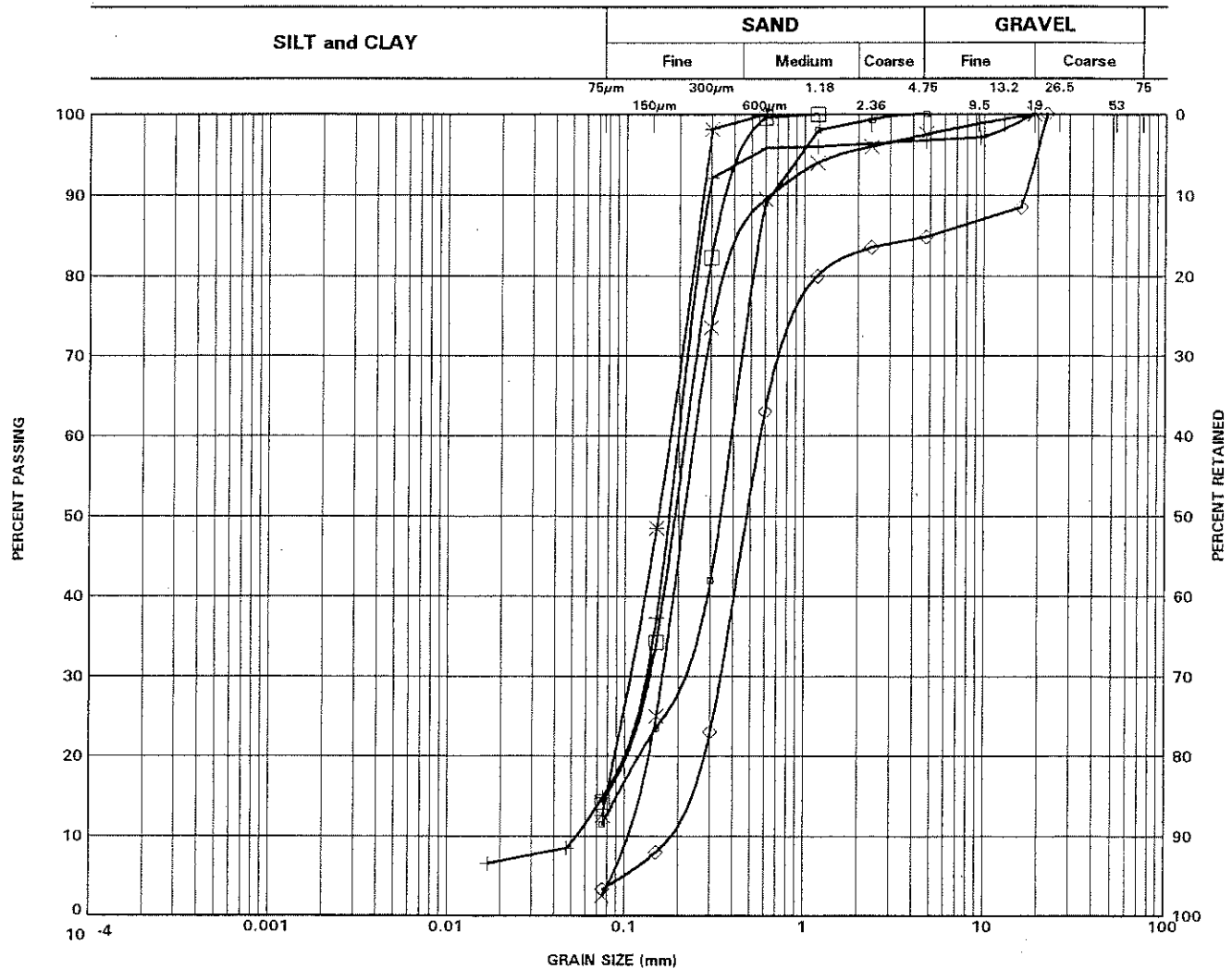
| SYMBOL | BOREHOLE | DEPTH (m) |
|--------|----------|-----------|
| □      | 98-07    | 8.4       |
| *      | 98-08    | 3.1       |
| ◇      | 98-09    | 7.6       |
| ×      | 98-10    | 3.8       |
| +      | 98-11    | 2.3       |
| ◻      | 98-11    | 4.6       |

**SAND to SILTY SAND**



# GRAIN SIZE DISTRIBUTION

## UNIFIED SOIL CLASSIFICATION SYSTEM



### LEGEND

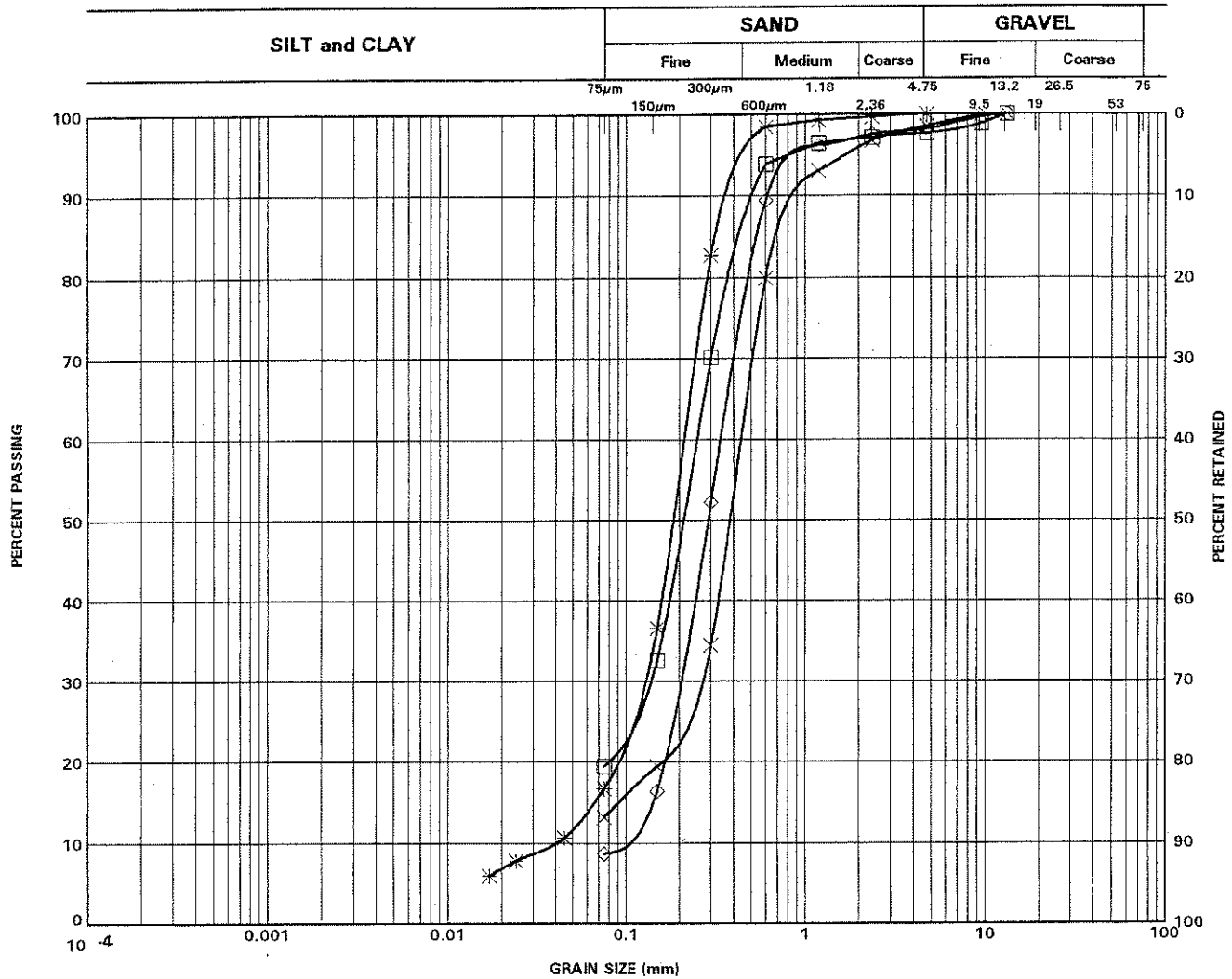
| SYMBOL | BOREHOLE | DEPTH (m) |
|--------|----------|-----------|
| □      | 98-12    | 7.6       |
| ✱      | 98-13    | 3.1       |
| ◇      | 98-13    | 9.1       |
| ×      | 98-15    | 3.1       |
| +      | 98-16    | 3.1       |
| ◻      | 98-18    | 4.6       |

**SAND to SILTY SAND**



# GRAIN SIZE DISTRIBUTION

UNIFIED SOIL CLASSIFICATION SYSTEM



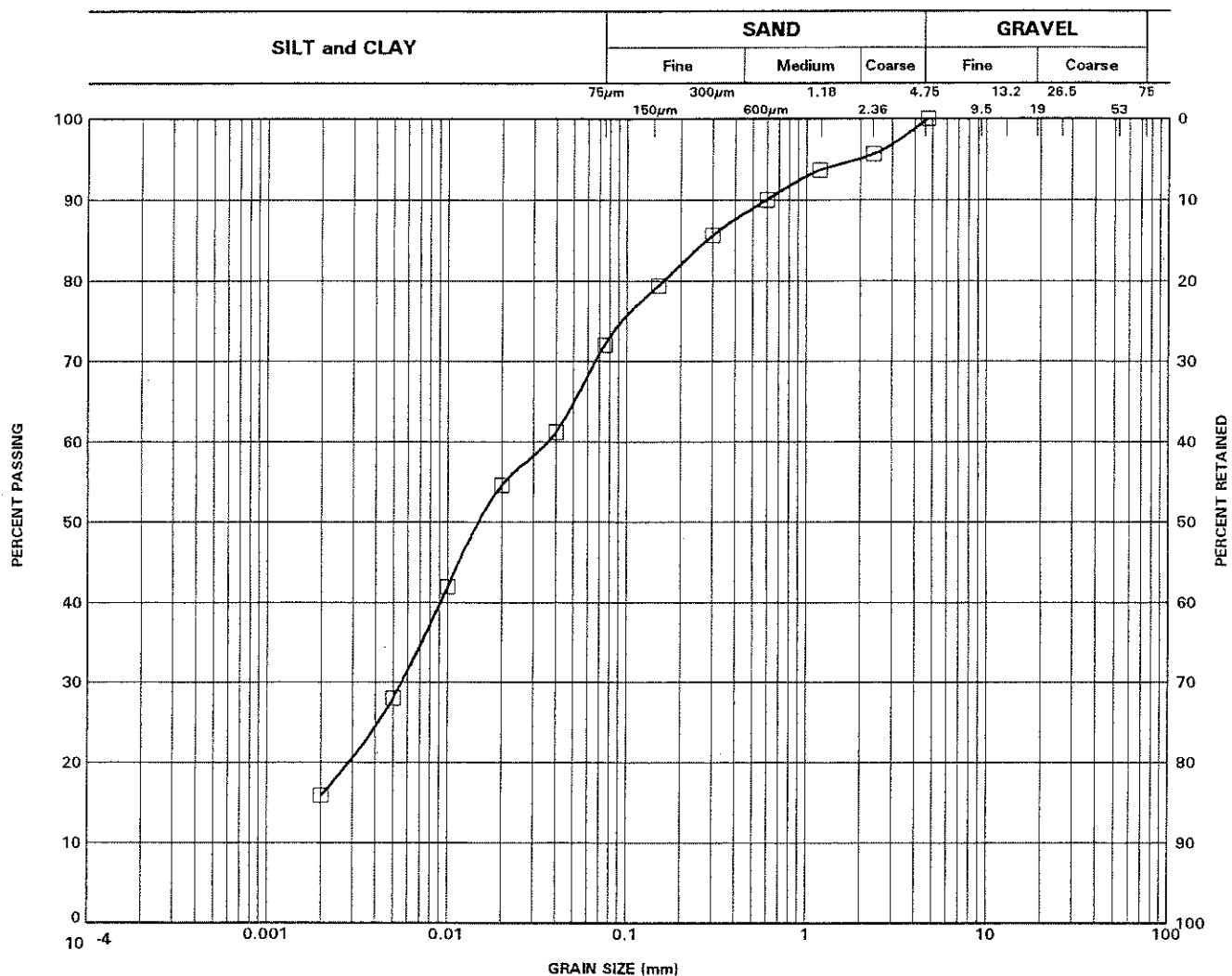
| LEGEND |          |           |
|--------|----------|-----------|
| SYMBOL | BOREHOLE | DEPTH (m) |
| □      | 98-19    | 3.7       |
| *      | 98-21    | 3.1       |
| ◇      | 98-22    | 3.1       |
| ×      | 98-22    | 4.6       |

**SAND to SILTY SAND**



# GRAIN SIZE DISTRIBUTION

## UNIFIED SOIL CLASSIFICATION SYSTEM



| LEGEND |          |           |
|--------|----------|-----------|
| SYMBOL | BOREHOLE | DEPTH (m) |
| □      | 98-21    | 6.1       |

**SILT TILL**

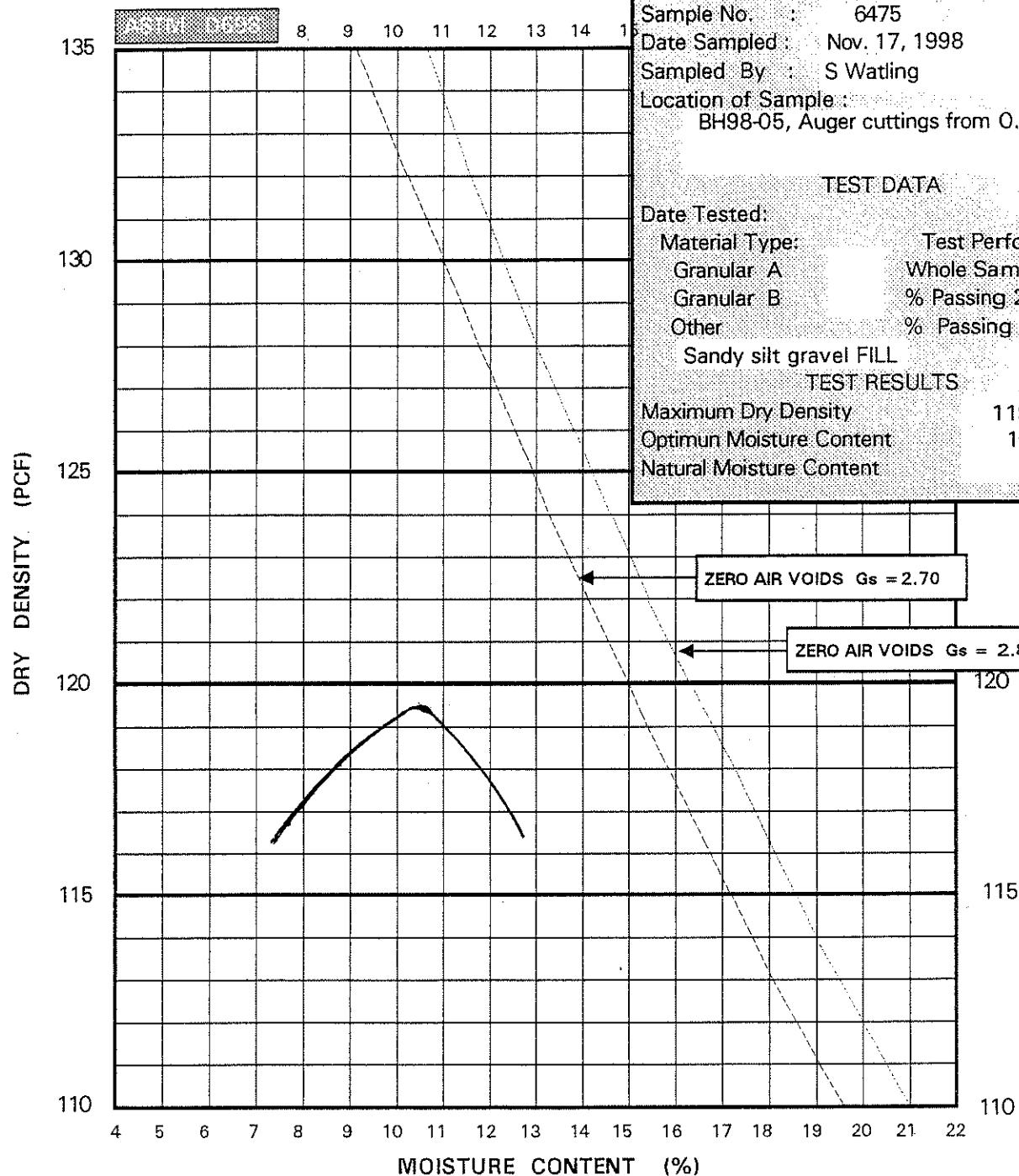
**WP** 363-94-00

**SITE** 33-221

**Figure No.** 6



# STANDARD PROCTOR TEST RESULTS



## SAMPLE DATA

Sample No. : 6475  
 Date Sampled : Nov. 17, 1998  
 Sampled By : S Watling  
 Location of Sample :  
 BH98-05, Auger cuttings from 0.8-2.0 m

## TEST DATA

Date Tested:  
 Material Type: Granular A  
 Granular B  
 Other  
 Test Performed on: Whole Sample ✓  
 % Passing 20mm  
 % Passing No.4

Sandy silt gravel FILL

## TEST RESULTS

Maximum Dry Density 119.5 PCF  
 Optimum Moisture Content 10.5 %  
 Natural Moisture Content 6.0 %

REFERENCE NO.

TK98-10-3 W.P. 363-94-00

COMMENTS

PROJECT

King St. Retaining Wall & Franklin St. Bridge

LOCATION

Kitchener, Ontario

CLIENT

Morrison Hershfield

**AGRA**  
 Earth & Environmental



# STANDARD PROCTOR TEST RESULTS

## SAMPLE DATA

Sample No. : 6472  
 Date Sampled : Nov. 19, 1998  
 Sampled By : S Watling  
 Location of Sample :  
 BH98-15, Auger cuttings from 1.5-2.6 m

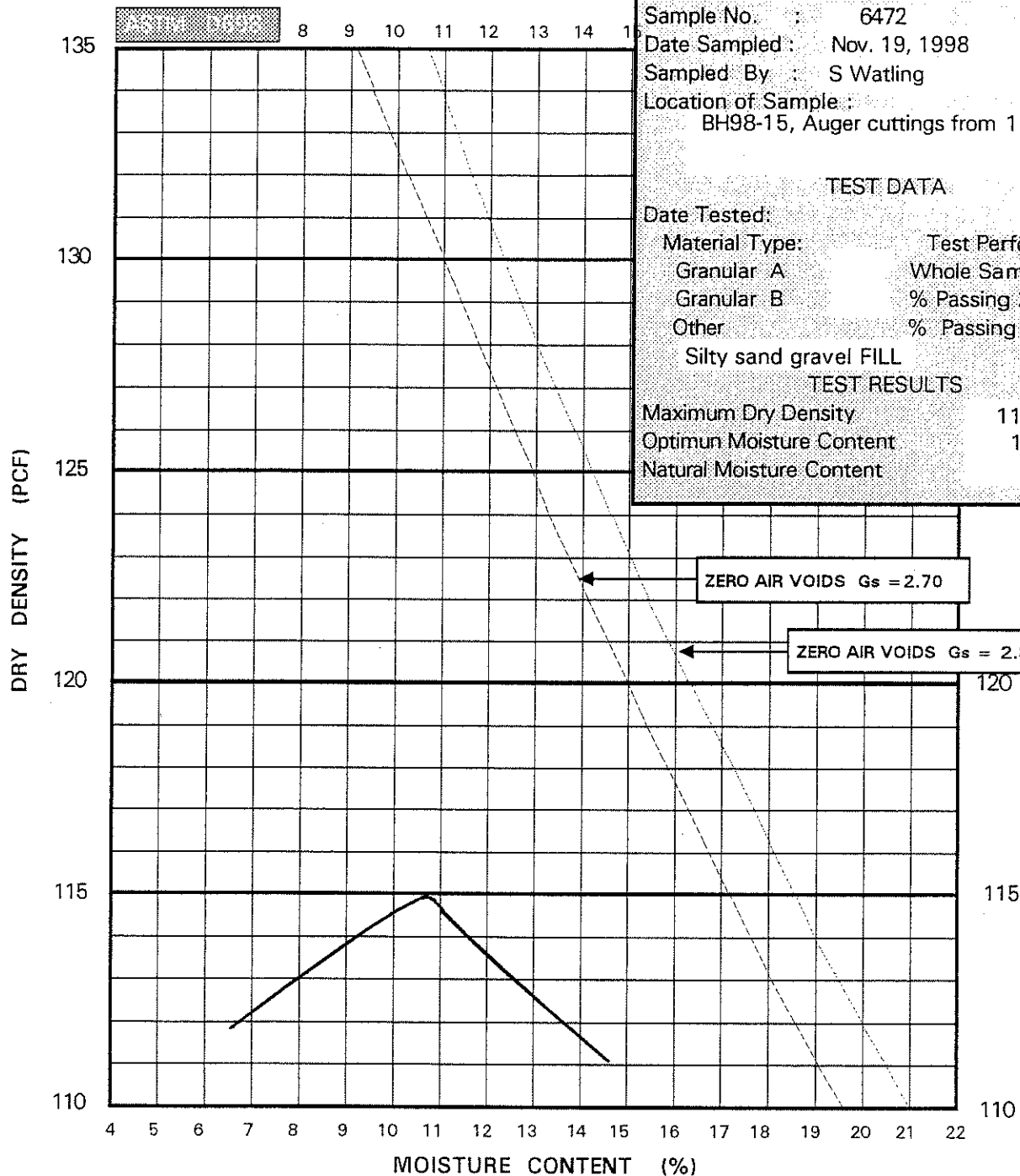
## TEST DATA

Date Tested:  
 Material Type:                      Test Performed on:  
 Granular A                      Whole Sample ✓  
 Granular B                      % Passing 20mm  
 Other                      % Passing No.4

Silty sand gravel FILL

## TEST RESULTS

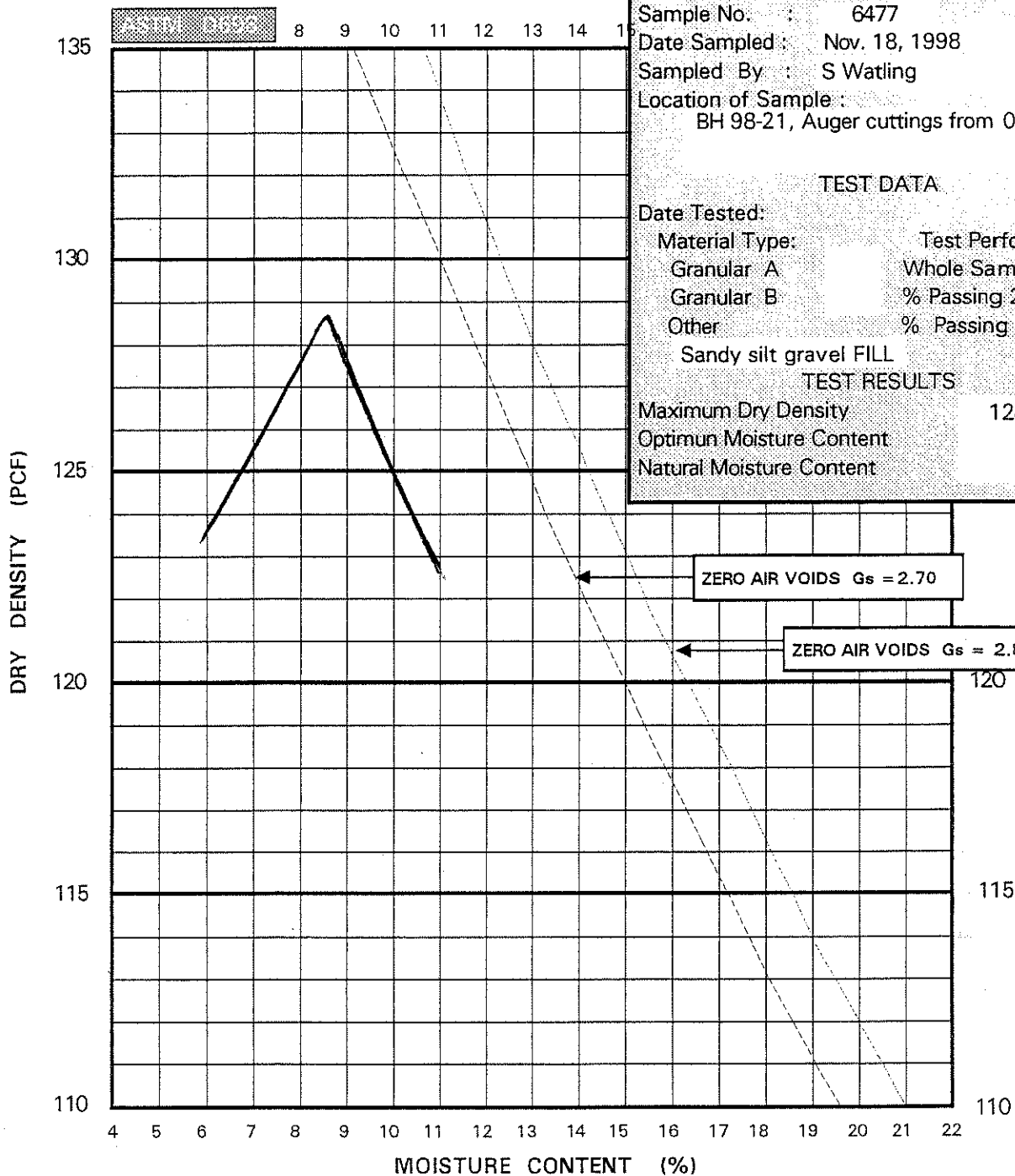
Maximum Dry Density                      115.0 PCF  
 Optimum Moisture Content                      10.8 %  
 Natural Moisture Content                      5.4 %



|               |   |          |
|---------------|---|----------|
| REFERENCE NO. | TK98-10-3 W.P. 363-94-00                    | COMMENTS |
| PROJECT       | KingSt. RetainingWall & Franklin St. Bridge |          |
| LOCATION      | Kitchener, Ontario                          |          |
| CLIENT        | Morrison Hershfield                         |          |



# STANDARD PROCTOR TEST RESULTS



## SAMPLE DATA

Sample No. : 6477  
 Date Sampled : Nov. 18, 1998  
 Sampled By : S Watling  
 Location of Sample :  
 BH 98-21, Auger cuttings from 0.4-3.0 m

## TEST DATA

Date Tested:  
 Material Type: Test Performed on:  
 Granular A: Whole Sample ✓  
 Granular B: % Passing 20mm  
 Other: % Passing No.4

Sandy silt gravel FILL

## TEST RESULTS

Maximum Dry Density 128.6 PCF  
 Optimum Moisture Content 8.6 %  
 Natural Moisture Content 3.5 %

REFERENCE NO.

TK98-10-3 W.P. 363-94-00

COMMENTS

PROJECT

King St. Retaining Wall & Franklin St. Bridge

LOCATION

Kitchener, Ontario

CLIENT

Morrison Hershfield



# STANDARD PROCTOR TEST RESULTS

## SAMPLE DATA

Sample No. : 6618  
 Date Sampled : Nov. 16, 1998  
 Sampled By : S Watling  
 Location of Sample :  
 BH 98-09, Auger cuttings from 4.3-7.0 m

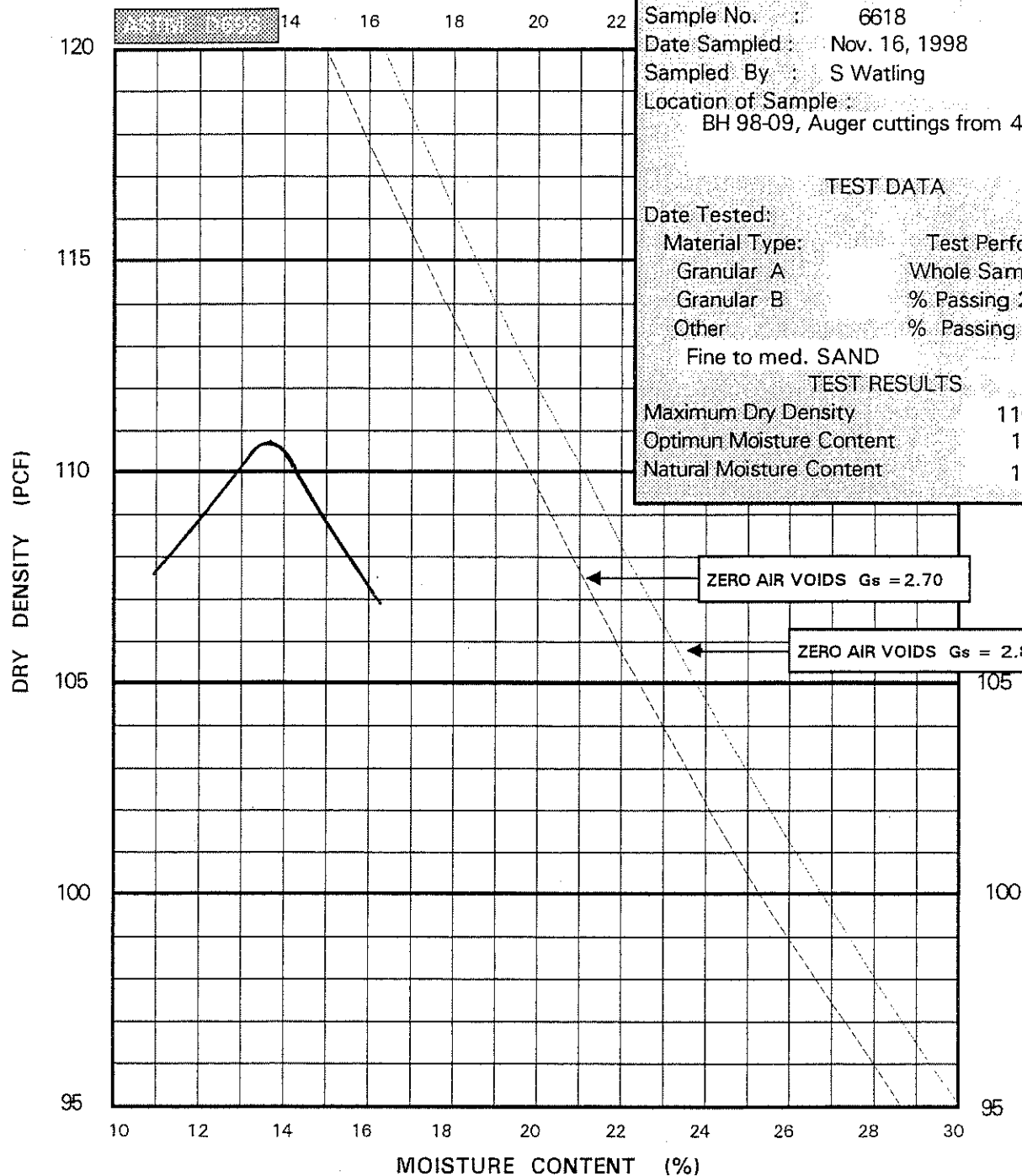
## TEST DATA


Date Tested:  
 Material Type: Granular A Test Performed on: Whole Sample ✓  
 Granular B % Passing 20mm  
 Other % Passing No.4

Fine to med. SAND

## TEST RESULTS

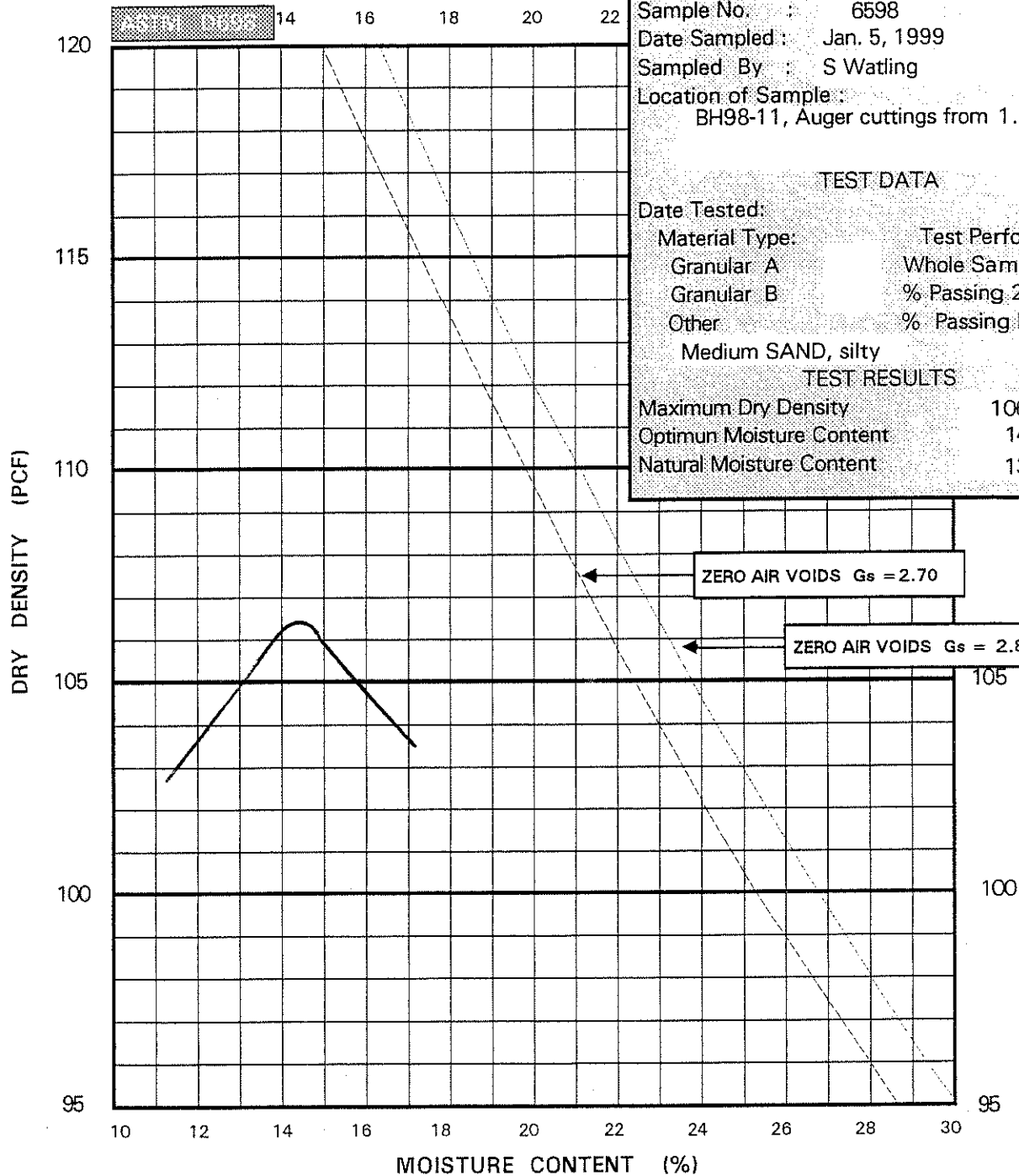
Maximum Dry Density 110.7 PCF  
 Optimum Moisture Content 13.7 %  
 Natural Moisture Content 10.6 %



|               |   |   |
|---------------|---|---|
| REFERENCE NO. | TK98-10-3 W.P. 363-94-00                      | COMMENTS  |
| PROJECT       | King St. Retaining Wall & Franklin St. Bridge |   |
| LOCATION      | Kitchener, Ontario                            |  |
| CLIENT        | Morrison Hershfield                           |   |



# STANDARD PROCTOR TEST RESULTS



## SAMPLE DATA

Sample No. : 6598  
 Date Sampled : Jan. 5, 1999  
 Sampled By : S Watling  
 Location of Sample :  
 BH98-11, Auger cuttings from 1.9-4.6 m

## TEST DATA

Date Tested:  
 Material Type: Granular A Test Performed on: Whole Sample ✓  
 Granular B % Passing 20mm  
 Other % Passing No.4  
 Medium SAND, silty

## TEST RESULTS

Maximum Dry Density 106.5 PCF  
 Optimum Moisture Content 14.5 %  
 Natural Moisture Content 13.0 %

ZERO AIR VOIDS  $G_s = 2.70$

ZERO AIR VOIDS  $G_s = 2.80$

REFERENCE NO. TK98-10-3 W.P. 363-94-00

PROJECT King St. Retaining Wall & Franklin St. Bridge

LOCATION Kitchener, Ontario

CLIENT Morrison Hershfield

COMMENTS



# STANDARD PROCTOR TEST RESULTS

## SAMPLE DATA

Sample No. : 6475  
 Date Sampled : Nov. 21, 1998  
 Sampled By : S Watling  
 Location of Sample :  
 BH98-13, Auger cuttings from 2.4-6.1 m

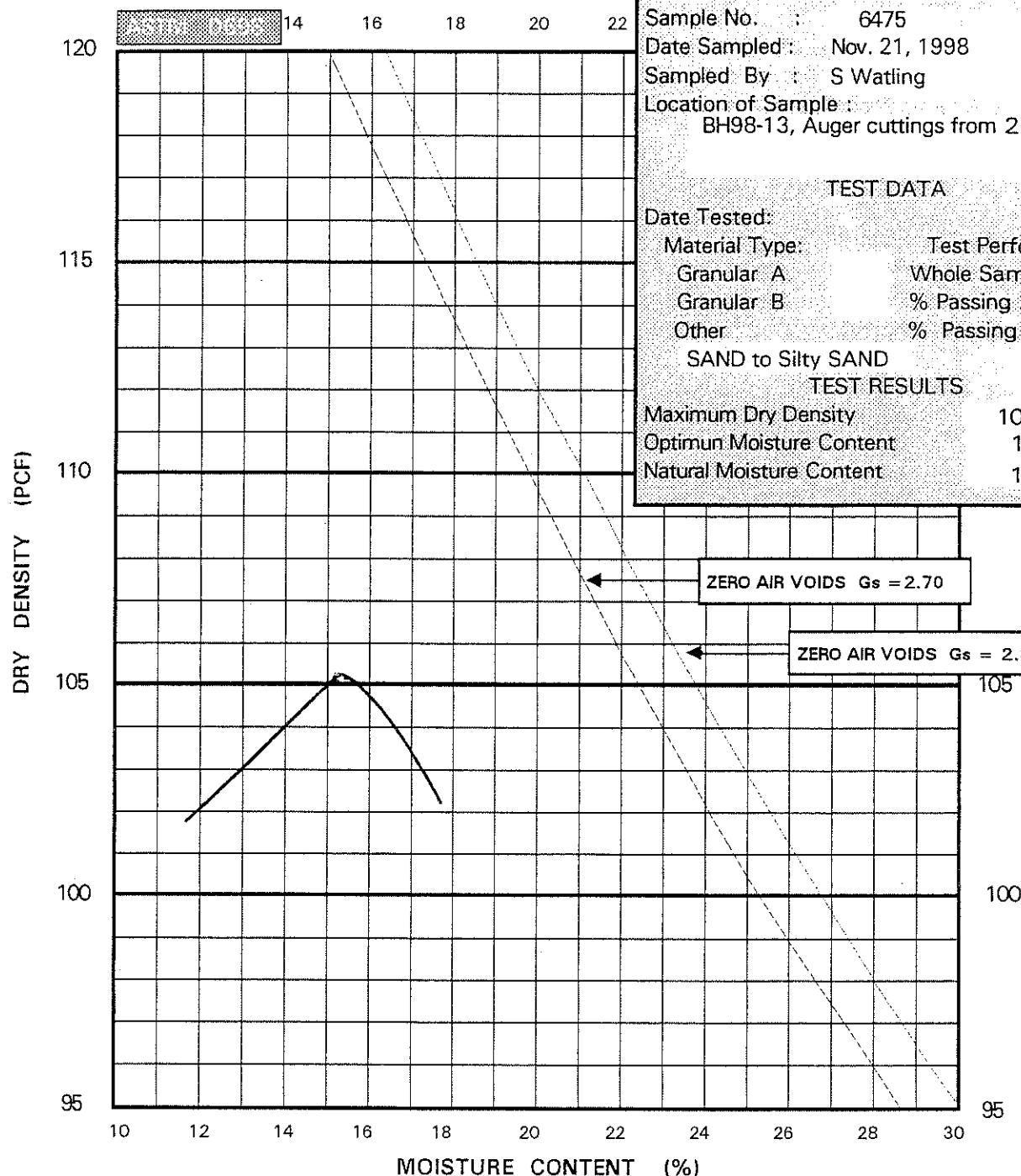
## TEST DATA

Date Tested:  
 Material Type: Granular A Test Performed on: Whole Sample ✓  
 Granular B % Passing 20mm  
 Other % Passing No.4

SAND to Silty SAND

## TEST RESULTS

Maximum Dry Density 105.5 PCF  
 Optimum Moisture Content 15.2 %  
 Natural Moisture Content 15.0 %



REFERENCE NO. TK98-10-3 W.P. 363-94-00

PROJECT King St. Retaining Wall & Franklin St. Bridge

LOCATION Kitchener, Ontario

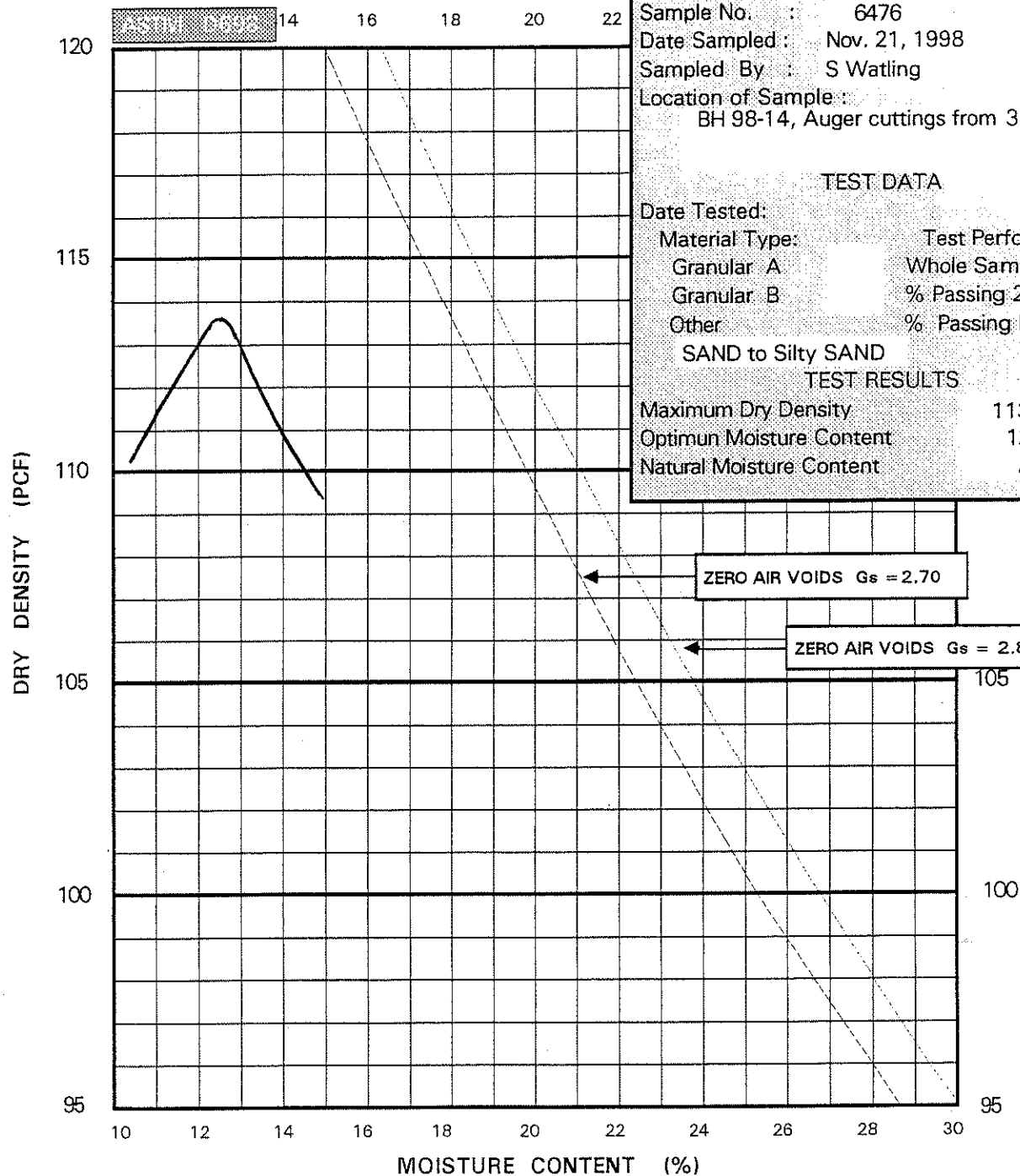
CLIENT Morrison Hershfield

COMMENTS

 **AGRA**  
 Earth & Environmental



# STANDARD PROCTOR TEST RESULTS



## SAMPLE DATA

Sample No. : 6476  
 Date Sampled : Nov. 21, 1998  
 Sampled By : S Watling  
 Location of Sample :  
 BH 98-14, Auger cuttings from 3.7-7.4 m

## TEST DATA

Date Tested:  
 Material Type: Granular A ☒ Whole Sample  
 Granular B ☐ % Passing 20mm  
 Other ☐ % Passing No.4

SAND to Silty SAND

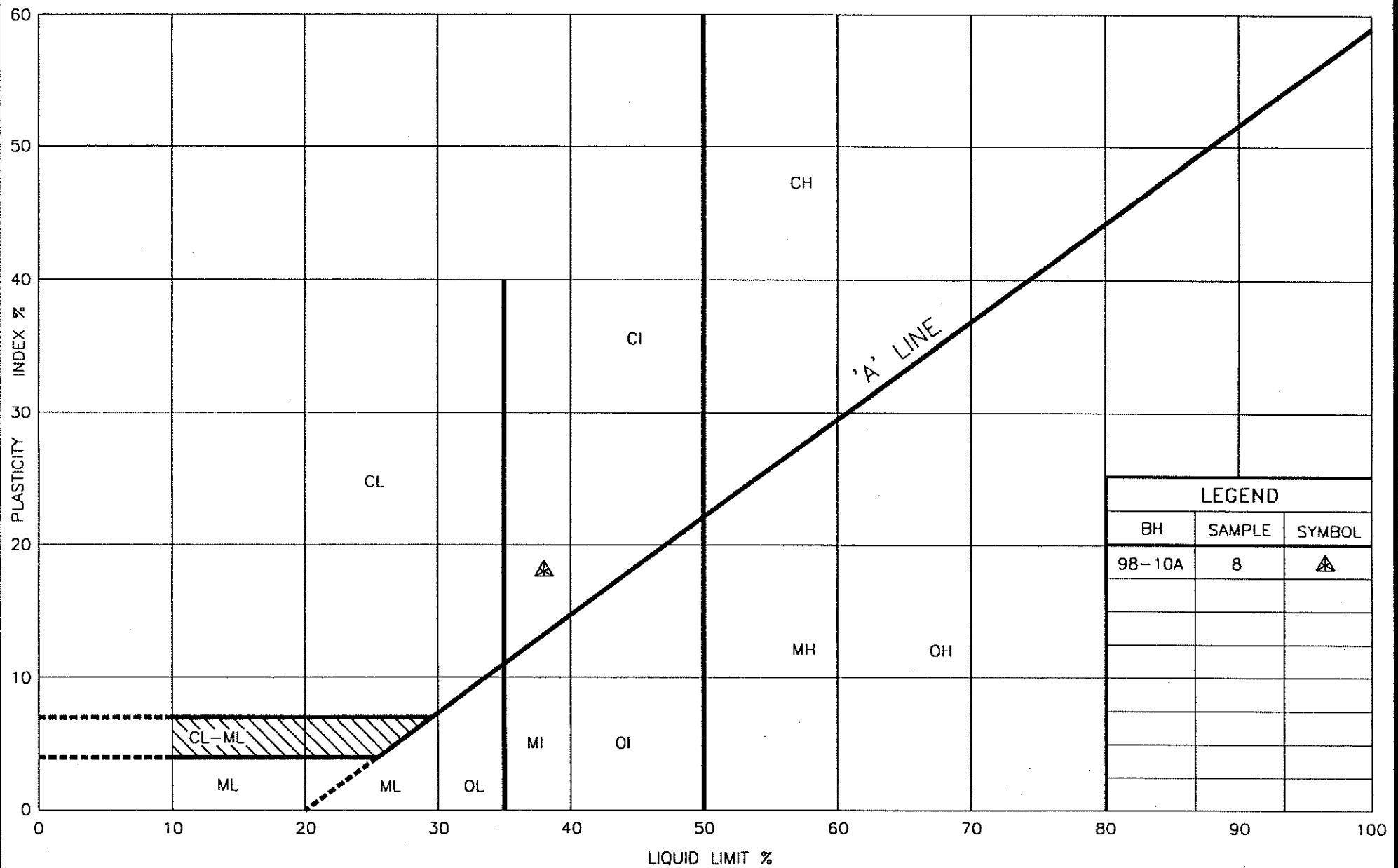
## TEST RESULTS

Maximum Dry Density 113.6 PCF  
 Optimum Moisture Content 12.6 %  
 Natural Moisture Content 4.6 %

|               |   |
|---------------|---|
| REFERENCE NO. | TK98-10-3, W.P. 363-94-00                     |
| PROJECT       | King St. Retaining Wall & Franklin St. Bridge |
| LOCATION      | Kitchener, Ontario                            |
| CLIENT        | Morrison Hershfield                           |

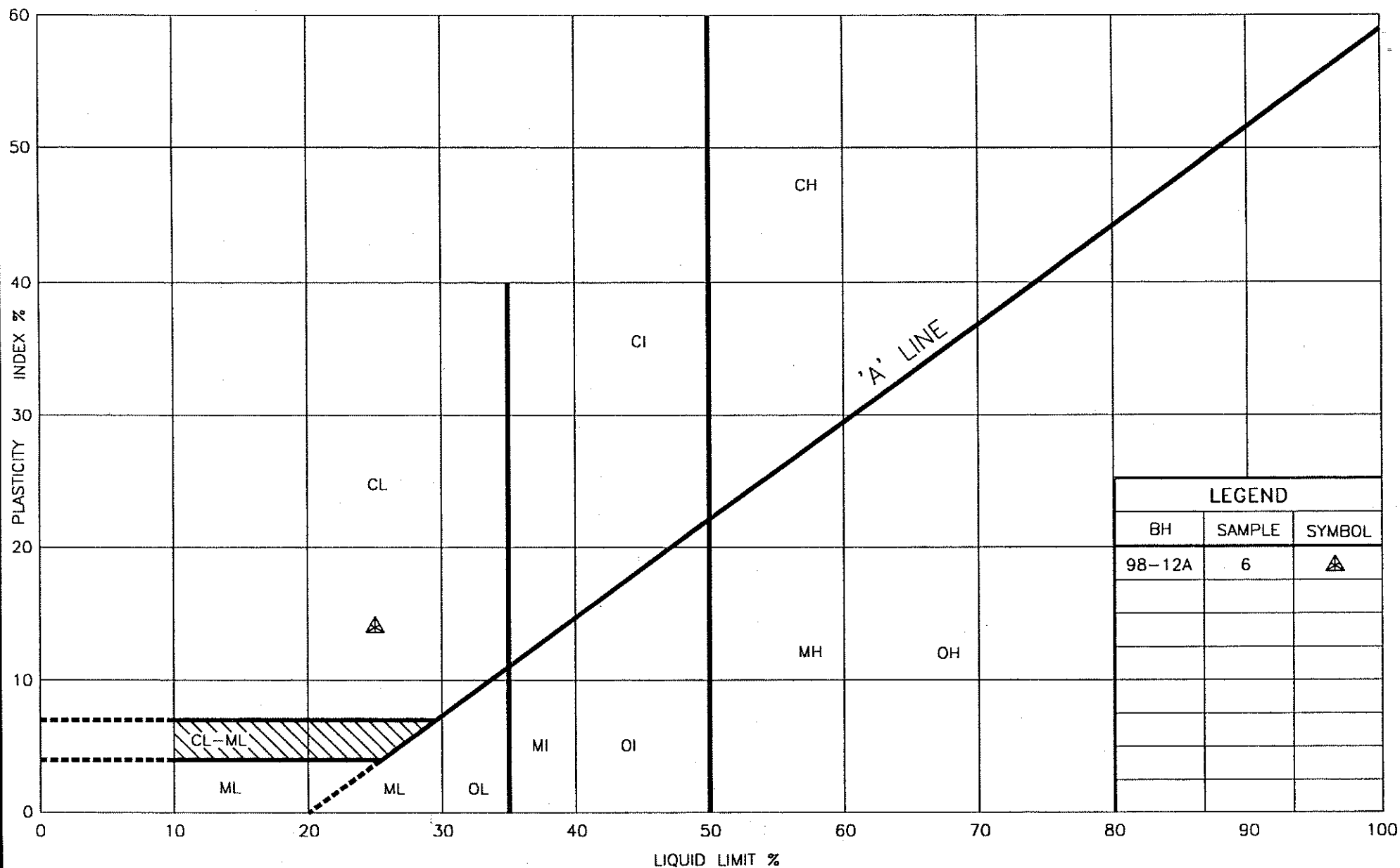
COMMENTS





| LEGEND |        |        |
|--------|--------|--------|
| BH     | SAMPLE | SYMBOL |
| 98-10A | 8      | △      |
|        |        |        |
|        |        |        |
|        |        |        |
|        |        |        |
|        |        |        |
|        |        |        |
|        |        |        |





| LEGEND |        |        |
|--------|--------|--------|
| BH     | SAMPLE | SYMBOL |
| 98-12A | 6      | △      |
|        |        |        |
|        |        |        |
|        |        |        |
|        |        |        |
|        |        |        |
|        |        |        |
|        |        |        |



## APPENDIX “C”

# CHEMICAL TEST RESULTS



AGRA Earth and Environmental Ltd.  
440 Philip Street, Unit 8  
Waterloo, Ontario N2L 5R9

Date: December 16, 1998

Page: 1 of 1

Project Name : -

Sample Type: Soil ( Sand )

Project No. : TK 98-10-3


Lab Ref.: F98-1900

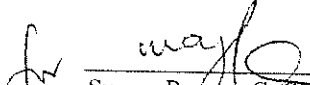
Contact : Steve

Final

**CERTIFICATE OF ANALYSIS**

| Lab #                        | Sample ID |            | pH  | Sulphate | Chloride |
|------------------------------|-----------|------------|-----|----------|----------|
| Unit                         |           |            |     | (ug/g)   | (ug/g)   |
| Method Detection Limit       |           |            |     | 1        | 1        |
| S9813206                     | BH4, SA3  | (18/11/98) | 8.9 | 8        | 130      |
| S9813207                     | BH10, SA6 | (16/11/98) | 9.0 | 2        | 67       |
| S9813208                     | BH19, SA6 | (19/11/98) | 9.1 | 7 (8)    | 83 (85)  |
| Lab Blank                    |           |            | 5.2 | <1       | <1       |
| Q.C. Standard Actual (ppm)   |           |            | 6.0 | 16.4     | 2.7      |
| Q.C. Standard Expected (ppm) |           |            | 6.0 | 16.0     | 2.8      |

  
Cynthia Ridge, C. Chem.  
Q.A./Q.C. Officer

  
Suman Punam, C. Chem.  
Laboratory Manager



Client : AGRA Earth and Environmental Ltd.  
440 Philip Street, Unit 8  
Waterloo, Ontario N2L 5R9

Date: February 5, 1999

Page: 1 of 1

Project Name : Hwy. 748

Sample Type: Soil (Sand)

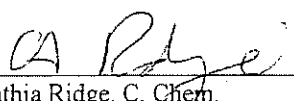
Project No. : -

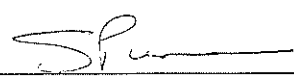
Lab Ref.: F99-0047

Contact : Steve Yonemitsu

Final

| Lab #                        | Sample ID       | Chloride  |
|------------------------------|-----------------|-----------|
| Unit                         |                 | (µg/g)    |
| Method Detection Limit       |                 | 1         |
| S9900226                     | BH21 (13/01/99) | 100       |
| S9900227                     | BH13 (13/01/99) | 88        |
| S9900228                     | BH5 (13/01/99)  | 150 (150) |
| Lab Blank                    |                 | <1        |
| Q.C. Standard Actual (ppm)   |                 | 2.7       |
| Q.C. Standard Expected (ppm) |                 | 2.8       |

  
Cynthia Ridge, C. Chem.  
Q.A./Q.C. Officer

  
Suman Punani, C. Chem.  
Laboratory Manager



# RESISTIVITY

PROJECT NO.: TK98-10-3

DATE : Jan 5/99

LOCATION:

SAMPLE 6521 (Sand)

|               |      | TEST RESULTS |
|---------------|------|--------------|
| Volts         | (mv) | 12400        |
| Initial Volts | (mv) | 10           |
| Amps          | (mA) | 1.06         |

RESISTIVITY = 11,708 ohm-cm

SAMPLE 6522

|               |      | TEST RESULTS |
|---------------|------|--------------|
| Volts         | (mv) | 12420        |
| Initial Volts | (mv) | 10           |
| Amps          | (mA) | 2.12         |

RESISTIVITY = 5,863 ohm-cm

SAMPLE 6523

|               |      | TEST RESULTS |
|---------------|------|--------------|
| Volts         | (mv) | 12130        |
| Initial Volts | (mv) | 6.3          |
| Amps          | (mA) | 0.79         |

RESISTIVITY = 15,362 ohm-cm



**FOUNDATION INVESTIGATION ~~CONFIDENTIAL~~ REPORT  
PROPOSED WEBER STREET OVERPASS  
S-E RAMP, STRUCTURE 33-394  
W.P. 363-94-00, AGREEMENT NO. 9730-7411-3178  
HWY8/CONESTOGA PARKWAY INTERCHANGE AND  
HWY 8 FROM CONESTOGA PARKWAY TO FERGUS AVENUE**

**Submitted to:**

**Mr. Doug Hoffman, Principal  
Morrison Hershfield Limited  
4 Lansing Square  
North York, Ontario  
M2J 1T1**

**Distribution:**

**16 Copies - Morrison Hershfield Limited  
2 Copies - AGRA Earth & Environmental Limited, Waterloo**

**July 21, 1999  
Project No.: TK98-10-3**

**Geocres: 40P8-117**



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## Explanation of Terms Used in Report

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| Drawings A and B    | Borehole Locations and Soil Data                              |
| <del>Figure 6</del> | <del>Integral Abutment CSP Detail</del>                       |
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## 1. INTRODUCTION

This report presents the results of a foundation investigation carried out by AGRA Earth & Environmental Limited (AGRA) on behalf of Morrison Hershfield Limited at the site of the proposed S-E Ramp from Highway 8 to Conestoga Parkway. The purpose of the investigation was to obtain information about the subsurface conditions at the site by means of boreholes and, based on the findings, to provide geotechnical recommendations for the foundation elements of the Weber Street Overpass Structure (Structure 33-394). The proposed bridge is a 72.52 m long, three-span post-tensioned concrete structure.

The work presented herein was undertaken under MTO W.P. 363-94-00, Agreement No. 9730-7411-3178, and authorized by Morrison Hershfield Limited in a letter dated November 2, 1998.

Previous investigation work at this site for the existing expressway overpass structure was undertaken by E.M. Peto and Associates in 1964 and Terraprobe Limited in 1995. This information was reviewed to supplement the present investigation.

## 2. SITE DESCRIPTION

### 2.1 Site Location

The site is located in the City of Kitchener along Conestoga Parkway (Highway 7/8) where there is an existing overpass structure across Weber Street which was constructed in 1966-1967. Widening to the west side of the same structure is presently being carried out by Dufferin Construction under MTO 98-05.

The existing structure has a post-tensioned concrete deck supported on concrete piers and abutments. Records indicate that the existing bridge abutments and piers were founded on driven pipe piles.

The proposed overpass is to be located on the east side of the existing structure on relatively flat ground, except for the fill embankment of the existing bridge. The north abutment of the new structure will be partly built into the embankment fill of Conestoga Parkway (Highway 7/8).

### 2.2 Physiography and Topography

The site is located within the Physiographic Region known as the Waterloo Sandhills. The area is characterized by a flat topography, heavy textured soil and poor drainage (Chapman and Putnam, 1984). The area also has a preponderance of fine sand, particularly on the surface. The hilly region is an extensive area of alluvial terraces of the Grand River spillway system which, although more nearly horizontal, contains similar but more uniform sandy and gravelly materials. Several till sheets underlay the area and are, in order from oldest to youngest, the Catfish Creek Till, Maryhill Till, and Port Stanley Till.



The elevation of the subject site ranges from 319 to 320 m above mean sea level and slopes gently to the west locally in the vicinity of the site.

### 3. INVESTIGATION PROCEDURES

#### 3.1 Field Investigation

Between November 21 and 25, 1998, a CME 75 truck mounted drill rig was used on site for drilling and Standard Penetration Testing (SPT, following the procedures of ASTM D 1586). Four (4) shallow and four (4) deep boreholes were drilled and sampled to obtain data for foundation design of the proposed overpass structure, approach fills and retaining walls. The locations of the boreholes are shown on Drawings A and B.

The boreholes were numbered 98-01 through 98-08 and the depths of sampling were as follows:

| Borehole No. | Depth of Sampling (m) |
|--------------|-----------------------|
| 98-01        | 6.6                   |
| 98-02        | 6.6                   |
| 98-03        | 8.2                   |
| 98-04        | 21.5                  |
| 98-05        | 20.0                  |
| 98-06        | 21.6                  |
| 98-07        | 21.6                  |
| 98-08        | 8.1                   |

The boreholes were drilled using hollow stem augers. Water and/or drilling mud were used to counter-balance the hydrostatic pressure within the hollow stem augers to prevent "blow back" of sands and silts during advancement and sampling operations.

Soil samples were retrieved at selected intervals throughout the depths of the boreholes in conjunction with Standard Penetration Tests (SPT). Samples were generally taken at intervals of 0.75 m in the upper 3 m and thereafter at intervals of 1.5 m to the maximum depth of exploration.

Seepage and water levels were noted in each borehole during and at the completion of drilling and sampling. Standpipe piezometers were installed in Boreholes 98-04 and 98-06 for future monitoring of the groundwater levels. All boreholes were grouted with a bentonite/cement mix at completion of sampling.

The fieldwork was supervised by member of our field engineering staff under the direction of the project engineer. Our field staff cleared the location of buried utilities and logged the boreholes. The soil samples obtained were placed in labeled containers and transported to our Waterloo Office for further examination and laboratory testing.



The stations, offsets and ground surface elevations at the as drilled borehole locations were surveyed by Morrison Hershfield Limited and provided to AGRA for the purpose of this report.

The results of the drilling, sampling, in-situ testing and water level measurements are summarized on the Borehole Logs and enclosed in Appendix "A".

### **3.2 Laboratory Analysis**

Geotechnical laboratory testing consisted of natural moisture content determinations and visual classifications of all retrieved soil samples. In addition, grain size analyses, Atterberg Limit tests and a quick triaxial compression test were performed on selected samples.

The results of the laboratory testing are presented on the borehole logs presented in Appendix "A", and in Figures 1 to 5 in Appendix "B".

## **4. SUBSURFACE CONDITIONS**

### **4.1 General Subsurface Conditions**

In general, the subsurface deposits at the site consist of compact to dense silty fine sand and silt to depths of 2.0 to 11.5 m, underlain by very stiff to hard grey silty clay which is in turn underlain by very dense grey silt till at depths of 16.7 to 19.3 m (Elevations 302.0 to 299.6 m).

Surficial pavement structures, topsoil and fills were also contacted in the upper 2.3 m zone. Within the upper 3 to 4 m, there are interbeds of silty clay, silty sand and sand.

#### **4.1.1 Fill, Pavement, Topsoil**

In Boreholes 98-01 to 98-04, 98-06 and 98-07, topsoil was encountered with measured thickness between 150 and 200 mm.

Borehole 98-08 was drilled on Shantz Lane pavement and penetrated a pavement structure consisting of 80 mm of asphalt over 250 mm crushed granular base.

Fill materials were encountered in Boreholes 98-03 (2.3 m), 98-05 (0.9 m), 98-06 (0.8 m), 98-07 (1.5 m), and 98-08 (1.2 m). The fill typically consists of cobbly sand and gravel to silty fine sand. The fill materials are assumed to be related to the buried utility construction. A typical grain size distribution of the sand fill from Borehole 98-03 is shown on Figure 2 of Appendix "B".

The fill is generally compact with "N" values in the range of 22 to 28 blows per 0.3 m. Locally at Borehole 98-08, the lower portion of the fill consisted of sand and silty clay in which an "N" value of 9 blows per 0.3 m was recorded.



#### 4.1.2 Upper Silty Clay

A surficial layer of silty clay, 0.5 to 1.6 m thick, was encountered in Boreholes 98-04 to 98-08 immediately below some thin sand layers or fill layers at depths ranging from 0.8 to 1.5 m below the ground surface or below elevations ranging from 318.2 and 317.4 m. This deposit is brown to grey in colour and the measured natural moisture contents range from 12 to 20 %, indicative of moistures that are drier than the plastic limit to near plastic limit.

Standard Penetration tests yielded "N" values from 10 to 40 blows per 0.3 m. Based on these values together with visual and tactile examination of the recovered soil samples, the consistency of this upper silty clay deposit is described as stiff to hard, but generally very stiff to hard.

#### 4.1.3 Sand, Silty Sand, Silt

Sand, silty fine sand and silt layers were found immediately below the topsoil, fill or the upper silty clay layers.

The results of the grain size analyses of three typical samples from these layers are plotted on Figure 3 (Appendix "B"). These results reveal varying proportions of sand and silt within these cohesionless deposits.

These deposits extended to depths of 2.0 to 11.5 m below ground surface or at elevations ranging between 318.1 m (Borehole 98-01) to 307.2 m (Borehole 98-05). The thickness of these deposits generally increases from north to south.

These deposits were in damp to moist conditions above the water table with moisture contents recorded in the range of 5 to 10 %. Below 2.5 to 3.5 m depths where the water table was encountered, they were in wet to saturated conditions with moisture contents measured in the 15 to 23 % ranges.

#### 4.1.4 Silty Clay

A major stratum of grey silty clay was contacted below the cohesionless deposits described in the preceding section, at depths ranging from 2.0 m (Elevation 318.1m at Borehole 98-01) to 11.5 m (Elevation 307.2 m at Borehole 98-05). It was not encountered within the explored depth of 8.1 m in Borehole 98-08. In Boreholes 98-04 through 98-07, the silty clay deposit was contacted between Elevations 307.2 and 312.1 m, and extended to Elevation 299.6 to 302.5 m, while in Boreholes 98-01, 98-02 and 98-03, it was encountered between Elevations 318.1 and 315.9 m and generally extended to the full depth of the boreholes (i.e. excess of 6 to 8 m below the ground surface). Occasional wet sand or silt layers were noted within this deposit, and it is most noticeable in Borehole 98-03.

Three grain size analyses were performed and the results are plotted on Figure 4 of Appendix "B".



Standard penetration tests yielded "N" values from 20 to 97 blows per 0.3 m. An unconfined compression test from a sample in Borehole 98-01 at 3.5 m depth yielded shear strength of 239 kPa at 6.2 % strain. The unit weight was measured at 20.9 kN/m<sup>3</sup>.

Six (6) silty clay samples were tested and exhibited the following Atterberg Limits. These results are shown in Figure 1 of Appendix "B" and summarized below:

|                  |                               |
|------------------|-------------------------------|
| Liquid Limit     | 30.5 to 42.0%, average at 34% |
| Plastic Limit    | 16.2 to 19.0%, average at 17% |
| Plasticity Index | 13.5 to 23.3%, average at 17% |

The natural moisture contents were in the range of 15 to 24% with an average of 19%. These results are characteristic of clayey soils of low to medium plasticity (CL to CI) and the fact that the measured natural moisture contents are generally very close to the measured plastic limits indicate that the deposit is pre-consolidated.

#### 4.1.5 Silt Till

A glacial till deposit, consisting of a heterogeneous mixture of sand, silt, gravel and clay size particles, was contacted in the four deep boreholes (i.e. Boreholes 98-04 through 98-07) at Elevations 299.6 to 302.5 m or at depths ranging from 16.7 to 19.3 m below the ground surface. The silt till was penetrated 2.3 to 4.8 m in the four boreholes to Elevations 297.3 to 298.7 m. This silt till deposit was also contacted in the previous boreholes, which were drilled by others for the existing structure, and for the widening being constructed.

The grain size distribution of a sample from Borehole 98-06 is shown in Figure 5 of Appendix "B". The glacial till grades into a sandy silt till.

Standard penetration test yielded "N" values consistently in excess of 100 blows per 0.3 m, indicating a very dense material. Boulders and/or cobbles are frequently embedded within glacial till deposits. From the very high blow counts and augering resistance within the silt till, the presence of cobbles and boulders may be inferred.

Natural moisture contents were between 5 and 7 %. The silt till is classified as very dense.



## 4.2 Groundwater Conditions

On completion of drilling, the following observations of groundwater levels were made:

| Borehole No. | Depth of Borehole (m) | Observation  |
|--------------|-----------------------|--|
| 98-01        | 6.6                   | No free water upon completion  |
| 98-02        | 6.6                   | Free water at 3.5 m, Elevation 316.3 m upon completion                             |
| 98-03        | 8.2                   | Free water at 1.9 m, Elevation 317.6 m upon completion                             |
| 98-04        | 21.5                  | Free water at 4.5 m, Elevation 314.7 m 48 hours after completion, in standpipe     |
| 98-05        | 20.0                  | Free water at 2.9 m, Elevation 315.8 m 24 hours after completion, in open borehole |
| 98-06        | 21.6                  | Free water at 4.0 m, Elevation 314.9 m 48 hours after completion, in standpipe     |
| 98-07        | 21.6                  | Free water at 4.3 m, Elevation 314.6 m 24 hours after completion, in open borehole |
| 98-08        | 8.1                   | Free water at 5.0 m, Elevation 314.0 m 24 hours after completion, in open borehole |

The water levels recorded indicate the static water level of the shallow water table.

These water levels are consistent with the observations made during the excavation of the pile caps of the Weber Street Bridge project (MTO 98-05) being carried out. The water levels are higher than the water level in the Montgomery Creek, and therefore the water table is suspected to flow westerly to Montgomery Creek.

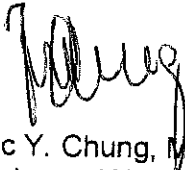


## 6. STATEMENT OF LIMITATION

We recommend that once the details of the proposed structure are finalized, our recommendations should be reviewed for their specific applicability.

The Limitations of Report, as Quoted in Appendix "D", is an integral part of this report.

Yours truly,  
**AGRA Earth & Environmental Limited**



Eric Y. Chung, M.Eng., P.Eng.  
Kitchener-Waterloo Branch Manager



Zuhtu S. Ozden, P.Eng.  
Designated MTO Contact





## EXPLANATION OF TERMS USED IN REPORT

**N VALUE:** THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS  $\bar{N}$ .

**DYNAMIC CONE PENETRATION TEST:** CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

**CONSISTENCY:** COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH ( $c_u$ ) AS FOLLOWS:

| $c_u$ (kPa) | 0 - 12    | 12 - 25 | 25 - 50 | 50 - 100 | 100 - 200  | > 200 |
|-------------|-----------|---------|---------|----------|------------|-------|
|             | VERY SOFT | SOFT    | FIRM    | STIFF    | VERY STIFF | HARD  |

**DENSENESS:** COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

| N (BLOWS/0.3m) | 0 - 5      | 5 - 10 | 10 - 30 | 30 - 50 | > 50       |
|----------------|------------|--------|---------|---------|------------|
|                | VERY LOOSE | LOOSE  | COMPACT | DENSE   | VERY DENSE |

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND / OR STRENGTH.

**RECOVERY:** SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

**MODIFIED RECOVERY:** SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY, IS:

| RQD (%) | 0 - 25    | 25 - 50 | 50 - 75 | 75 - 90 | 90 - 100  |
|---------|-----------|---------|---------|---------|-----------|
|         | VERY POOR | POOR    | FAIR    | GOOD    | EXCELLENT |

**JOINTING AND BEDDING:**

| SPACING  | 50mm       | 50 - 300mm | 0.3m - 1m  | 1m - 3m | > 3m       |
|----------|------------|------------|------------|---------|------------|
| JOINTING | VERY CLOSE | CLOSE      | MOD. CLOSE | WIDE    | VERY WIDE  |
| BEDDING  | VERY THIN  | THIN       | MEDIUM     | THICK   | VERY THICK |

## ABBREVIATIONS AND SYMBOLS

### FIELD SAMPLING

|     |                     |     |                            |
|-----|---------------------|-----|----------------------------|
| S S | SPLIT SPOON         | T P | THINWALL PISTON            |
| W S | WASH SAMPLE         | O S | OSTERBERG SAMPLE           |
| S T | SLOTTED TUBE SAMPLE | R C | ROCK CORE                  |
| B S | BLOCK SAMPLE        | P H | T W ADVANCED HYDRAULICALLY |
| C S | CHUNK SAMPLE        | P M | T W ADVANCED MANUALLY      |
| T W | THINWALL OPEN       | F S | FOIL SAMPLE                |

### MECHANICAL PROPERTIES OF SOIL

|                |                   |                                      |
|----------------|-------------------|--------------------------------------|
| $m_v$          | kPa <sup>-1</sup> | COEFFICIENT OF VOLUME CHANGE         |
| $C_c$          | 1                 | COMPRESSION INDEX                    |
| $C_s$          | 1                 | SWELLING INDEX                       |
| $C_\alpha$     | 1                 | RATE OF SECONDARY CONSOLIDATION      |
| $c_v$          | m <sup>2</sup> /s | COEFFICIENT OF CONSOLIDATION         |
| H              | m                 | DRAINAGE PATH                        |
| $T_v$          | 1                 | TIME FACTOR                          |
| U              | %                 | DEGREE OF CONSOLIDATION              |
| $\sigma'_{vo}$ | kPa               | EFFECTIVE OVERBURDEN PRESSURE        |
| $\sigma'_p$    | kPa               | PRECONSOLIDATION PRESSURE            |
| $\tau_f$       | kPa               | SHEAR STRENGTH                       |
| $c'$           | kPa               | EFFECTIVE COHESION INTERCEPT         |
| $\phi'$        | °                 | EFFECTIVE ANGLE OF INTERNAL FRICTION |
| $c_u$          | kPa               | APPARENT COHESION INTERCEPT          |
| $\phi_u$       | °                 | APPARENT ANGLE OF INTERNAL FRICTION  |
| $\tau_r$       | kPa               | RESIDUAL SHEAR STRENGTH              |
| $\tau_r$       | kPa               | REMOULDED SHEAR STRENGTH             |
| $S_j$          | 1                 | SENSITIVITY = $\frac{c_u}{\tau_r}$   |

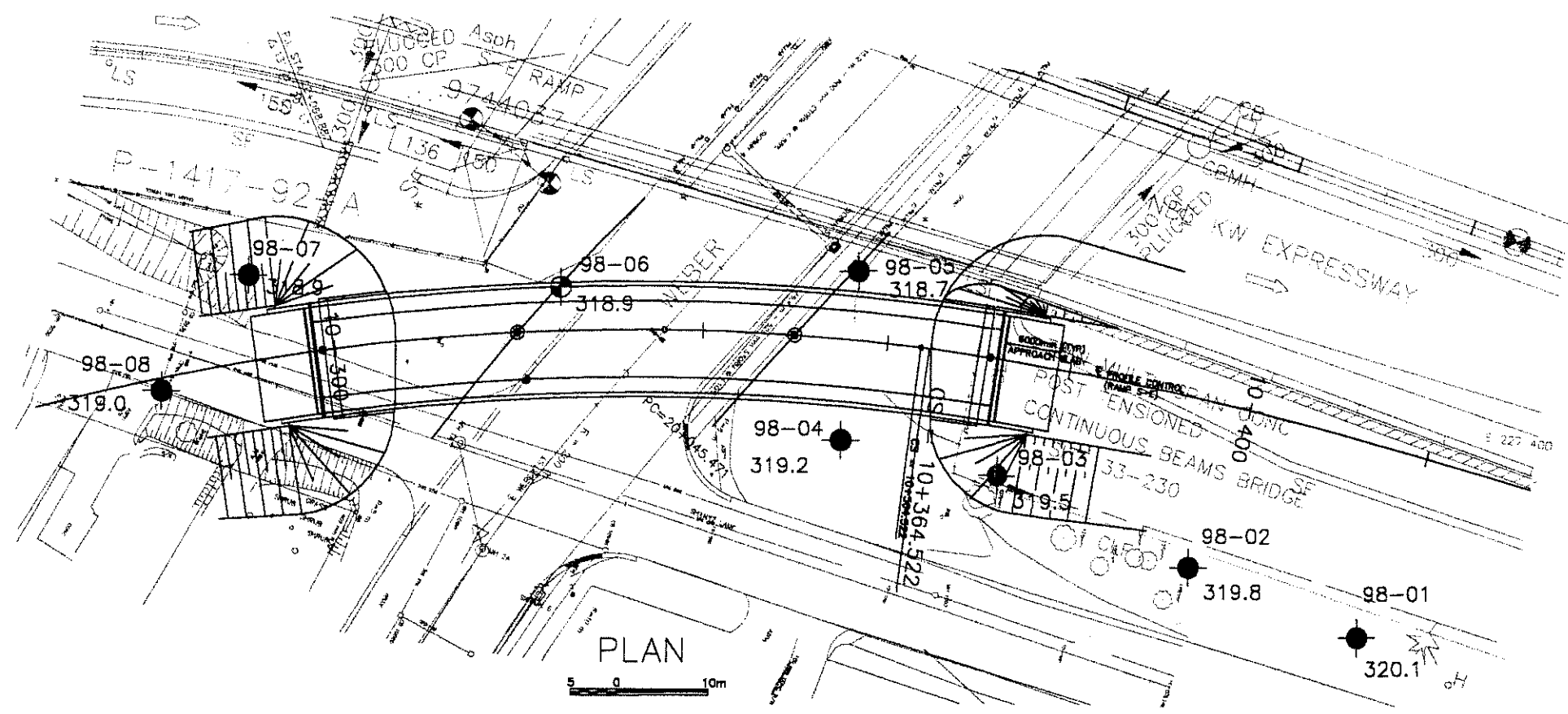
### STRESS AND STRAIN

|                                      |     |                               |
|--------------------------------------|-----|-------------------------------|
| $u_w$                                | kPa | PORE WATER PRESSURE           |
| $r_u$                                | 1   | PORE PRESSURE RATIO           |
| $\sigma$                             | kPa | TOTAL NORMAL STRESS           |
| $\sigma'$                            | kPa | EFFECTIVE NORMAL STRESS       |
| $\tau$                               | kPa | SHEAR STRESS                  |
| $\sigma_1, \sigma_2, \sigma_3$       | kPa | PRINCIPAL STRESSES            |
| $\epsilon$                           | %   | LINEAR STRAIN                 |
| $\epsilon_1, \epsilon_2, \epsilon_3$ | %   | PRINCIPAL STRAINS             |
| E                                    | kPa | MODULUS OF LINEAR DEFORMATION |
| G                                    | kPa | MODULUS OF SHEAR DEFORMATION  |
| $\mu$                                | 1   | COEFFICIENT OF FRICTION       |

### PHYSICAL PROPERTIES OF SOIL

|                |                   |                                |           |      |   |           |                   |   |
|----------------|-------------------|--------------------------------|-----------|------|---|-----------|-------------------|---|
| $\rho_s$       | kg/m <sup>3</sup> | DENSITY OF SOLID PARTICLES     | e         | 1, % | VOID RATIO                                | $e_{min}$ | 1, %              | VOID RATIO IN DENSEST STATE                             |
| $\gamma_s$     | kN/m <sup>3</sup> | UNIT WEIGHT OF SOLID PARTICLES | n         | 1, % | POROSITY                                  | $I_D$     | 1                 | DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$ |
| $\rho_w$       | kg/m <sup>3</sup> | DENSITY OF WATER               | w         | 1, % | WATER CONTENT                             | D         | mm                | GRAIN DIAMETER  |
| $\gamma_w$     | kN/m <sup>3</sup> | UNIT WEIGHT OF WATER           | $S_r$     | %    | DEGREE OF SATURATION                      | $D_n$     | mm                | n PERCENT - DIAMETER                                    |
| $\rho$         | kg/m <sup>3</sup> | DENSITY OF SOIL                | $w_L$     | %    | LIQUID LIMIT                              | $C_u$     | 1                 | UNIFORMITY COEFFICIENT                                  |
| $\gamma$       | kN/m <sup>3</sup> | UNIT WEIGHT OF SOIL            | $w_p$     | %    | PLASTIC LIMIT                             | h         | m                 | HYDRAULIC HEAD OR POTENTIAL                             |
| $\rho_d$       | kg/m <sup>3</sup> | DENSITY OF DRY SOIL            | $w_s$     | %    | SHRINKAGE LIMIT                           | q         | m <sup>3</sup> /s | RATE OF DISCHARGE                                       |
| $\gamma_d$     | kN/m <sup>3</sup> | UNIT WEIGHT OF DRY SOIL        | $I_p$     | %    | PLASTICITY INDEX = $w_L - w_p$            | v         | m/s               | DISCHARGE VELOCITY                                      |
| $\rho_{sat}$   | kg/m <sup>3</sup> | DENSITY OF SATURATED SOIL      | $I_L$     | 1    | LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$   | i         | 1                 | HYDRAULIC GRADIENT                                      |
| $\gamma_{sat}$ | kN/m <sup>3</sup> | UNIT WEIGHT OF SATURATED SOIL  | $I_C$     | 1    | CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$ | k         | m/s               | HYDRAULIC CONDUCTIVITY                                  |
| $\rho'$        | kg/m <sup>3</sup> | DENSITY OF SUBMERGED SOIL      | $e_{max}$ | 1, % | VOID RATIO IN LOOSEST STATE               | j         | kn/m <sup>2</sup> | SEEPAGE FORCE   |
| $\gamma'$      | kN/m <sup>3</sup> | UNIT WEIGHT OF SUBMERGED SOIL  |           |      |   |           |                   |   |



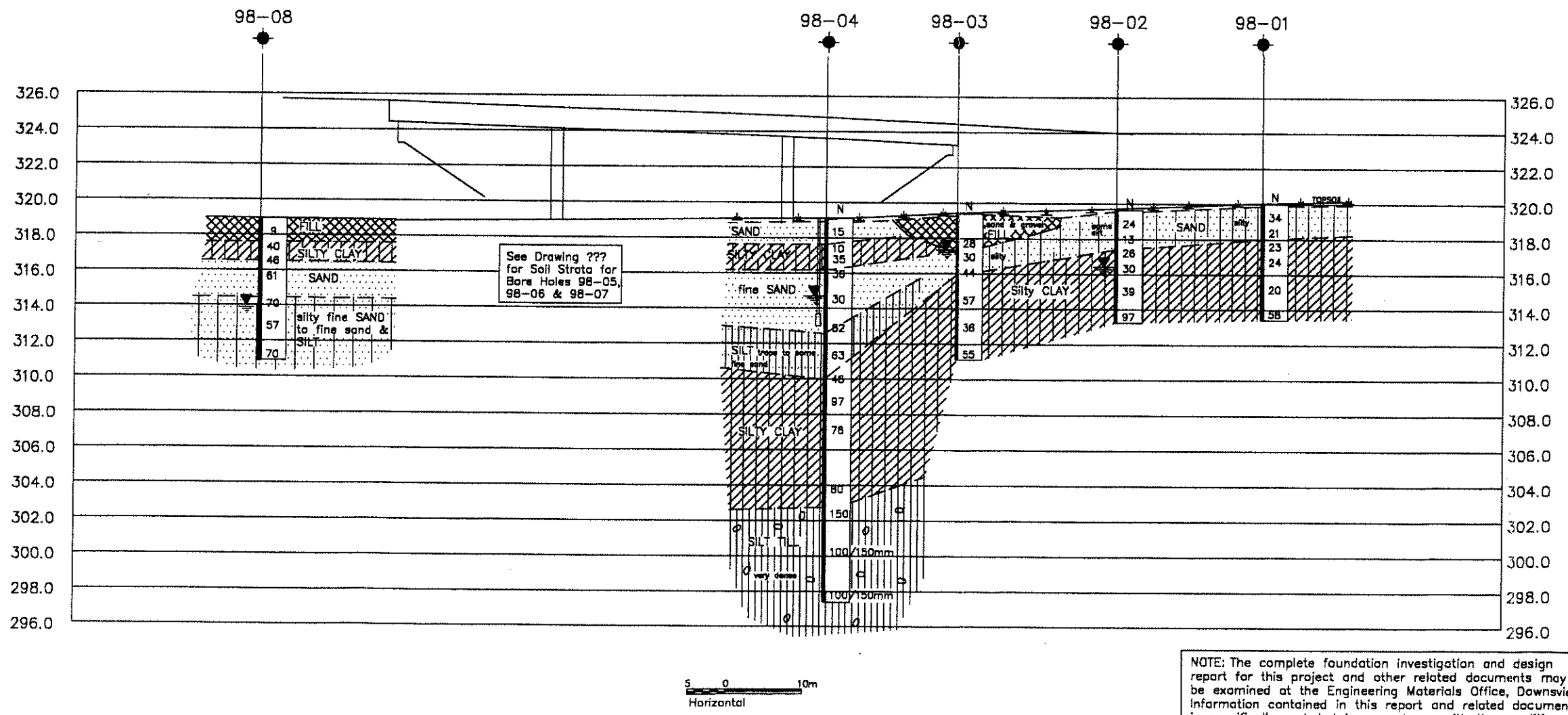
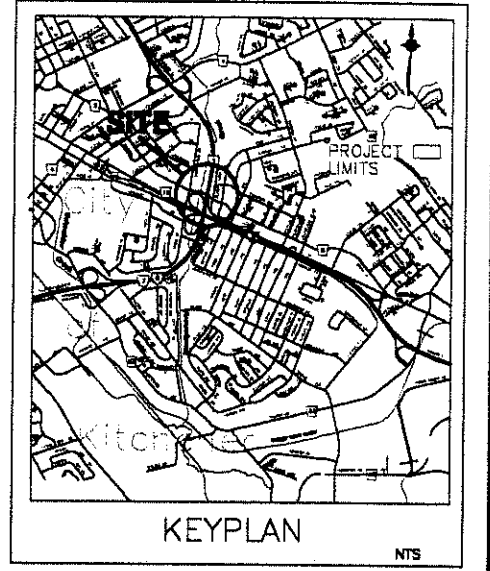


METRIC  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

CONT No 2001-3011  
WP No 363-94-00

WEBER STREET OVERPASS  
0000  
BORE HOLE LOCATIONS & SOIL STRATA

SHEET  
000



### LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- Blows/0.3m (Std Pen Test, 475 J/blow)
- Blows/0.3m (80° Cone, 475 J/blow)
- W.L. at time of investigation
- Standpipe

| No.   | ELEVATION | CO-ORDINATES |         |
|-------|-----------|--------------|---------|
|       |           | NORTH        | EAST    |
| 98-01 | 320.1     | 4 811 375    | 227 424 |
| 98-02 | 319.8     | 4 811 355    | 227 419 |
| 98-03 | 319.5     | 4 811 335    | 227 412 |
| 98-04 | 319.2     | 4 811 318    | 227 410 |
| 98-05 | 318.7     | 4 811 315    | 227 393 |
| 98-06 | 318.9     | 4 811 284    | 227 399 |
| 98-07 | 318.9     | 4 811 250    | 227 402 |
| 98-08 | 319.0     | 4 811 243    | 227 416 |

NOTE: The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section GC2.01 of OPS Gen. Cond.

| REVISIONS |      |    |            |
|-----------|------|----|------------|
|           | DATE | BY | DISCUSSION |
|           |      |    |            |
|           |      |    |            |
|           |      |    |            |
|           |      |    |            |

|                       |            |                |             |
|-----------------------|------------|----------------|-------------|
| GEOCRETS NO. 40P8-117 |            |                |             |
| HWY No.               | HWY 7 & 8  |                | DIST 2      |
| SUBM'D 00             | CHECKED 00 | DATE June 1999 | SITE 33-394 |
| DRAWN LWM             | CHECKED    | APPROVED       | DWG A       |

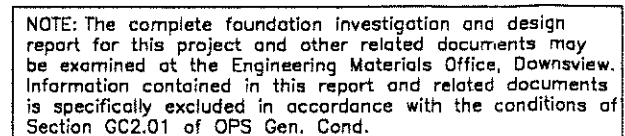
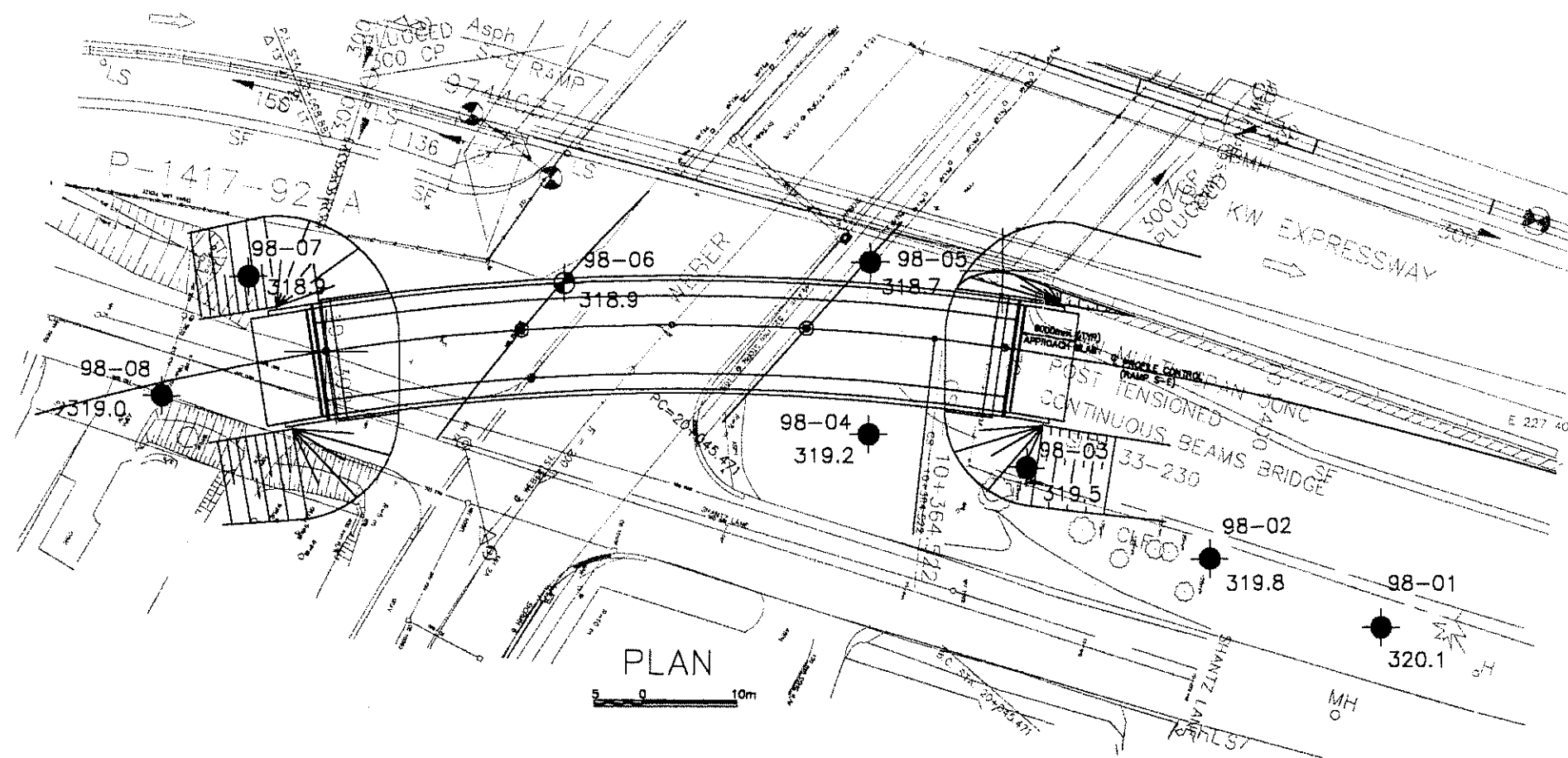




HEET



**AGRA Earth & Environmental**  
ENGINEERING GLOBAL SOLUTIONS



-- NOTE --

The boundaries between soil strata have been established only at Serehole locations. Between Sereholes the boundaries are assumed from geological evidence.

|           |    |            |  |
|-----------|----|------------|--|
| REVISIONS |    |            |  |
|           |    |            |  |
|           |    |            |  |
| DATE      | BY | DISCRPTION |  |

|                      |             |                |             |
|----------------------|-------------|----------------|-------------|
| GEOGRES NO. 40P8-117 |             |                |             |
| HWY No.              | HWY 7 & 8   | DIST           | 2           |
| SUBM'D 00            | CHECKED EYC | DATE June 1999 | SITE 33-394 |
| DRAWN LWM            | CHECKED     | APPROVED       | DWG 8       |



# FIGURES



# APPENDIX "A"

## Record of Borehole Sheets



# RECORD OF BOREHOLE No 98-01

1 OF 1

METRIC

W.P. 363-94-00 SITE 33-394 LOCATION S-E Ramp at Weber Street, 4811375N, 227424E ORIGINATED BY S.W.  
 DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
 DATUM GEODETIC DATE 25.11.98 - 25.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT  |    |    | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|--|----|----|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa<br>○ UNCONFINED    + FIELD VANE<br>● QUICK TRIAXIAL    × LAB VANE |    |    |                                    |                                     |                                   |  |  |
| 320.1         |   |            |         |      |            |                            | 20              | 40   | 60 | 80 | 100                                | 10                                  | 20                                | 30   |  |
| 0.0           | TOPSOIL 150 mm<br>Dense, light brown SILTY FINE<br>SAND, trace cobble<br>damp to moist  |            | 1       | SS   | 34         |                            |                 |  |    |    |                                    |                                     |                                   |  |  |
|               |   |            | 2       | SS   | 21         |                            |                 |  |    |    |                                    |                                     |                                   |  |  |
| 318.1         |   |            |         |      |            |                            |                 |  |    |    |                                    |                                     |                                   |  |  |
| 2.0           | Hard, brown to grey SILTY CLAY,<br>some medium to coarse sand<br>seams<br>damp to moist |            | 3       | SS   | 23         |                            |                 |  |    |    |                                    |                                     |                                   |  |  |
|               |   |            | 4       | SS   | 24         |                            |                 |  |    |    |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |  |    |    |                                    |                                     |                                   |  |  |
|               |   |            | 5       | SS   | 20         |                            |                 |  |    |    |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |  |    |    |                                    |                                     |                                   |  |  |
|               |   |            | 6       | SS   | 58         |                            |                 |  |    |    |                                    |                                     |                                   |  |  |
| 313.5         |   |            |         |      |            |                            |                 |  |    |    |                                    |                                     |                                   |  |  |
| 6.6           | END OF BOREHOLE @ 6.6 m<br>NOTE: Borehole dry upon<br>completion                        |            |         |      |            |                            |                 |  |    |    |                                    |                                     |                                   |  |  |

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+ 3 - 3 Numbers refer to Sensitivity 3% STRAIN AT FAILURE



RECORD OF BOREHOLE No 98-02

1 OF 1

METRIC

W.P. 363-94-00 SITE 33-394 LOCATION S-E Ramp at Weber Street, 4811355N, 227419E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 25.11.98 - 25.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT  |    |    |     | PLASTIC<br>LIMIT | NATURAL<br>MOISTURE<br>CONTENT | LIQUID<br>LIMIT | UNIT<br>WEIGHT<br><br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |                   |    |    |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|--|----|----|-----|------------------|--------------------------------|-----------------|-------------------------|---|-------------------|----|----|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa<br>○ UNCONFINED      + FIELD VANE<br>● QUICK TRIAXIAL      - LAB VANE |    |    |     | W <sub>p</sub>   | W                              | W <sub>L</sub>  |                         |   | WATER CONTENT (%) |    |    |
| 319.8         |   |            |         |      |            |                            | 20              | 40   | 60 | 80 | 100 |                  |                                |                 |                         | GR  | SA                | SI | CL |
| 0.0           | TOPSOIL 150 mm<br>Compact, brown FINE SAND, some<br>silt, occasional gravel<br>damp |            | 1       | SS   | 24         |                            |                 |  |    |    |     |                  |                                |                 |                         |   |                   |    |    |
|               | wet with saturated medium sand<br>seams   |            | 2       | SS   | 13         |                            |                 |  |    |    |     |                  |                                |                 |                         |   |                   |    |    |
| 317.4         |   |            | 3       | SS   | 26         |                            |                 |  |    |    |     |                  |                                |                 |                         |   |                   |    |    |
| 2.4           | Very stiff to hard, grey SILTY CLAY<br>moist  |            | 4       | SS   | 30         |                            |                 |  |    |    |     |                  |                                |                 |                         |   |                   |    |    |
|               |   |            | 5       | SS   | 39         |                            |                 |  |    |    |     |                  |                                |                 |                         |   |                   |    |    |
| 314.0         |   |            | 6       | SS   | 97         |                            |                 |  |    |    |     |                  |                                |                 |                         |   |                   |    |    |
| 5.8           | Very dense, grey FINE SAND<br>saturated   |            |         |      |            |                            |                 |  |    |    |     |                  |                                |                 |                         |   |                   |    |    |
| 313.2         |   |            |         |      |            |                            |                 |  |    |    |     |                  |                                |                 |                         |   |                   |    |    |
| 6.6           | END OF BOREHOLE @ 6.6m<br>NOTE: Water level @ 316.3 m<br>upon completion            |            |         |      |            |                            |                 |  |    |    |     |                  |                                |                 |                         |   |                   |    |    |

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EXPRESS 3-394 GPJ EXPRESS GDT 19/07/99

+ 3 3. Numbers refer to 3% STRAIN AT FAILURE  
Sensitivity



RECORD OF BOREHOLE No 98-03

1 OF 1

METRIC

W.P. 363-94-00 SITE: 33-394 LOCATION S-E Ramp at Weber Street, 4811335N, 227412E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 25.11.98 - 25.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 319.5<br>0.0  | TOPSOIL 200 mm<br>Compact, brown cobbley sand and<br>gravel FILL<br>moist |            |         |      |            |                            | 319             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 317.7<br>1.8  | Compact, brown sand FILL<br>saturated                                     |            | 1       | As   |            |                            | 318             |   |    |    |    |     |                                    |                                     |                                   |                     | 0 90 (10)   |
| 317.2<br>2.3  | Dense, brown SILTY SAND, some<br>gravel<br>very moist                     |            | 2       | SS   | 28         |                            | 317             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 316.4<br>3.1  | Dense, brown SAND, trace fine<br>gravel<br>saturated                      |            | 3       | SS   | 30         |                            | 316             |   |    |    |    |     |                                    |                                     |                                   |                     | 2 86 (12)   |
| 315.9<br>3.6  | Hard, grey SILTY CLAY, frequent<br>saturated sand seams<br><br>moist      |            | 4       | SS   | 44         |                            | 315             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 313.5<br>6.0  | Dense grey SILTY FINE SAND<br>saturated                                   |            | 5       | SS   | 57         |                            | 314             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 313.1<br>6.4  | Hard, grey SILTY CLAY   |            | 6       | SS   | 36         |                            | 313             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 311.6<br>7.9  | Very dense, grey SAND<br>saturated  |            | 7       | SS   | 55         |                            | 312             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 311.3<br>8.2  | END OF BOREHOLE @ 8.2m<br>NOTE: Water level @ 317.6 m<br>upon completion  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

EXPRESS: 3-394 GPJ EXPRESS GDT 19/07/99



# RECORD OF BOREHOLE No 98-04

1 OF 2

METRIC

W.P. 363-94-00 SITE: 33-394 LOCATION S-E Ramp at Weber Street, 4811318N, 227410E ORIGINATED BY S.W.  
 DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
 DATUM GEODETIC DATE 24.11.98 - 24.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |                 | PLASTIC<br>LIMIT | NATURAL<br>MOISTURE<br>CONTENT | LIQUID<br>LIMIT | UNIT<br>WEIGHT<br>$\gamma$<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)      |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|-----------------|------------------|--------------------------------|-----------------|---|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | 20 40 60 80 100                             | 20 40 60 80 100 | W <sub>p</sub>   | W                              | W <sub>L</sub>  |   |  |
| 319.2<br>0.0  | TOPSOIL 200 mm<br>Compact, brown FINE SAND, trace<br>silt,<br>very moist                            |            |         |      |            |                            | 319             |   |                 |                  |                                |                 |   | piezometer<br>installed to<br>6.1m, slotted to<br>4.6m |
|               | frequent silt seams   |            | 1       | SS   | 15         |                            | 318             |   |                 |                  |                                |                 |   |  |
| 317.7<br>1.5  | Stiff to hard, brown SILTY CLAY,<br>trace fine gravel<br>very moist<br>frequent wet fine sand seams |            | 2       | SS   | 10         |                            | 317             |   |                 |                  |                                |                 |   |  |
|               |   |            | 3       | SS   | 35         |                            | 316             |   |                 |                  |                                |                 |   |  |
| 316.1<br>3.1  | Dense to very dense, grey FINE<br>SAND<br>wet   |            | 4       | SS   | 36         |                            | 315             |   |                 |                  |                                |                 |   |  |
|               | saturated   |            | 5       | SS   | 30         |                            | 314             |   |                 |                  |                                |                 |   |  |
|               |   |            | 6       | SS   | 52         |                            | 313             |   |                 |                  |                                |                 |   |  |
| 312.2<br>7.0  | Very dense, grey SILT, trace to<br>some fine sand<br>saturated                                      |            | 7       | SS   | 63         |                            | 312             |   |                 |                  |                                |                 |   |  |
|               |   |            |         |      |            |                            | 311             |   |                 |                  |                                |                 |   |  |
| 310.0<br>9.2  | Hard, grey SILTY CLAY, occasional<br>wet sand seam  |            | 8       | SS   | 46         |                            | 310             |   |                 |                  |                                |                 |   |  |
|               |   |            | 9       | SS   | 97         |                            | 309             |   |                 |                  |                                |                 |   |  |
|               |   |            |         |      |            |                            | 308             |   |                 |                  |                                |                 |   |  |

Continued Next Page

+ 3 3: Numbers refer to Sensitivity ( ) 3% STRAIN AT FAILURE



# RECORD OF BOREHOLE No 98-04

2 OF 2

METRIC

W.P. 363-94-00 SITE: 33-394 LOCATION S-E Ramp at Weber Street, 4811318N 227410E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 24.11.98 - 24.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE   |   |            | SAMPLES |             |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT         |    |    |    |     | UNIT<br>WEIGHT<br>$\gamma$<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|----------------|---|------------|---------|-------------|------------|----------------------------|-----------------|---|----|----|----|-----|---|---|
| ELEV.<br>DEPTH | DESCRIPTION                                     | STRAT PLOT | NUMBER  | TYPE        | "N" VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |   |   |
|                |   |            |         |             |            |                            |                 | SHEAR STRENGTH kPa                                  |    |    |    |     |   |   |
|                |   |            |         |             |            |                            |                 | ○ UNCONFINED + FIELD VANE                           |    |    |    |     |   |   |
|                |   |            |         |             |            |                            |                 | ● QUICK TRIAXIAL × LAB VANE                         |    |    |    |     |   |   |
|                |   |            |         |             |            |                            |                 | 20  | 40 | 60 | 80 | 100 |   |   |
|                |   |            |         |             |            |                            |                 | WATER CONTENT (%)                                   |    |    |    |     |   |   |
|                |   |            |         |             |            |                            |                 | PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT |    |    |    |     |   |   |
|                |   |            |         |             |            |                            |                 | W <sub>p</sub> W W <sub>L</sub>                     |    |    |    |     |   |   |
|                |   |            |         |             |            |                            |                 | 10 20 30  |    |    |    |     |   |   |
|                |   |            |         |             |            |                            |                 | GR SA SI CL   |    |    |    |     |   |   |
|                | Hard, grey SILTY CLAY, occasional wet sand seam |            | 10      | SS          | 76         |                            | 307             |   |    |    |    |     |   | 1 4 53 42   |
|                |   |            |         |             |            |                            | 306             |   |    |    |    |     |   |   |
|                |   |            |         |             |            |                            | 305             |   |    |    |    |     |   |   |
|                |   |            | 11      | SS          | 80         |                            | 304             |   |    |    |    |     | 42  |   |
|                |   |            |         |             |            |                            | 303             |   |    |    |    |     |   |   |
| 302.5          | Very dense, grey SILT TILL moist                |            | 12      | SS          | 150        |                            | 302             |   |    |    |    |     |   |   |
| 16.7           |   |            |         |             |            |                            | 301             |   |    |    |    |     |   |   |
|                | trace gravel                                    |            | 13      | SS100/150mm |            |                            | 300             |   |    |    |    |     |   |   |
|                |   |            |         |             |            |                            | 299             |   |    |    |    |     |   |   |
|                |   |            |         |             |            |                            | 298             |   |    |    |    |     |   |   |
| 297.7          | END OF BOREHOLE @ 21.5m                         |            | 14      | SS100/150mm |            |                            |                 |   |    |    |    |     |   |   |
| 21.5           | NOTE: Water level @ 314.7 m after 48 hours      |            |         |             |            |                            |                 |   |    |    |    |     |   |   |

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# RECORD OF BOREHOLE No 98-05

1 OF 2

METRIC

W.P. 363-94-00 SITE 33-394 LOCATION S-E Ramp at Weber Street, 4811316N 227392E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 25.11.98 - 26.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>w <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>w | LIQUID<br>LIMIT<br>w <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 318.7<br>0.0  | Compact, dark brown cobbly sand and gravel FILL very moist              |            |         |      |            |                            | 318             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 317.8<br>0.9  | Very stiff, brown SILTY CLAY, frequent thin wet sand seams very moist   |            | 1       | SS   | 15         |                            | 317             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 316.8<br>2.1  | Dense, grey FINE SAND to SANDY SILT wet to saturated                    |            | 2       | SS   | 19         |                            | 316             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 3       | SS   | 37         |                            | 315             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 4       | SS   | 31         |                            | 314             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 5       | SS   | 38         |                            | 313             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 312.8<br>5.9  | Very dense, grey SILT, trace fine sand, some silty sand seams saturated |            | 6       | SS   | 50         |                            | 312             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 7       | SS   | 45         |                            | 311             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 8       | SS   | 19         |                            | 310             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 9       | SS   | 52         |                            | 309             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 307.2<br>11.5 | Hard, grey SILTY CLAY moist   |            |         |      |            |                            | 308             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            |         |      |            |                            | 307             |   |    |    |    |     |                                    |                                     |                                   |                     |   |

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Continued Next Page

+ 3. 3. Numbers refer to Sensitivity ( ) 3% STRAIN AT FAILURE



RECORD OF BOREHOLE No 98-05

2 OF 2

METRIC

W.P. 363-94-00 SITE 33-394 LOCATION S-E Ramp at Weber Street, 4811316N, 227392E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 25.11.98 - 26.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |   |            | SAMPLES |             |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|-------------|------------|----------------------------|-----------------|---|----|----|----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE        | "N" VALUES |                            |                 | 20  | 40 | 60 | 80 | 100                                |                                     |                                   |                     |   |
|               | Hard, grey SILTY CLAY<br>moist  |            | 10      | SS          | 76         |                            |                 |   |    |    |    |                                    |                                     |                                   |                     |   |
| 302.0         |   |            |         |             |            |                            | 306             |   |    |    |    |                                    |                                     |                                   |                     |   |
| 16.7          | Very dense, grey SILT TILL<br>damp to moist                               |            |         |             |            |                            | 305             |   |    |    |    |                                    |                                     |                                   |                     |   |
|               |   |            |         |             |            |                            | 304             |   |    |    |    |                                    |                                     |                                   |                     |   |
|               |   |            |         |             |            |                            | 303             |   |    |    |    |                                    |                                     |                                   |                     |   |
|               |   |            |         |             |            |                            | 302             |   |    |    |    |                                    |                                     |                                   |                     |   |
|               |   |            |         |             |            |                            | 301             |   |    |    |    |                                    |                                     |                                   |                     |   |
|               |   |            | 11      | SS150/150mm |            |                            | 300             |   |    |    |    |                                    |                                     |                                   |                     |   |
|               |   |            |         |             |            |                            | 299             |   |    |    |    |                                    |                                     |                                   |                     |   |
| 298.7         |   |            | 12      | SS150/100mm |            |                            |                 |   |    |    |    |                                    |                                     |                                   |                     |   |
| 20.0          | END OF BOREHOLE @ 20.0 m<br>NOTE: Water level @ 315.8 m after<br>24 hours |            |         |             |            |                            |                 |   |    |    |    |                                    |                                     |                                   |                     |   |

EXPRESS 3-394.GPJ EXPRESS.GOT 19/07/99



## METRIC

94



RECORD OF BOREHOLE No 98-06

2 OF 2

METRIC

W.P. 363-94-00 SITE: 33-394 LOCATION S-E Ramp at Weber Street, 4611284N, 227398E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 23.11.98 - 24.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |  |            | SAMPLES |             |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>w <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>w | LIQUID<br>LIMIT<br>w <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|------------|---------|-------------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE        | "N" VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
|               | Hard, grey SILTY CLAY  |            | 9       | SS          | 43         |                            | 306             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |  |            | 10      | SS          | 63         |                            | 305             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |  |            | 11      | SS          | 59         |                            | 304             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |  |            | 12      | SS          | 59         |                            | 302             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |  |            | 13      | SS          | 79         |                            | 300             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 299.6<br>19.3 | Very dense, grey SILT TILL<br>moist to damp                              |            | 14      | SS100/150mm |            |                            | 299             |   |    |    |    |     |                                    |                                     |                                   |                     | 15 33 44 8  |
| 297.3<br>21.6 | END OF BOREHOLE @ 21.6m<br>NOTE: Water level @ 314.9 m after<br>24 hours |            | 15      | SS100/150mm |            |                            | 298             |   |    |    |    |     |                                    |                                     |                                   |                     |   |

EXPRESS 3-394 GPJ EXPRESS GDT 22/07/99



# RECORD OF BOREHOLE No 98-07

1 OF 2

METRIC

W.P. 363-94-00 SITE: 33-394 LOCATION S-E Ramp at Weber Street, 4811250N, 227402E ORIGINATED BY S.W.  
 DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
 DATUM GEODETIC DATE 23.11.98 - 23.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |    |    |     |    |    |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|----|----|-----|----|----|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | 20  | 40 |                                    |                                     |                                   |                     |   | 60 | 80 | 100 | 20 | 40 |
| 318.9<br>0.0  | TOPSOIL 150 mm<br>Compact, rust brown fine sand and<br>silt FILL<br>moist |            | 1       | SS   | 22         |                            |                 |   |    |                                    |                                     |                                   |                     |   |    |    |     |    |    |
| 317.4<br>1.5  | Hard, brown SILTY CLAY  |            | 2       | SS   | 43         |                            |                 |   |    |                                    |                                     |                                   |                     |   |    |    |     |    |    |
| 316.9<br>2.0  | Compact to dense, brown SAND,<br>trace gravel                             |            | 3       | SS   | 41         |                            |                 |   |    |                                    |                                     |                                   |                     |   |    |    |     |    |    |
|               |   |            | 4       | SS   | 30         |                            |                 |   |    |                                    |                                     |                                   |                     |   |    |    |     |    |    |
|               | grey<br>saturated   |            | 5       | SS   | 30         |                            |                 |   |    |                                    |                                     |                                   |                     |   |    |    |     |    |    |
|               |   |            | 6       | SS   | 35         |                            |                 |   |    |                                    |                                     |                                   |                     |   |    |    |     |    |    |
|               |   |            | 7       | SS   | 80         |                            |                 |   |    |                                    |                                     |                                   |                     |   |    |    |     |    |    |
|               |   |            | 8       | SS   | 44         |                            |                 |   |    |                                    |                                     |                                   |                     |   |    |    |     |    |    |
| 309.3<br>9.6  | Very dense, grey SILTY FINE<br>SAND to SANDY SILT<br>very moist to wet    |            | 9       | SS   | 26         |                            |                 |   |    |                                    |                                     |                                   |                     |   |    |    |     |    |    |
| 307.8<br>11.1 | Hard, grey, SILTY CLAY<br>moist   |            |         |      |            |                            |                 |   |    |                                    |                                     |                                   |                     |   |    |    |     |    |    |

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Continued Next Page

+ 3 3 Numbers refer to  
Sensitivity 3% STRAIN AT FAILURE



## METRIC

+ 3, 3 Numbers refer to Sensitivity      3% STRAIN AT FAILURE



# RECORD OF BOREHOLE No 98-08

1 OF 1

METRIC

W.P. 363-94-00 SITE: 33-394 LOCATION S-E Ramp at Weber Street, 4811243N, 227416E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETTIC DATE 21.11.98 - 21.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |     |  | PLASTIC<br>LIMIT<br>w <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>w | LIQUID<br>LIMIT<br>w <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |                   |  |  |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|-----|--|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|-------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |    |    |     |  |                                    |                                     |                                   |                     |   | WATER CONTENT (%) |  |  |
|               |  |            |         |      |            |                            |                 |   |    |    |     |  |                                    |                                     |                                   |                     |   |                   |  |  |
|               |  |            |         |      |            |                            |                 |   |    |    |     |  |                                    |                                     |                                   |                     |   |                   |  |  |
| 319.0         |  |            |         |      |            |                            | 20              | 40  | 60 | 80 | 100 |  |                                    |                                     |                                   |                     |   |                   |  |  |
| 0.0           | ASPHALT 80mm   |            |         |      |            |                            |                 |   |    |    |     |  |                                    |                                     |                                   |                     |   |                   |  |  |
| 318.7         | CRUSHED GRANULAR 250mm   |            |         |      |            |                            |                 |   |    |    |     |  |                                    |                                     |                                   |                     |   |                   |  |  |
| 0.3           | Compact, dark brown gravelly sand                                    |            |         |      |            |                            |                 |   |    |    |     |  |                                    |                                     |                                   |                     |   |                   |  |  |
| 318.4         | FILL   |            |         |      |            |                            |                 |   |    |    |     |  |                                    |                                     |                                   |                     |   |                   |  |  |
| 0.7           | Loose/Firm, dark brown sand and silty clay FILL very moist           |            | 1       | SS   | 9          |                            | 318             |   |    |    |     |  |                                    |                                     |                                   |                     |   |                   |  |  |
| 317.8         | Compact to dense, grey SILTY CLAY moist                              |            | 2       | SS   | 40         |                            | 317             |   |    |    |     |  |                                    |                                     |                                   |                     |   |                   |  |  |
| 316.7         | Dense to very dense, brown MEDIUM SAND damp                          |            | 3       | SS   | 46         |                            | 316             |   |    |    |     |  |                                    |                                     |                                   |                     |   |                   |  |  |
|               |  |            | 4       | SS   | 61         |                            | 315             |   |    |    |     |  |                                    |                                     |                                   |                     |   |                   |  |  |
|               |  |            |         |      |            |                            | 314             |   |    |    |     |  |                                    |                                     |                                   |                     |   |                   |  |  |
| 314.3         | Very dense, grey SILTY FINE SAND to FINE SAND and SILT wet saturated |            | 5       | SS   | 70         |                            | 313             |   |    |    |     |  |                                    |                                     |                                   |                     |   |                   |  |  |
| 4.7           |  |            | 6       | SS   | 57         |                            | 312             |   |    |    |     |  |                                    |                                     |                                   |                     |   |                   |  |  |
|               |  |            | 7       | SS   | 70         |                            | 311             |   |    |    |     |  |                                    |                                     |                                   |                     |   |                   |  |  |
| 310.9         | END OF BOREHOLE @ 8.1m   |            |         |      |            |                            |                 |   |    |    |     |  |                                    |                                     |                                   |                     |   |                   |  |  |
| 8.1           | NOTE: Water level @ 314.0 m after 24 hours in open borehole          |            |         |      |            |                            |                 |   |    |    |     |  |                                    |                                     |                                   |                     |   |                   |  |  |

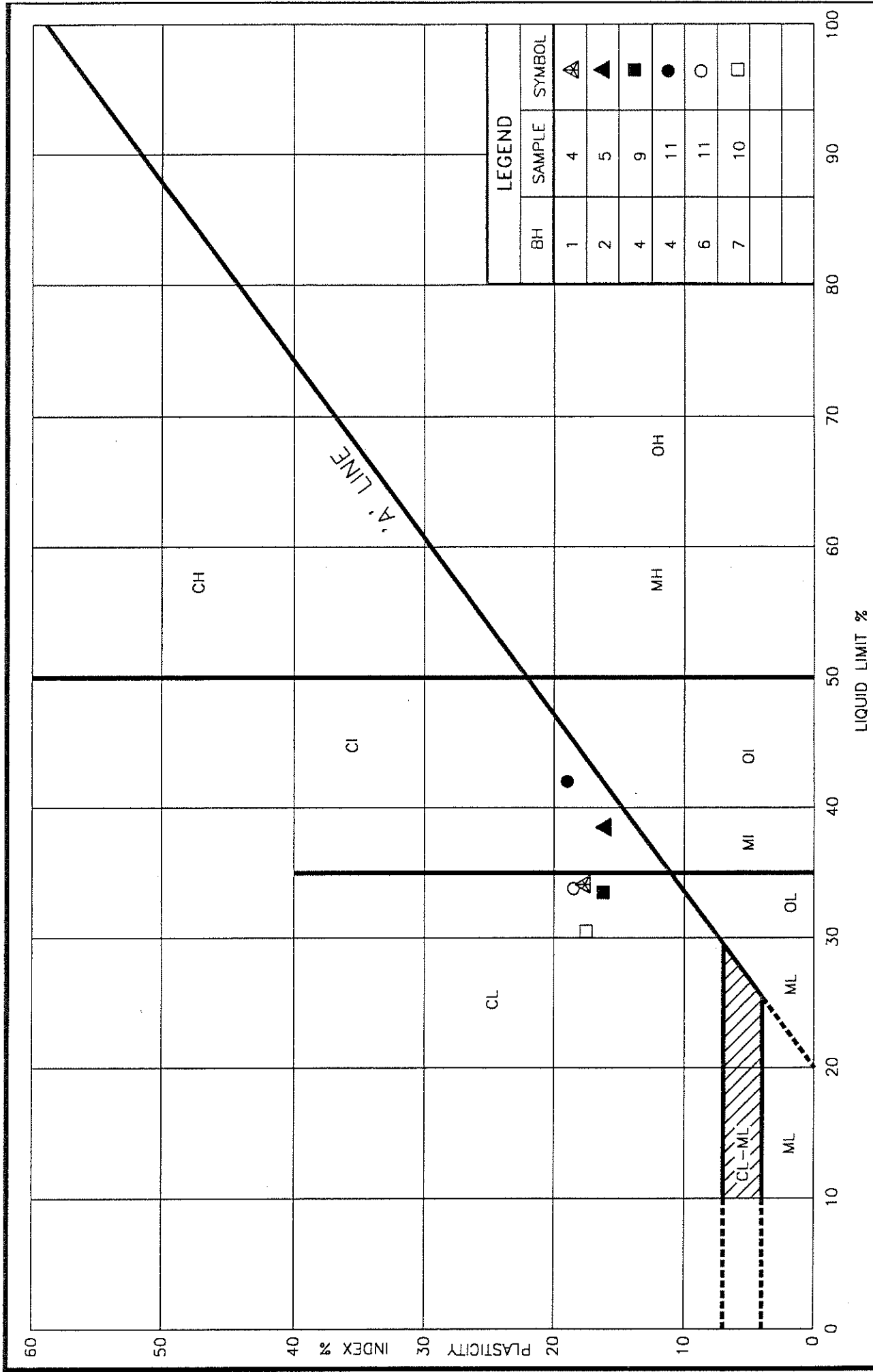
EXPRESS, 3-394 GPJ EXPRESS.GDT 19/07/99



## APPENDIX “B”

### Laboratory Test Results

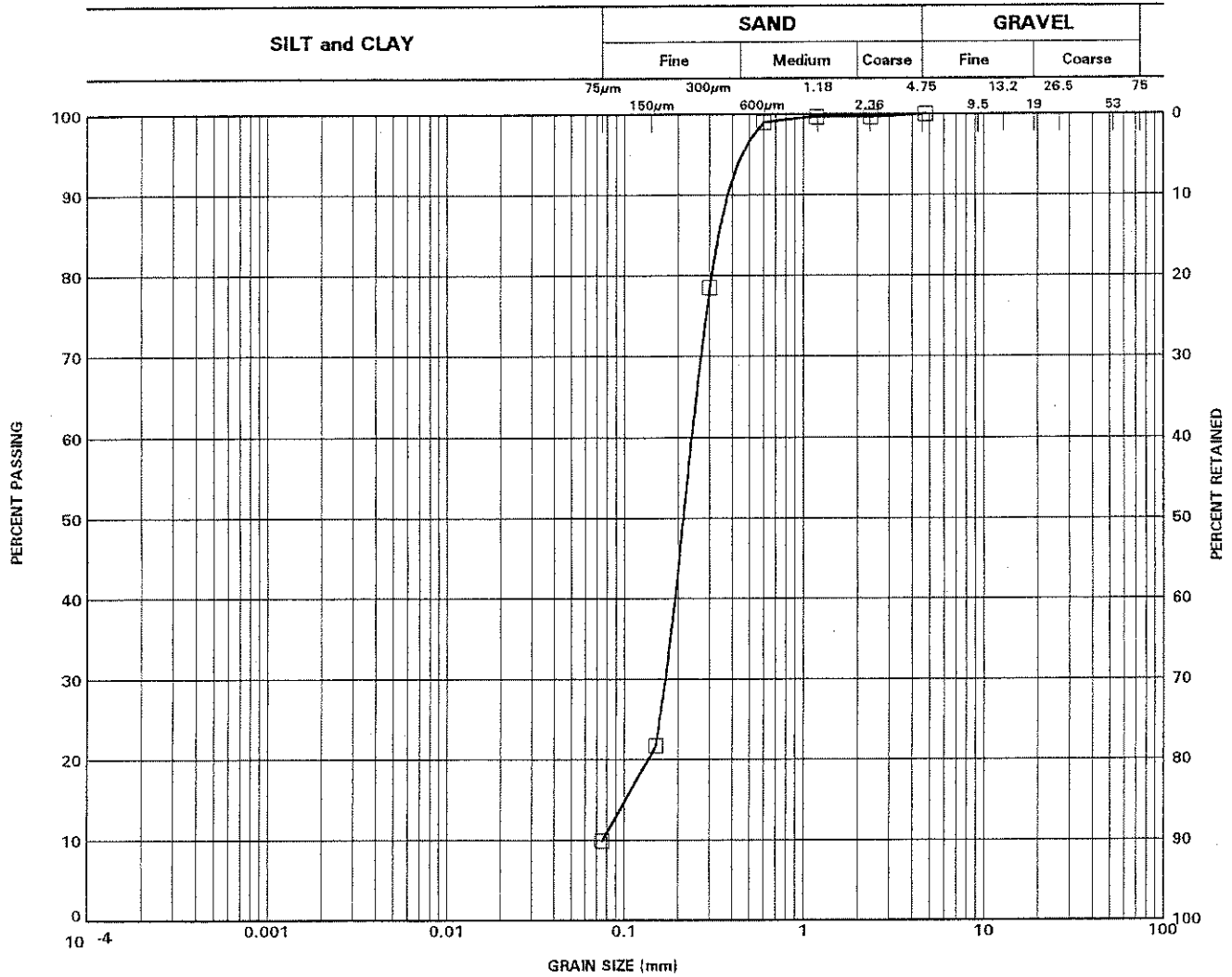






# GRAIN SIZE DISTRIBUTION

UNIFIED SOIL CLASSIFICATION SYSTEM



| LEGEND |          |           |
|--------|----------|-----------|
| SYMBOL | BOREHOLE | DEPTH (m) |
| □      | 98-03    | 1.5       |

**SAND FILL**

**WP** 363-94-00

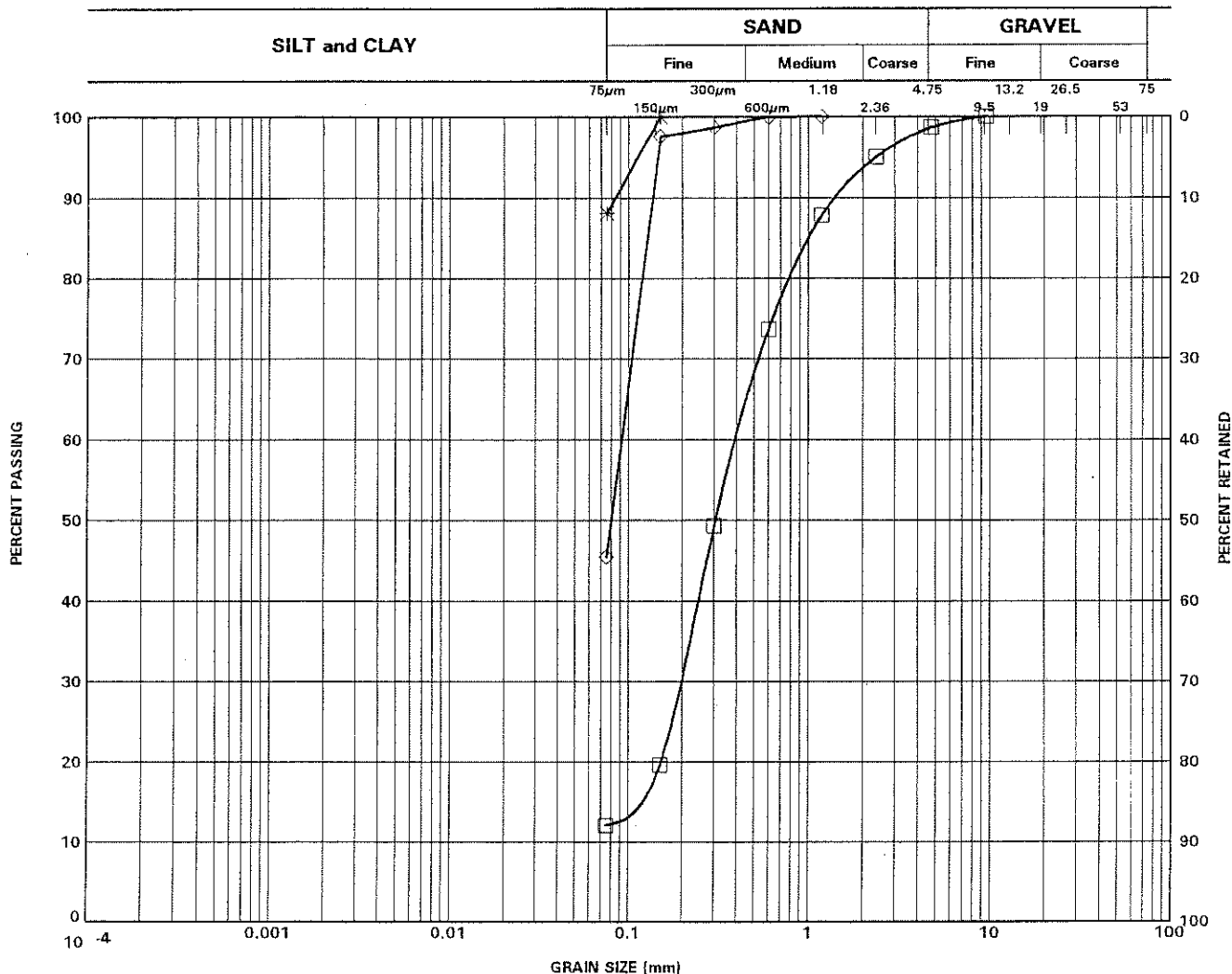
**SITE** 33-394

**Figure No.** 2



# GRAIN SIZE DISTRIBUTION

UNIFIED SOIL CLASSIFICATION SYSTEM



## LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) |
|--------|----------|-----------|
| □      | 98-03    | 3.1       |
| *      | 98-05    | 7.5       |
| ◇      | 98-08    | 6.0       |

**SAND, SILTY SAND, SILT**

WP 363-94-00

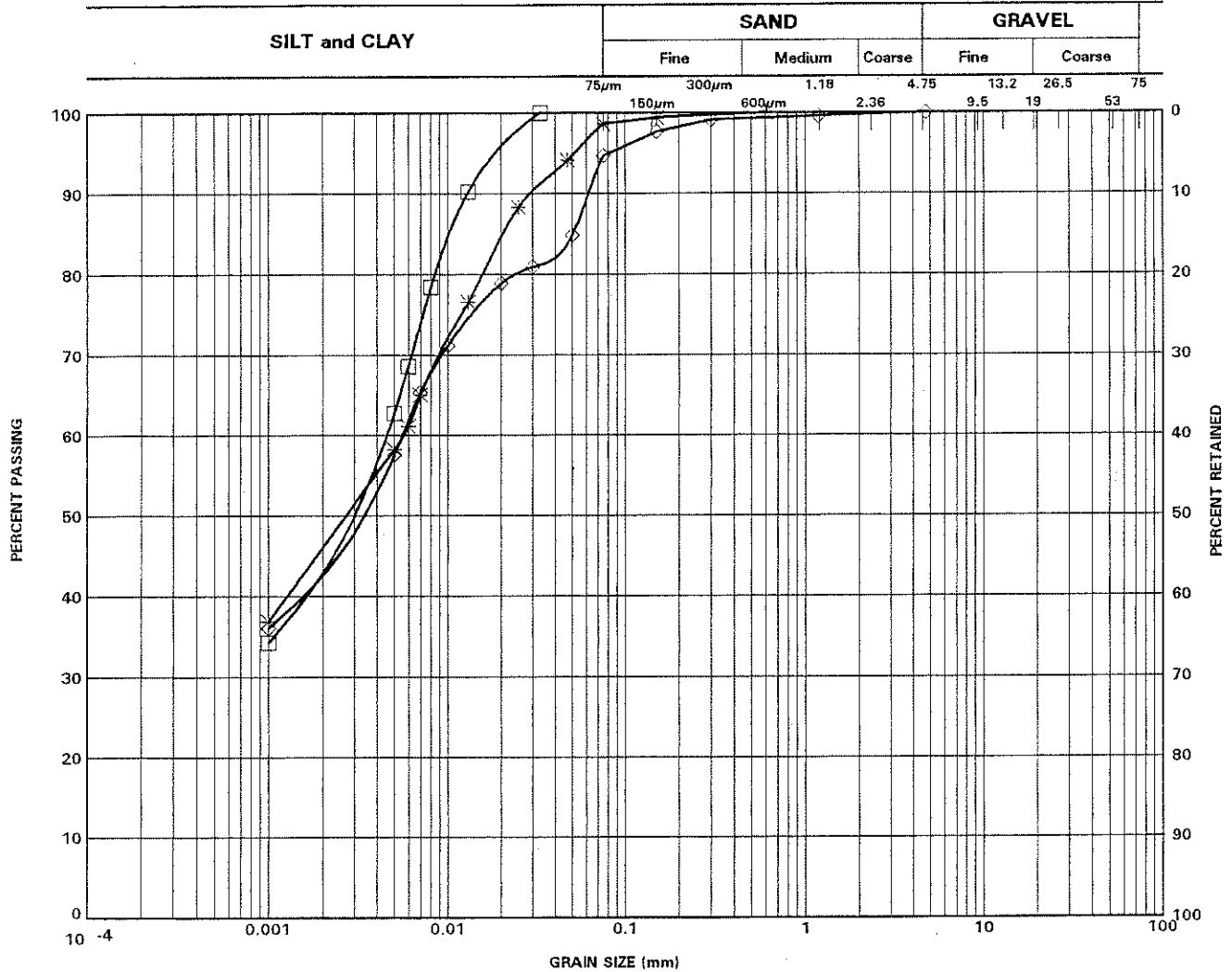
SITE 33-394

Figure No. 3



# GRAIN SIZE DISTRIBUTION

UNIFIED SOIL CLASSIFICATION SYSTEM



## LEGEND

| SYMBOL | BOREHOLE | DEPTH (m) |
|--------|----------|-----------|
| □      | 98-01    | 4.6       |
| *      | 98-02    | 3.1       |
| ◇      | 98-04    | 12.5      |

**SILTY CLAY**

**WP** 363-94-00

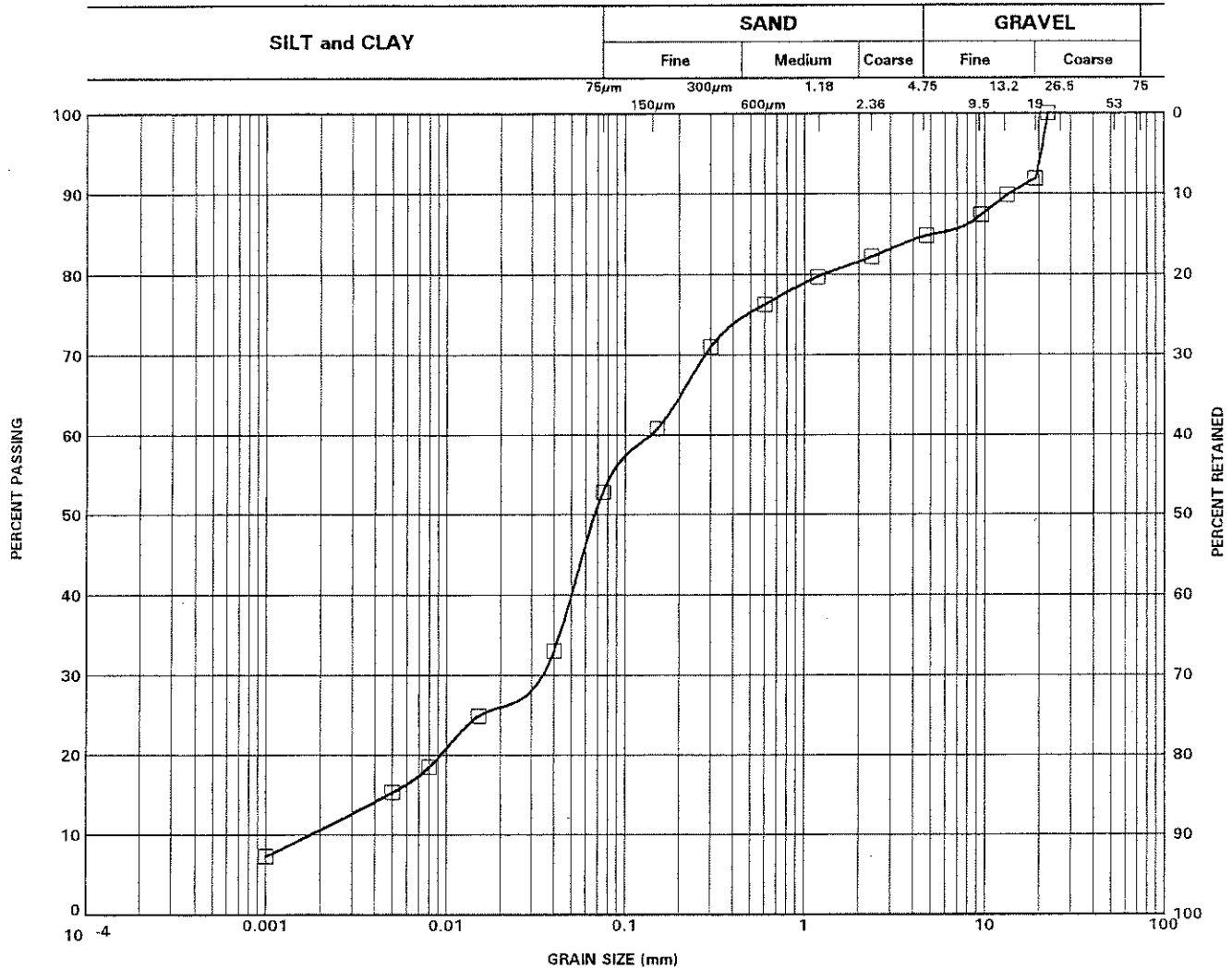
**SITE** 33-394

**Figure No.** 4



# GRAIN SIZE DISTRIBUTION

UNIFIED SOIL CLASSIFICATION SYSTEM



WP 363-94-00

SITE 33-394

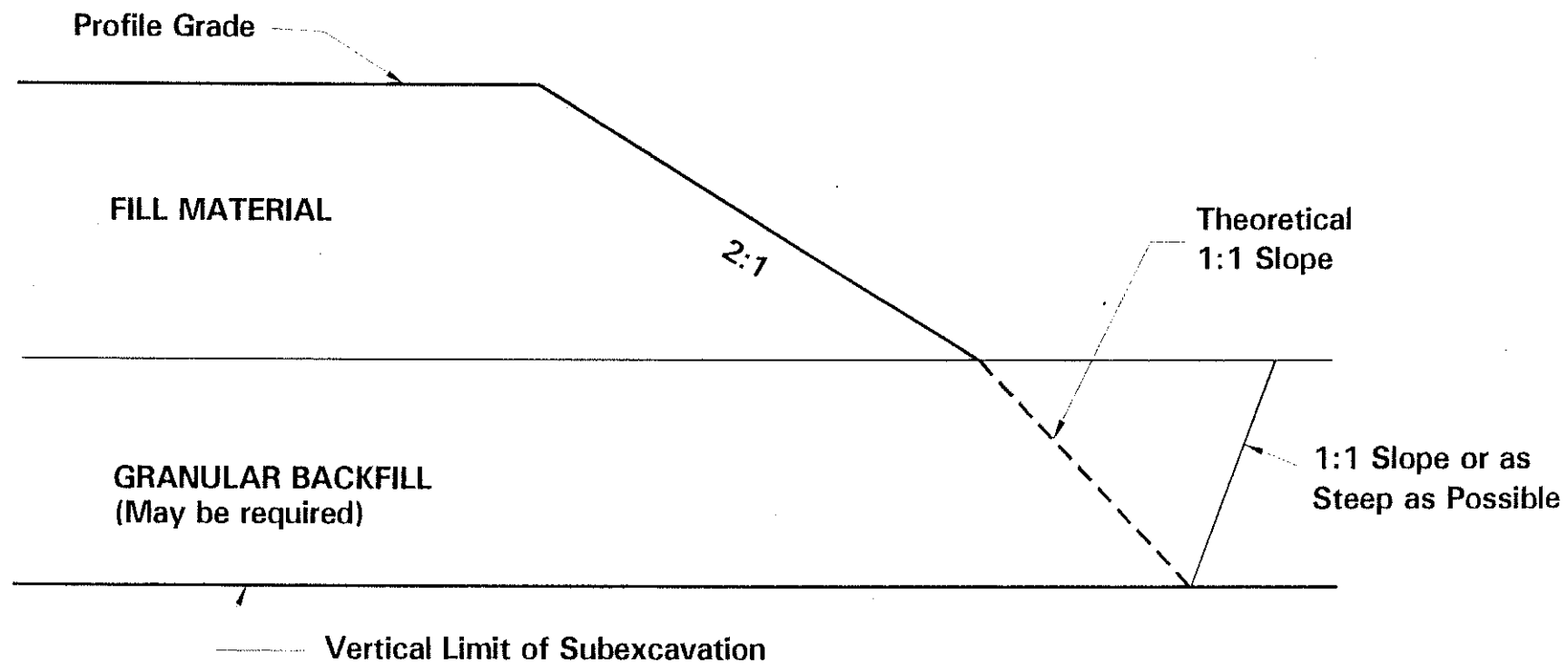
Figure No. 5



## APPENDIX “C”

# REMOVAL OF UNSUITABLE SOILS FROM BENEATH APPROACH FILLS





REMOVAL OF UNSTABLE SOILS FROM BENEATH APPROACH FILLS

NTS



# APPENDIX “D”

## STATEMENT OF LIMITATIONS



## LIMITATIONS OF REPORT

The conclusions and recommendations given in this report are based on information determined at the testhole locations. Subsurface and groundwater conditions between and beyond the testholes may differ from those encountered at the testhole locations, and conditions may become apparent during construction which could not be detected or anticipated at the time of the site investigation. It is recommended practice that the Soils Engineer be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the testholes.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of testholes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusion as to how the subsurface conditions may affect their work.

The benchmark and elevations mentioned in this report were obtained strictly for use in the geotechnical design of the project and by this office only, and should not be used by any other parties for any other purposes.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. AGRA Earth & Environmental Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

This report does not reflect the environmental issues or concerns unless otherwise stated in the report. The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final design stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.



**FINAL  
FOUNDATION INVESTIGATION ADDENDUM REPORT  
PROPOSED E-S RAMP STRUCTURE  
STRUCTURE NO. 33-393  
W.P. 363-94-00, AGREEMENT NO. 9730-7411-3178  
HWY8/CONESTOGA PARKWAY INTERCHANGE AND  
HWY 8 FROM CONESTOGA PARKWAY TO FERGUS AVENUE**

**Submitted To:**

**Morrison Hershfield Limited  
4 Lansing Square  
North York, Ontario M2J 1T1  
Canada**

**Submitted By:**

**AGRA  
104 Crockford Blvd.  
Scarborough, Ontario, M1R 3C6  
Canada**

**April 2000  
TT20807**

**Geocres No. 40P8-119**



April 25, 2000  
**Ref. No.: TT20807**

Morrison Hershfield Limited  
4 Lansing Square  
North York, Ontario M2J 1T1  
Canada

**Attention: Mr. Doug Hoffman, P. Eng.  
Principal**

Dear Sir:

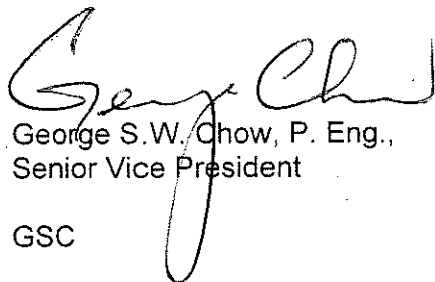
**Re: FINAL  
FOUNDATION INVESTIGATION ADDENDUM REPORT  
PROPOSED E-S RAMP STRUCTURE  
STRUCTURE NO. 33-393  
W.P. 363-94-00, AGREEMENT NO. 9730-7411-3178  
HWY8/CONESTOGA PARKWAY INTERCHANGE AND  
HWY 8 FROM CONESTOGA PARKWAY TO FERGUS AVENUE**

We take pleasure in enclosing ten (10) copies of our Final Foundation Investigation Addendum Report carried out for the above mentioned project and we will be glad to discuss any questions arising from this work.

Soil samples will be retained for a period of one year, and will thereafter be disposed of unless we are otherwise instructed.

We thank you for giving us this opportunity to be of service to you.

Sincerely,

  
George S.W. Chow, P. Eng.,  
Senior Vice President  
GSC



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| 4.2 Silts and Sands .....                   | 3    |
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## ENCLOSURES

BOREHOLE LOCATIONS AND SOIL STRATA  
BOREHOLE LOG SHEETS

DWG. NO. E



## 1.0 INTRODUCTION

AGRA, Consulting Geotechnical Engineers, has been retained by Morrison Hershfield Limited to conduct an additional foundation investigation at the site of the proposed E-S Ramp structure (Structure 33-393). The structure will carry 2 lanes of traffic from the westbound traffic lanes on Conestoga Parkway (KW Expressway) onto the southbound lanes of Highway 8.

The purpose of this addendum report is to provide supplementary information about the subsurface conditions at the site of the proposed E-S Ramp Structure by means of exploratory boreholes. The information in this addendum should be read in conjunction with AGRA's Foundation Investigation Report, dated August 27, 1999 (Ref. No. TK98-10-3), for the proposed E-S Ramp Structure 33-393.

The work presented herein was undertaken under MTO W.P. 363-94-00, Agreement No. 9730-7411-3178, and authorized by Morrison Hershfield Limited, in a letter dated February 11, 2000.

## 2.0 SITE DESCRIPTION AND PHYSIOGRAPHY

The site is located in the City of Kitchener at the intersection of Highway 8 and KW Expressway. The E-S Ramp Structure will be located immediately east of Montgomery Creek within the existing KW Expressway embankment. The invert of Montgomery Creek is near Elevation 314 m, and the KW Expressway grade is between Elevations 320 and 325 m.

The site is located within the Physiographic Region known as the Waterloo Sandhills. The area is characterized by a flat topography, heavy textured soil and poor drainage (Chapman and Putnam, 1984). The area also has a preponderance of fine sand, particularly on the surface. The hilly region is an extensive area of alluvial terraces of the Grand River spillway system, which, although more nearly horizontal, contains similar but more uniform sandy and gravelly materials. Several till sheets underlie the area and are, in order from oldest to youngest, the Catfish Creek Till, Maryhill Till, and Port Stanley Till.

## 3.0 INVESTIGATION PROCEDURES

The field work for this additional investigation was carried out on February 16, 2000, and consisted of drilling and sampling seven boreholes (Borehole Nos. 00-1 to 00-7, inclusive) to depths of 4.3 to 5.8 m below the existing ground surface.

The locations of the boreholes along with a stratigraphic section parallel to the E-S Ramp Structure alignment are shown on Drawing No. E. Details of subsurface conditions encountered at each borehole location, including the results of in-situ testing, are presented on the Record of Borehole sheets.



The boreholes were advanced using hollow stem continuous flight augers with a track-mounted power auger drill rig (CME 45) owned and operated by London Soil Test, under the full-time supervision of experienced geotechnical personnel from AGRA.

Sampling in the boreholes were carried out at regular intervals of depth (every 0.76 m) by the Standard Penetration Test Method (SPT), as specified in ASTM Method D 1586. This consists of freely dropping a 63.5 kg hammer for a vertical distance of 0.76 m to drive a 51 mm diameter outside diameter split barrel (split-spoon) sampler into the ground. The number of blows of the hammer to drive the sampler into the relatively undisturbed ground for a vertical distance of 0.30 m is recorded as the Standard Penetration Resistance or the 'N'-value of the soil, and this gives an indication of the consistency or the relative density of the soil deposit.

The borehole locations, co-ordinates and elevations were established in the field by Morrison Hershfield Limited.

The soil samples were transported to our geotechnical laboratory in Waterloo for further examination and classification. A laboratory testing programme, consisting of natural moisture content determinations, was performed on selected representative soil samples. The results of the laboratory tests are presented on the appropriate Record of Borehole Sheets.

Seepage and water levels were noted in each borehole during and at the completion of drilling and sampling. All boreholes were adequately backfilled with auger cuttings on completion.

#### **4.0 SUBSURFACE CONDITIONS**

The subsurface conditions were explored at seven boreholes (Borehole Nos. 00-1 to 00-7) west of the existing KW Expressway, during the current investigation. The locations of the boreholes along with the stratigraphic section along the E-S Ramp Structure alignment are shown on Drawing No. E. Details of subsurface conditions encountered at each borehole location, including the results of in-situ testing, groundwater observations and laboratory test results are presented on the Record of Borehole sheets. The subsurface conditions are summarized in the following.

In general, the subsurface stratigraphy comprises embankment fill overlying silts, sands, gravelly sands, silty clay and silt till. The embankment fill is composed of a mixture of sand, topsoil, silt and peat. The groundwater level is 3 to 5.1 m below existing ground surface at the northern end of the proposed structure and below the borehole depths explored towards the south end.

#### **4.1 Topsoil and Fill**

All boreholes were drilled within the existing embankment of the KW Expressway and as such contacted a veneer of topsoil. The surficial topsoil at the borehole locations ranges in thickness from 150 to 350 mm. A second topsoil layer was contacted in Boreholes 00-5 and 00-6 immediately below the fill, with thicknesses of about 0.2 and 0.4m.



The surficial topsoil is underlain by embankment fill, which consists predominantly of topsoil, peat, sand and silt with traces of gravel. Occasional cobbles and pieces of wood were found within the fill. The fill and underlying topsoil ranges in thickness from 2.4 to 4.0 m at the borehole locations and extends to elevations ranging from 318.1 to 317.0m.

Measured 'N'-values within the fill and topsoil range from 12 to 40 blows/0.3m, with occasional higher values due to cobbles or wood pieces. The fill can therefore be considered to be in a compact to dense condition.

The fill materials were generally in a damp condition, with natural moisture contents measured between 9 and 65 %.

#### **4.2 Silts and Sands**

The native deposits immediately underlying the embankment fill consist of fine sand, silt, and gravelly sand. Minor inclusions of gravel were found within the fine sand and silt. The native cohesionless deposits extend to Elevations 316.0 to 314.4m, and depths of 5m or deeper. These soil strata were not fully penetrated in Boreholes 00-1, 00-5, 00-6 and 00-7.

Measured 'N'-values range from 13 to 80 blows/0.3 m, indicating a relative density of compact to very dense, but generally compact to dense. The majority of the 'N'-values range from 20 to 45.

Measured natural moisture contents range from 4 to 17%.

#### **4.3 Silty Clay**

Underlying the cohesionless silts, sands and gravelly sands in Boreholes 00-3 and 00-4, is a silty clay deposit. The cohesive deposit was encountered at depths of 4.9 and 5.6 m, or Elevations 316.0 and 315.6 m, in Boreholes 00-3 and 00-4 respectively. These two boreholes were terminated within this deposit at depths of 5.8 m, or Elevations 315.0 and 315.4m, respectively. It was not encountered in any other boreholes.

A measured 'N'-value of 30 blows/0.3m was obtained in this deposit, indicating a hard consistency, with a measured natural moisture content of 11%.

#### **4.4 Silt Till**

A heterogeneous mixture of sandy silt, gravel and clay (glacial till) was contacted in Borehole 00-2 below the cohesionless soils at a depth of 4.6 m or Elevation 315.7m. The borehole was terminated within this deposit.

A measured 'N'-value of 45 blows/0.3 m was obtained within the till, indicating a dense relative density, with a measured natural moisture content of 8%.



#### 4.5 Groundwater Conditions

On completion of drilling, the following observations of groundwater levels were made:

| Borehole No. | Depth of Borehole (m) | Station No. | Observations  |
|--------------|-----------------------|-------------|---|
| 00-1         | 5.1                   | 10+140 3Lt  | Free water at 3.0m, Elevation 316.5m upon completion  |
| 00-2         | 5.1                   | 10+173 6 Lt | Free water at 3.0 m, Elevation 317.3m upon completion |
| 00-3         | 5.8                   | 10+195 5 Lt | No free water on completion                           |
| 00-4         | 5.8                   | 10+222 6 Lt | Free water at 5.1m, Elevation 316.1m upon completion  |
| 00-5         | 4.3                   | 10+256 6 Lt | No free water on completion                           |
| 00-6         | 5.1                   | 10+291 6 Lt | No free water on completion                           |
| 00-7         | 4.3                   | 10+316 6 Lt | No free water on completion                           |

Groundwater conditions were observed in the open boreholes during the drilling and after sampling. Groundwater levels ranged from 3 to 5.1 m, or about Elevations 317.3 to 316.1m toward the north end of the proposed structure, and below the depths explored to the south end. It should, however, be pointed out that the groundwater at the site would fluctuate seasonally and in response to severe weather events.



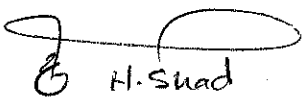
## 5.0 CLOSURE

The fieldwork was carried out in accordance with current geotechnical engineering practice. The subsurface and groundwater conditions described are valid only at the borehole locations and the time at which the investigation was carried out. The findings in this report must only be used for this specific project.

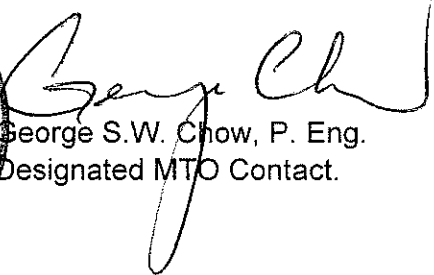
Sincerely,

  
Andrew Drevininkas, P. Eng.



  
for Barry Walker, Ph.D., P. Eng.



  
George S.W. Chow, P. Eng.  
Designated MTO Contact.



## ENCLOSURES



METRIC  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

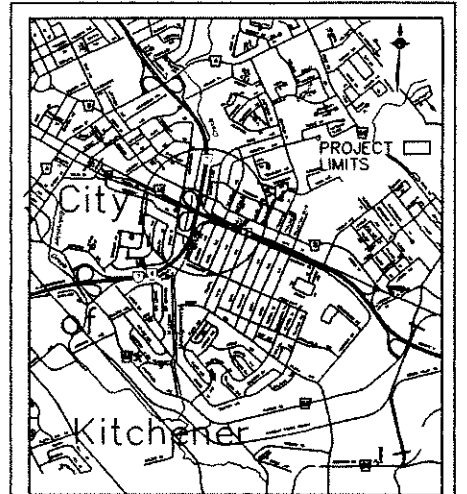
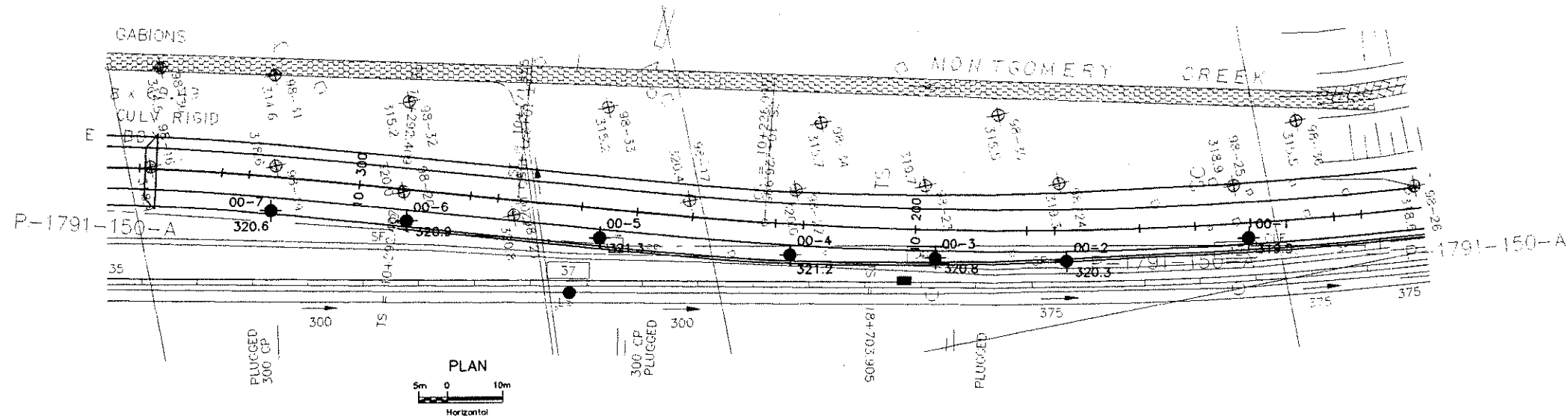
CONT No 2001-3011  
WP No 363-94-00



PROPOSED E-S RAMP STRUCTURE  
HWY8/CONESTOGA PARKWAY  
BOREHOLE LOCATIONS & SOIL STRATA

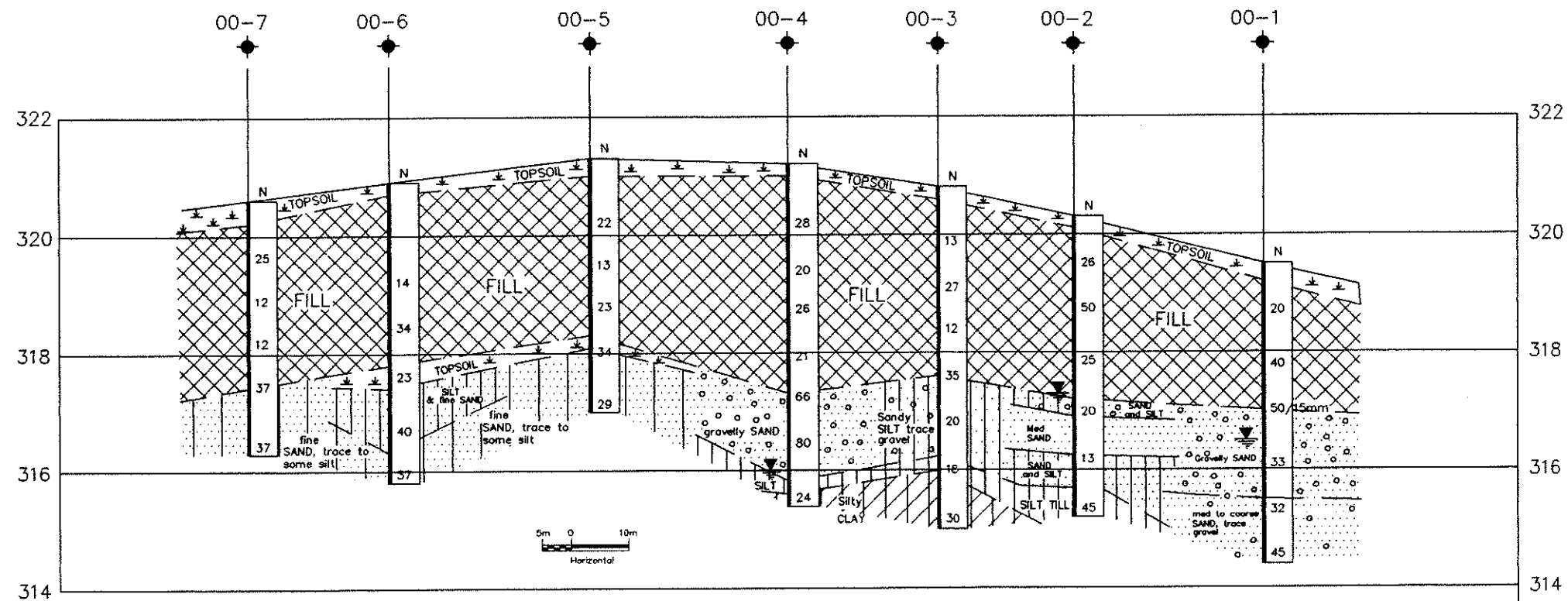
SHEET

AGRA Earth & Environmental  
ENGINEERING GLOBAL SOLUTIONS



KEYPLAN

NTS



LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W L at time of investigation
- Standpipe

| No.  | ELEVATION | CO-ORDINATES |         |
|------|-----------|--------------|---------|
|      |           | NORTH        | EAST    |
| 00-1 | 319.5     | 4 811 595    | 227 391 |
| 00-2 | 320.3     | 4 811 562    | 227 389 |
| 00-3 | 320.8     | 4 811 539    | 227 384 |
| 00-4 | 321.2     | 4 811 514    | 227 378 |
| 00-5 | 321.3     | 4 811 481    | 227 368 |
| 00-6 | 320.9     | 4 811 448    | 227 359 |
| 00-7 | 320.6     | 4 811 424    | 227 352 |

NOTE: The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section GC2.01 of OPS Gen. Cond.

|           |      |    |             |
|-----------|------|----|-------------|
| REVISIONS |      |    |             |
|           |      |    |             |
|           |      |    |             |
|           |      |    |             |
|           |      |    |             |
|           | DATE | BY | DESCRIPTION |

|                  |             |                |             |
|------------------|-------------|----------------|-------------|
| GEOCREs 40P8-119 |             |                |             |
| HWY No.          |             | 7 & 8          | DIST 31     |
| SUBM'D 00        | CHECKED AD  | DATE Mar. 2000 | SITE 33-393 |
| DRAWN LWM        | CHECKED BPW | APPROVED       | DWG E       |



RECORD OF BOREHOLE No 00-1

1 OF 1

METRIC

W.P. 363-94-00 SITE: 33-393 LOCATION E-S Ramp ORIGINATED BY SW  
DIST 31 HWY 7 & 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY SW  
DATUM Geodetic DATE 16.02.00 - 16.02.00 CHECKED BY AD

| SOIL PROFILE  |   | SAMPLES    |        |      | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT |   |                | UNIT WEIGHT<br>$\gamma$<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|--------|------|----------------------------|-----------------|---|----|----|----|-----|---|---|----------------|--|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER | TYPE | "N" VALUES                 |                 | 20  | 40 | 60 | 80 | 100 | W <sub>p</sub>                                      | W | W <sub>L</sub> |  |   |
| 319.5         | 275 mm TOPSOIL  |            |        |      |                            |                 |   |    |    |    |     |   |   |                |  |   |
| 319.2         |   |            |        |      |                            |                 |   |    |    |    |     |   |   |                |  |   |
| 0.3           | Silt, trace fine sand, compact, dark greyish brown, damp (FILL)               |            |        |      |                            |                 |   |    |    |    |     |   |   |                |  |   |
|               |   |            | 1      | SS   | 20                         |                 |   |    |    |    |     |   |   |                |  |   |
|               |   |            |        |      |                            |                 |   |    |    |    |     |   |   |                |  |   |
|               | some greyish black silt inclusions  |            |        |      |                            |                 |   |    |    |    |     |   |   |                |  |   |
| 317.8         | Fine sand, dense, dark brown, damp, (FILL)                                    |            |        |      |                            |                 |   |    |    |    |     |   |   |                |  |   |
| 1.7           |   |            | 2      | SS   | 40                         |                 |   |    |    |    |     |   |   |                |  |   |
|               |   |            |        |      |                            |                 |   |    |    |    |     |   |   |                |  |   |
|               | some thin black stained silt lenses   |            |        |      |                            |                 |   |    |    |    |     |   |   |                |  |   |
| 317.0         |   |            | 3      | SS   | 50/15                      |                 |   |    |    |    |     |   |   |                |  |   |
| 2.5           | Dense, greyish brown GRAVELLY fine SAND                                       |            |        |      |                            |                 |   |    |    |    |     |   |   |                |  |   |
| 316.5         | moist   |            |        |      |                            |                 |   |    |    |    |     |   |   |                |  |   |
| 3.0           | wet   |            |        |      |                            |                 |   |    |    |    |     |   |   |                |  |   |
|               |   |            | 4      | SS   | 33                         |                 |   |    |    |    |     |   |   |                |  |   |
|               |   |            |        |      |                            |                 |   |    |    |    |     |   |   |                |  |   |
| 315.5         |   |            |        |      |                            |                 |   |    |    |    |     |   |   |                |  |   |
| 4.0           | Dense, greyish brown medium to coarse SAND, trace gravel, wet                 |            |        |      |                            |                 |   |    |    |    |     |   |   |                |  |   |
|               |   |            | 5      | SS   | 32                         |                 |   |    |    |    |     |   |   |                |  |   |
|               |   |            |        |      |                            |                 |   |    |    |    |     |   |   |                |  |   |
|               |   |            |        |      |                            |                 |   |    |    |    |     |   |   |                |  |   |
|               |   |            | 6      | SS   | 45                         |                 |   |    |    |    |     |   |   |                |  |   |
|               |   |            |        |      |                            |                 |   |    |    |    |     |   |   |                |  |   |
| 314.4         | END OF BOREHOLE @ 5.1 m<br>NOTE: Water level recorded @ 3.0 m Upon Completion |            |        |      |                            |                 |   |    |    |    |     |   |   |                |  |   |
| 5.1           |   |            |        |      |                            |                 |   |    |    |    |     |   |   |                |  |   |

EXPRESS: 33-393.GPJ EXPRESS.GDT 07/04/00

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE



RECORD OF BOREHOLE No 00-2

1 OF 1

METRIC

W.P. 363-94-00 SITE: 33-393 LOCATION E-S Ramp ORIGINATED BY SW  
DIST 31 HWY 7 & 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY SW  
DATUM Geodetic DATE 16.02.00 - 16.02.00 CHECKED BY AD

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |                   |  |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|-------------------|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |    |    |                                    |                                     |                                   |                     |   | WATER CONTENT (%) |  |
| 320.3         |  |            |         |      |            |                            |                 | 20  | 40 | 60 | 80                                 | 100                                 |                                   |                     |   |                   |  |
| 0.0           | 150 mm TOPSOIL   |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
| 320.1         |  |            |         |      |            |                            | 320             |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
| 0.2           | Fine sand, trace gravel, compact, dark brown, damp (FILL)                                  |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
| 319.5         |  |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
| 0.8           | Fine sand and silt, compact, light brown, damp (FILL)                                      |            | 1       | SS   | 28         |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
| 319.2         |  |            |         |      |            |                            | 319             |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
| 1.1           | Topsoil, loose, black, damp (FILL) large wood inclusion between 1.52-2.0 m (possible tree) |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
|               |  |            | 2       | SS   | 50         |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
| 318.3         |  |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
| 2.0           | Silt, trace gravel, compact, dark brown, damp (FILL)                                       |            |         |      |            |                            | 318             |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
|               |  |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
| 317.8         |  |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
| 2.4           | Fine sand, trace gravel, compact, grey, some dark grey silt inclusions, damp (FILL)        |            | 3       | SS   | 25         |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
|               |  |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
| 317.2         |  |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
| 3.1           | Compact, greyish brown SILT and fine SAND, trace gravel, wet                               |            | 4       | SS   | 20         |                            | 317             |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
| 316.9         |  |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
| 3.4           | Compact, grey medium SAND, wet   |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
|               |  |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
| 316.3         |  |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
| 4.0           | Compact, grey fine SAND and SILT, wet  |            | 5       | SS   | 13         |                            | 316             |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
|               |  |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
| 315.7         |  |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
| 4.6           | Dense, greyish brown SILT, some fine sand, trace gravel, damp (TILL)                       |            | 6       | SS   | 45         |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
|               |  |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
| 315.2         |  |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |
| 5.1           | END OF BOREHOLE @ 5.1 m<br>NOTE: Water level recorded @ 3.0 m Upon Completion              |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |                     |   |                   |  |

EXPRESS: 33-393 GPJ EXPRESS.GDT 06/04/00












# RECORD OF BOREHOLE No 00-3

1 OF 1

METRIC

W.P. 363-94-00 SITE 33-393 LOCATION E-S Ramp ORIGINATED BY SW  
DIST 31 HWY 7 & 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY SW  
DATUM Geodetic DATE 16.02.00 - 16.02.00 CHECKED BY AD

| SOIL PROFILE  |   |   | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>w <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>w | LIQUID<br>LIMIT<br>w <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|---|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|--|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT  | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |    |    |    |     | WATER CONTENT (%)                  |                                     |                                   |  |   |
| 320.8         |   |   |         |      |            |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |  |   |
| 0.0           | 200 mm TOPSOIL  |  |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |
| 320.6         |   |   |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |
| 0.2           | Fine sand, trace gravel, compact, dark brown, damp (FILL)                     |  |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |
| 319.9         |   |   |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |
| 0.9           | Silt, peaty, loose, dark brown, damp (FILL)                                   |  | 1       | SS   | 13         |                            | 320             |   |    |    |    |     |                                    |                                     |                                   |  |   |
| 319.6         |   |   |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |
| 1.3           | Sand, compact, dark grey, damp (FILL)   |  |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |
| 319.1         |   |   |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |
| 1.7           | Silt and sand, trace to some gravel, compact, dark grey to black, damp (FILL) |  | 2       | SS   | 27         |                            | 319             |   |    |    |    |     |                                    |                                     |                                   |  |   |
|               |   |   |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |
|               |   |   | 3       | SS   | 12         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |
|               |   |   |         |      |            |                            | 318             |   |    |    |    |     |                                    |                                     |                                   |  |   |
|               |   |   |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |
| 317.6         |   |   |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |
| 3.2           | Dense, grey fine SAND, damp   |  | 4       | SS   | 35         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |
|               |   |   |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |
| 317.0         |   |   |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |
| 3.8           | Compact, greyish brown SANDY SILT, trace gravel, moist                        |  | 5       | SS   | 20         |                            | 317             |   |    |    |    |     |                                    |                                     |                                   |  |   |
|               |   |   |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |
| 316.2         |   |   |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |
| 4.6           | Compact, grey SILT, trace fine sand, moist                                    |  |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |
| 316.0         |   |   | 6       | SS   | 18         |                            | 316             |   |    |    |    |     |                                    |                                     |                                   |  |   |
|               |   |   |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |
| 4.9           | Hard, brown SILTY CLAY, damp  |  |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |
|               |   |   | 7       | SS   | 30         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |
|               |   |   |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |
| 315.0         |   |   |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |
| 5.8           | END OF BOREHOLE @ 5.8 m<br>NOTE: Borehole Dry<br>Upon Completion              |   |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |   |

EXPRESS, 33-393 GPJ EXPRESS GDT 06/04/00

+3, X3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE



# RECORD OF BOREHOLE No 00-4

1 OF 1

METRIC

W.P. 363-94-00 SITE: 33-393 LOCATION E-S Ramp ORIGINATED BY SW  
DIST 31 HWY 7 & 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY SW  
DATUM Geodetic DATE 16.02.00 - 16.02.00 CHECKED BY AD

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 321.2         | 250 mm TOPSOIL  |            |         |      |            |                            | 321             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 321.0         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.3           | Sandy silt, compact, dark brown, damp (FILL)                                    |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 320.2         |   |            | 1       | SS   | 28         |                            | 320             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 1.1           | Fine sand, trace gravel, compact, dark grey, damp (FILL)                        |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 2       | SS   | 20         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 319.2         |   |            |         |      |            |                            | 319             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 2.0           | Topsoil, compact, black, large wood inclusions, damp (FILL)                     |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 319.0         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 2.3           | Fine sand, compact, dark brown to grey, frequent black silt lenses, damp (FILL) |            | 3       | SS   | 26         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 318.0         |   |            |         |      |            |                            | 318             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 3.2           | Silty peat, loose, dark brown, damp (FILL)                                      |            | 4       | SS   | 21         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 317.8         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 3.4           | Gravelly sand, compact, dark brown, damp (FILL)                                 |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 317.3         |   |            |         |      |            |                            | 317             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 4.0           | Dense greyish brown GRAVELLY SAND   |            | 5       | SS   | 66         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 6       | SS   | 80         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 316.1         |   |            |         |      |            |                            | 316             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 5.1           | damp  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               | wet   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 315.8         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 5.4           | Compact, greyish brown SILT, moist  |            | 7       | SS   | 24         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 315.6         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 5.6           | Hard, brown SILTY CLAY, damp  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 315.4         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 5.8           | END OF BOREHOLE @ 5.8 m<br>NOTE: Water level recorded @ 5.1 m Upon Completion   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

EXPRESS, 33-393.GPJ EXPRESS.GDT 06/04/00

+ 3, X 3: Numbers refer to Sensitivity O 3% STRAIN AT FAILURE



# RECORD OF BOREHOLE No 00-5

1 OF 1

METRIC

W.P. 363-94-00 SITE: 33-393 LOCATION E-S Ramp ORIGINATED BY SW  
DIST 31 HWY 7 & 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY SW  
DATUM Geodetic DATE 16.02.00 - 16.02.00 CHECKED BY AD

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |                               | PLASTIC LIMIT   NATURAL MOISTURE CONTENT   LIQUID LIMIT |  |    | UNIT<br>WEIGHT<br><br>γ<br><br>kN/m³ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR   SA   SI   CL |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|-------------------------------|---|--|----|--------------------------------------|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |                               | WATER CONTENT (%)                                       |  |    |                                      |  |
| 321.3<br>0.0  | 300 mm TOPSOIL  |            |         |      |            |                            |                 | 20   40   60   80   100                     | ○ UNCONFINED   ♦ FIELD VANE   | W <sub>p</sub> W   W <sub>L</sub>                       |  |    |                                      |  |
| 321.0<br>0.3  | Sand, some silt and gravel,<br>compact, dark brown, damp (FILL)       |            | 1       | SS   | 22         |                            | 321             | 20   40   60   80   100                     | ● QUICK TRIAXIAL   × LAB VANE | 10   20   30  |  |    |                                      |  |
| 319.8<br>1.5  | Silty topsoil, loose to compact, dark<br>brown to black, damp (FILL)  |            | 2       | SS   | 13         |                            | 320             |   |                               |   |  | 46 |                                      |  |
| 318.7<br>2.6  | Sandy silt, trace gravel, compact,<br>dark brown to grey, damp (FILL) |            | 3       | SS   | 23         |                            | 319             |   |                               |   |  |    |                                      |  |
| 318.3<br>3.0  | Loose, black peaty TOPSOIL  |            |         |      |            |                            |                 |   |                               |   |  |    |                                      |  |
| 318.1<br>3.2  | Dense to compact, greyish brown<br>fine SAND, some silt, damp         |            | 4       | SS   | 34         |                            | 318             |   |                               |   |  |    |                                      |  |
| 317.0<br>4.3  | END OF BOREHOLE @ 4.3 m<br>NOTE: Borehole Dry<br>Upon Completion      |            | 5       | SS   | 29         |                            |                 |   |                               |   |  |    |                                      |  |

EXPRESS 33-393.GPJ EXPRESS.GDT 06/04/00

+ 3, X 3: Numbers refer to Sensitivity O 3% STRAIN AT FAILURE



# RECORD OF BOREHOLE No 00-6

1 OF 1

METRIC

W.P. 363-94-00 SITE: 33-393 LOCATION E-S Ramp ORIGINATED BY SW  
DIST 31 HWY 7 & 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY SW  
DATUM Geodetic DATE 18.02.00 - 16.02.00 CHECKED BY AD

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 320.9         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | 200 mm TOPSOIL  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 320.7         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.2           | Silt and sand, occasional gravel,<br>compact, dark brown, damp (FILL)               |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 1       | AS   |            |                            | 320             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 319.3         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 1.6           | Silty peat topsoil, compact, dark<br>brown, damp (FILL)                             |            | 2       | SS   | 14         |                            | 319             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 318.4         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 2.4           | Silty fine sand, dense, dark grey,<br>damp (FILL)                                   |            | 3       | SS   | 34         |                            | 318             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 317.8         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 3.1           | Compact, black silt TOPSOIL,<br>damp  |            | 4       | SS   | 23         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 317.4         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 3.5           | Compact, light grey SILT and fine<br>SAND, trace to occasional fine<br>gravel, damp |            | 5       | SS   | 40         |                            | 317             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 316.3         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 4.6           | Dense, grey fine SAND, some silt,<br>damp   |            | 6       | SS   | 37         |                            | 316             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 315.8         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 5.1           | END OF BOREHOLE @ 5.1 m<br>NOTE: Borehole Dry<br>Upon Completion                    |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

EXPRESS: 33-393.GPJ EXPRESS.GDT 06/04/00

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE



# RECORD OF BOREHOLE No 00-7

1 OF 1

METRIC

W.P. 363-94-00 SITE: 33-393 LOCATION E-S Ramp ORIGINATED BY SW  
DIST 31 HWY 7 & 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY SW  
DATUM Geodetic DATE 16.02.00 - 16.02.00 CHECKED BY AD

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |                  |              |            | PLASTIC<br>LIMIT<br>w <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>w | LIQUID<br>LIMIT<br>w <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |                   |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|------------------|--------------|------------|------------------------------------|-------------------------------------|-----------------------------------|--|--|-------------------|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |                  |              |            |                                    |                                     |                                   |  |  | WATER CONTENT (%) |
|               |   |            |         |      |            |                            |                 | ○ UNCONFINED                                | ● QUICK TRIAXIAL | ✱ FIELD VANE | ✱ LAB VANE |                                    |                                     |                                   |  |  |                   |
| 320.6<br>0.0  | 350 mm TOPSOIL  |            |         |      |            |                            |                 |   |                  |              |            |                                    |                                     |                                   |  |  |                   |
| 320.2<br>0.4  | Sand, compact, dark brown, damp (FILL)<br>wood fragments below 0.75 m |            |         |      |            |                            | 320             |   |                  |              |            |                                    |                                     |                                   |  |  |                   |
| 319.5<br>1.1  | Silt and sand, compact, dark brown, damp (FILL)                       |            | 1       | SS   | 25         |                            |                 |   |                  |              |            |                                    |                                     |                                   |  |  |                   |
| 319.0<br>1.5  | Silty peat, loose to compact, dark brown to black, damp (FILL)        |            | 2       | SS   | 12         |                            | 319             |   |                  |              |            |                                    |                                     |                                   | 65                                       |  |                   |
| 318.1<br>2.4  | Silty sand some gravel, compact, dark brown, damp (FILL)              |            | 3       | SS   | 12         |                            | 318             |   |                  |              |            |                                    |                                     |                                   | 53                                       |  |                   |
| 317.4<br>3.2  | Dense, light grey fine SAND, trace to some silt, damp                 |            | 4       | SS   | 37         |                            | 317             |   |                  |              |            |                                    |                                     |                                   |  |  |                   |
| 316.3<br>4.3  | END OF BOREHOLE @ 4.3 m<br>NOTE: Borehole Dry Upon Completion         |            | 5       | SS   | 37         |                            |                 |   |                  |              |            |                                    |                                     |                                   |  |  |                   |

EXPRESS: 33-393 GPJ EXPRESS.GDT 06/04/00

+3, X3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE



**FINAL  
FOUNDATION INVESTIGATION [REDACTED] REPORT  
PROPOSED HIGH MAST LIGHTING & OVERHEAD SIGNS  
ALONG HIGHWAY 8  
W.P. 363-94-00, AGREEMENT NO. 9730-7411-3178  
HWY8/CONESTOGA PARKWAY INTERCHANGE AND  
HWY 8 FROM CONESTOGA PARKWAY TO FERGUS AVENUE  
DISTRICT 31 - LONDON/STRATFORD**

**Submitted To:**

**Morrison Hershfield Limited  
4 Lansing Square  
North York, Ontario  
M2J 1T1  
Canada**

**Submitted By:**

**AGRA  
104 Crockford Blvd.  
Scarborough, Ontario, M1R 3C6  
Canada**

**April 2000  
TK98-10-3**



April 11, 2000.

**Ref. No.: TK98-10-3**

Morrison Hershfield Limited  
4 Lansing Square  
North York, Ontario  
M2J 1T1  
Canada

**Attention: Mr. Doug Hoffman, P. Eng.  
Principal**

Dear Sir:

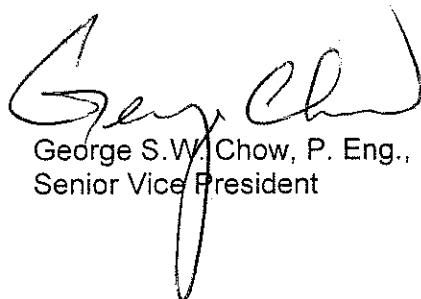
**Re: FINAL  
FOUNDATION INVESTIGATION AND DESIGN REPORT  
PROPOSED HIGH MAST LIGHTING & OVERHEAD SIGNS  
ALONG HIGHWAY 8  
W.P. 363-94-00, AGREEMENT NO. 9730-7411-3178  
HWY8/CONESTOGA PARKWAY INTERCHANGE AND  
HWY 8 FROM CONESTOGA PARKWAY TO FERGUS AVENUE  
DISTRICT 31 - LONDON/STRATFORD**

We take pleasure in enclosing ten (10) copies of our Final Foundation Investigation ~~and Design~~ Report carried out for the above mentioned project and we will be glad to discuss any questions arising from this work.

Soil samples will be retained for a period of one year, and will thereafter be disposed of unless we are otherwise instructed.

We thank you for giving us this opportunity to be of service to you.

Sincerely,

  
George S.W. Chow, P. Eng.,  
Senior Vice President



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## **1.0 INTRODUCTION**

This report presents the results of a foundation investigation carried out by AGRA Earth & Environmental Limited (AGRA) on behalf of Morrison Hershfield Limited at the site of the proposed widening of Highway 8 from Fergus Avenue north to the intersection of KW Expressway. In conjunction with the widening, nine (9) high mast lighting poles (HML) and four (4) overhead sign (OS) structures are also to be constructed. The locations and details of these structures are summarized on Table 1 attached (Appendix D).

The purpose of the investigation was to obtain information about the subsurface conditions at the site from existing borehole information and, based on this information, to provide geotechnical recommendations for the design and construction of these foundations. No additional fieldwork was carried out for this investigation, but two AGRA reports from 1999 and one report by E.M. Peto Associates Limited from 1964, are referenced in Section 3.0.

The work presented herein was undertaken under MTO W.P. 363-94-00, Agreement No. 9730-7411-3178, and authorized by Morrison Hershfield Limited, in a letter dated November 2, 1998.

## **2. SITE DESCRIPTION**

### **2.1 Site Location**

The site is located in the City of Kitchener along Highway 8 from Fergus Avenue north to the intersection of KW Expressway. The retaining walls and the Franklin Street Bridge (underpass) structure were constructed in 1966 - 1967. This section of Highway 8 is depressed due to the level crossing of Franklin Street between Kingsway and King Street. The existing grade along Highway 8 slopes downwards in a northerly direction from Elevation 329.5 to 323.0 m. At Franklin Street Bridge, the pavement grade on Highway 8 is near Elevation 321.0 m, approximately 6 m below the grades of King Street and Kingsway. The existing retaining walls, which are 1 to 6 m high, were constructed to provide the grade separation.

### **2.2 Physiography and Topography**

The site is located within the Physiographic Region known as the Waterloo Sandhills. The area is characterized by a flat topography, heavy textured soil and poor drainage (Chapman and Putnam, 1984). The area also has a preponderance of fine sand, particularly on the surface. The hilly region is an extensive area of alluvial terraces of the Grand River spillway system which, although more nearly horizontal, contains similar but more uniform sandy and gravelly materials. Several till sheets underlie the area and are, in order from oldest to youngest, the Catfish Creek Till, Maryhill Till, and Port Stanley Till.

## **3. EXISTING BOREHOLE INFORMATION**

In conjunction with foundation investigations for the proposed widening of Highway 8 from Fergus Avenue north to the intersection of the KW Expressway, under W.P. 363-94-00, boreholes were advanced throughout the proposed high mast lighting and overhead sign areas. The existing

.../...  
C:\reports\hmlhwy8.wpd



borehole information has been utilized to determine the design soil parameters in this foundation report for the design and construction for the HML and OS foundations.

The following reports are referenced in this report:

- "Foundation Investigation and Design Report, Proposed King Street Retaining Wall and Franklin Street Bridge, Structure 33-221, W.P. 363-94-00, Agreement No. 9730-7411-3178, Hwy8/Conestoga Parkway Interchange and Hwy 8 from Conestoga Parkway to Fergus Avenue", prepared by AGRA Earth & Environmental Limited, dated July 21, 1999 (GEOCRES No. 40P8-118).
- "Foundation Investigation and Design Report, Proposed E-S Ramp Structure, Structure 33-393, W.P. 363-94-00, Agreement No. 9730-7411-3178, Hwy8/Conestoga Parkway Interchange and Hwy 8 from Conestoga Parkway to Fergus Avenue", prepared by AGRA Earth & Environmental Limited, dated August 27, 1999 (GEOCRES No. 40P8-119).
- "Subsoil Investigation for the King Street Underpass at Franklin Street", W.P. 621-64, prepared by E.M. Peto Associates Limited, dated December, 1964 (GEOCRES No. 40P8-33).

Relevant borehole logs and stratigraphic sections are presented in Appendix A (E-S Ramp - Structure 33-393, by AGRA; Boreholes 98-03, 98-04, 98-09, 98-10, 98-11, 98-12), Appendix B (Franklin Street Bridge and King Street Retaining Wall - Structure 33-221, by AGRA; Boreholes 98-01, 98-03, 98-04, 98-07, 98-08, 98-14, 98-18, 98-19, 98-20) and Appendix C (King Street Underpass at Franklin Street by E.M. Peto & Associates; Boreholes 4, 5, 8, 9, 13, 16, 18).

## **4. SUBSURFACE CONDITIONS**

### **4.1 General Subsurface Conditions**

In general, the anticipated subsurface deposits at the HML and OS locations consist of 1 to 4 m of pavement structure and/or surficial fills underlain by fine sand to silt to depths of about 8 to 14 m depths below the ground surface. Several boreholes also contacted a discontinuous silty clay layer within the upper cohesionless deposits. Silt till underlies the above noted soil deposits at depth. Details of the deposits are given in the above referenced three reports. Drawings 1 to 4 and D-5634-2, included in the Appendices, present the locations of the boreholes and a stratigraphic cross-section in the area of the proposed HML and OS locations.

### **4.2 Groundwater Conditions**

The water table was about 5 to 9 m below the King Street grade, corresponding to Elevations 322.3 to 317.2 m. The water level at the depressed Highway 8 underneath the Franklin Street Bridge was 1.9 m below grade, corresponding to Elevation 319.0 m. These water levels indicate that the groundwater flows in a north-west direction towards Montgomery Creek. It may also flow locally towards the depressed Highway 8 and/or to the storm water system under Highway 8.

It is noted that the water table was measured at Elevation 320.0 m (1050 ft) in 1964 prior to



construction of the retaining walls and the depressed Highway 8.

The water levels recorded indicate the static water level of the shallow water table. Fluctuation in the groundwater table can be expected seasonally and in response to major weather events.



## 6. CLOSURE

We recommend that once the details of the structure are finalized, our recommendations should be reviewed for their specific applicability. It should be noted that AGRA guarantees the results only at the borehole locations. The findings in this report must only be used by MTO and its representatives for this specific project.

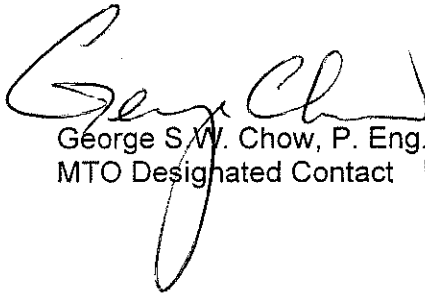
Sincerely,



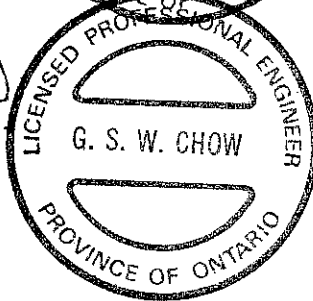
Andrew Drevininkas, P. Eng.



Barry P. Walker, Ph. D., P. Eng.



George S.W. Chow, P. Eng.  
MTO Designated Contact





# APPENDIX "A"

## Borehole Log Sheets and Borehole Locations and Soil Strata Drawings

GEOCRES 40P8-119



# RECORD OF BOREHOLE No 98-03

1 OF 1

METRIC

W.P. 363-94-00 SITE: 33-393 LOCATION E-S Ramp, 4810999N 227697E ORIGINATED BY SW  
 DIST 2 HWY 7 & 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY SY  
 DATUM Geodetic DATE 29.12.98 - 29.12.98 CHECKED BY EYC

| SOIL PROFILE  |   | SAMPLES    |        |      | GROUND WATER<br>CONDITIONS | ELEVATION<br>SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  |  | PLASTIC NATURAL LIQUID<br>LIMIT MOISTURE LIMIT<br>CONTENT |   |                | UNIT<br>WEIGHT<br>$\gamma$<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|--------|------|----------------------------|--------------------|---|--|--|--|--|---|---|----------------|---|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER | TYPE | "N" VALUES                 |                    | SHEAR STRENGTH kPa                          |  |  |  |  | W <sub>p</sub>  | W | W <sub>L</sub> |   |   |
| 323.9<br>0.0  | ASPHALT 310 mm<br>Crushed Granular 200 mm<br>Compact, brown sand and gravel<br>FILL<br>damp |            | 1      | SS   | 24                         | 323                |   |  |  |  |  |   |   |                |   |   |
| 322.4<br>1.5  | Compact to Very Dense, brown<br>Fine SAND, trace silt<br>damp                               |            | 2      | SS   | 26                         | 322                |   |  |  |  |  |   |   |                |   |   |
|               |   |            | 3      | SS   | 32                         | 321                |   |  |  |  |  |   |   |                |   | 0 93 7 0  |
|               |   |            | 4      | SS   | 42                         | 320                |   |  |  |  |  |   |   |                |   |   |
| 319.0<br>4.9  | Dense to Very Dense grey, SILT,<br>trace fine sand<br>wet to saturated                      |            | 5      | SS   | 74                         | 319                |   |  |  |  |  |   |   |                |   |   |
|               |   |            | 6      | SS   | 110                        | 318                |   |  |  |  |  |   |   |                |   | 0 16 82 2   |
| 316.6<br>7.3  | END OF BOREHOLE @ 7.3 m<br>NOTE: Water Level @ 5.5 m Upon<br>Completion                     |            | 7      | SS   | 48                         | 317                |   |  |  |  |  |   |   |                |   |   |



RECORD OF BOREHOLE No 98-04

1 OF 1

METRIC

W.P. 363-94-00 SITE 33-393 LOCATION E-S Ramp, 4811017N, 227665E ORIGINATED BY SW  
DIST 2 HWY 7 & 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY SY  
DATUM Geodetic DATE 29.12.98 - 29.12.98 CHECKED BY EYC

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | UNIT<br>WEIGHT<br>$\gamma$<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|---|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |   |   |
| 323.8         | ASPHALT 170 mm<br>Crushed Granular 200 mm<br>Compact, dark brown sandy silt to<br>silty sand FILL<br>damp |            |         |      |            |                            |                 |   |    |    |    |     |   |   |
| 0.0           | Very loose  |            | 1       | SS   | 15         |                            | 323             |   |    |    |    |     |   |   |
|               |   |            | 2       | SS   | 2          |                            | 322             |   |    |    |    |     |   |   |
| 321.5         |   |            |         |      |            |                            |                 |   |    |    |    |     |   |   |
| 2.3           | Dense to Very Dense, brown<br>medium-fine SAND, trace silt and<br>gravel<br>damp                          |            | 3       | SS   | 32         |                            | 321             |   |    |    |    |     |   |   |
|               |   |            | 4       | SS   | 53         |                            | 320             |   |    |    |    |     |   |   |
|               |   |            |         |      |            |                            |                 |   |    |    |    |     |   |   |
|               |   |            | 5       | SS   | 100        |                            | 319             |   |    |    |    |     |   |   |
|               |   |            |         |      |            |                            |                 |   |    |    |    |     |   |   |
| 317.7         | Very Dense, grey Silty Fine SAND<br>saturated   |            | 6       | SS   | 80         |                            | 318             |   |    |    |    |     |   | 7 83 10 0   |
| 6.1           |   |            |         |      |            |                            |                 |   |    |    |    |     |   |   |
| 316.8         | Hard, grey Silty CLAY<br>moist  |            |         |      |            |                            | 317             |   |    |    |    |     |   |   |
| 7.0           |   |            |         |      |            |                            |                 |   |    |    |    |     |   |   |
|               |   |            | 7       | SS   | 100        |                            | 316             |   |    |    |    |     |   | 0 3 80 37   |
| 315.8         | END OF BOREHOLE @ 8.0 m<br>NOTE: Water Level @ 6.1 m Upon<br>Completion                                   |            |         |      |            |                            |                 |   |    |    |    |     |   |   |
| 8.0           |   |            |         |      |            |                            |                 |   |    |    |    |     |   |   |

EXPRESS, 33-393.GPJ EXPRESS.GDT 24/08/99



# RECORD OF BOREHOLE No 98-09

1 OF 1

METRIC

W.P. 363-94-00 SITE 33-393 LOCATION E-S Ramp, 4811063N 227530E ORIGINATED BY SY  
DIST 2 HWY 7 & 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY SY  
DATUM Geodetic DATE 20.01.99 - 20.01.99 CHECKED BY EYC

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 322.4<br>0.0  | ASPHALT 175 mm<br>sand and gravel FILL<br>Compact to Dense, dark brown to<br>black cobbly silty sand and gravel<br>FILL<br>damp |            | 1       | SS   | 37         |                            | 322             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 320.7<br>1.7  | Compact to Dense, brown<br>medium-fine SAND<br>damp   |            | 2       | SS   | 28         |                            | 321             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 319.5         |   |            | 3       | SS   | 34         |                            | 320             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 319.1<br>2.9  | Very Stiff, brown Silty CLAY  |            | 4       | SS   | 17         |                            | 319             |   |    |    |    |     |                                    |                                     |                                   |                     | 0 3 62 35   |
| 317.8<br>3.4  | grey<br>moist   |            | 5       | SS   | 17         |                            | 318             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 315.7<br>4.6  | Compact to Very Dense, grey SILT,<br>trace sand<br>moist  |            | 6       | SS   | 22         |                            | 317             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 315.7<br>6.7  | saturated   |            | 7       | SS   | 50         |                            | 316             |   |    |    |    |     |                                    |                                     |                                   |                     | 0 37 60 3   |
|               |   |            | 8       | SS   | 55         |                            | 315             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 9       | SS   | 57         |                            | 314             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 10      | SS   | 55         |                            | 313             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 311.2<br>11.2 | END OF BOREHOLE @ 11.2 m<br>NOTE: Water Level @ 6.7 m Upon<br>Completion  |            |         |      |            |                            | 312             |   |    |    |    |     |                                    |                                     |                                   |                     |   |

EXPRESS: 33-393 GPJ EXPRESS GDT 24/08/99



# RECORD OF BOREHOLE No 98-10

1 OF 2

METRIC

W.P. 363-94-00 SITE 33-393 LOCATION E-S Ramp, 4811077N, 227500E ORIGINATED BY SY/SW  
DIST 2 HWY 7 & 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY SY  
DATUM Geodetic DATE 21.01.99 - 05.02.99 CHECKED BY EYC

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |              |                  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |                   |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|--------------|------------------|------------------------------------|-------------------------------------|-----------------------------------|--|--|-------------------|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |              |                  |                                    |                                     |                                   |  |  | WATER CONTENT (%) |
|               |  |            |         |      |            |                            |                 | ○ UNCONFINED                                | + FIELD VANE | ● QUICK TRIAXIAL |                                    |                                     |                                   |  |  |                   |
| 321.8<br>0.0  | 190 mm ASPHALT<br>sand and gravel FILL 810mm<br>Compact, dark brown to black<br>cobbley sand and gravel FILL |            | 1       | SS   | 29         |                            |                 |   |              |                  |                                    |                                     |                                   |  |  |                   |
| 320.0<br>1.8  | Compact, brown Medium SAND<br>damp   |            | 2       | SS   | 19         |                            |                 |   |              |                  |                                    |                                     |                                   |  |  |                   |
| 319.2<br>2.6  | Hard, grey Silty Clay<br>moist   |            | 3       | SS   | 22         |                            |                 |   |              |                  |                                    |                                     |                                   |  |  |                   |
|               | Silt Seam  |            | 4       | SS   | 49         |                            |                 |   |              |                  |                                    |                                     | 22.0                              | 0 11 49 40<br>313 kPa                    |  |                   |
| 317.5<br>4.3  | Dense to Very Dense, grey SILT,<br>trace sand<br>wet to saturated  |            | 5       | SS   | 58         |                            |                 |   |              |                  |                                    |                                     |                                   | 0 32 60 8                                |  |                   |
|               |  |            | 6       | SS   | 49         |                            |                 |   |              |                  |                                    |                                     |                                   |  |  |                   |
|               |  |            | 7       | SS   | 88         |                            |                 |   |              |                  |                                    |                                     |                                   |  |  |                   |
| 312.6<br>9.2  | occasional saturated sand seams  |            | 8       | SS   | 79         |                            |                 |   |              |                  |                                    |                                     |                                   |  |  |                   |
|               |  |            | 9       | SS   | 85         |                            |                 |   |              |                  |                                    |                                     |                                   |  |  |                   |
| 309.0<br>12.8 | Hard, grey Silty Clay<br>moist   |            | 10      | SS   | 120        |                            |                 |   |              |                  |                                    |                                     |                                   |  |  |                   |
|               |  |            | 11      | SS   | 78         |                            |                 |   |              |                  |                                    |                                     |                                   | 0 3 57 40                                |  |                   |
|               |  |            | 12      | SS   | 105        |                            |                 |   |              |                  |                                    |                                     |                                   |  |  |                   |

Continued Next Page

+ 3, × 3: Numbers refer to  
Sensitivity ○ 3% STRAIN AT FAILURE



# RECORD OF BOREHOLE No 98-10

2 OF 2

METRIC

W.P. 363-94-00 SITE 33-393 LOCATION E-S Ramp, 4811077N, 227500E ORIGINATED BY SY/SW  
 DIST 2 HWY 7 & 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY SY  
 DATUM Geodetic DATE 21 01.99 - 05.02.99 CHECKED BY EYC

| SOIL PROFILE  |             |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |                             |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |
|---------------|-------------|------------|---------|------|------------|----------------------------|-----------------|---|-----------------------------|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |                             |  | WATER CONTENT (%)                  |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 | 20 40 60 80 100                             | ○ UNCONFINED + FIELD VANE   |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 | 20 40 60 80 100                             | ● QUICK TRIAXIAL × LAB VANE |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |
|               |             |            |         |      |            |                            |                 |   |                             |  |                                    |                                     |                                   |  |  |

EXPRESS 33-393 GPJ EXPRESS GOT 24/08/99

+ 3, x 3 Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE



# RECORD OF BOREHOLE No 98-11

1 OF 2

METRIC

W.P. 363-94-00 SITE 33-393 LOCATION E-S Ramp, 4811094N, 227458E ORIGINATED BY SW  
DIST 2 HWY 7 & 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY SY  
DATUM Geodetic DATE 21 01 99 - 05 02 99 CHECKED BY EYC

| SOIL PROFILE  |   |            | SAMPLES |       |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |              | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |                   |     |    |            |    |    |     |
|---------------|---|------------|---------|-------|------------|----------------------------|-----------------|---|----|--------------|------------------------------------|-------------------------------------|-----------------------------------|--|---|-------------------|-----|----|------------|----|----|-----|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE  | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |    |              |                                    |                                     |                                   |  |   | WATER CONTENT (%) |     |    |            |    |    |     |
|               |   |            |         |       |            |                            |                 | ○ UNCONFINED                                |    | + FIELD VANE |                                    |                                     |                                   |  |   | ○ QUICK TRIAXIAL  |     |    | x LAB VANE |    |    |     |
|               |   |            |         |       |            |                            |                 | 20  | 40 | 60           |                                    |                                     |                                   |  |   | 80                | 100 | 20 | 40         | 60 | 80 | 100 |
| 320.6         |   |            |         |       |            |                            |                 |   |    |              |                                    |                                     |                                   |  | GR SA SI CL                                       |                   |     |    |            |    |    |     |
| 0.0           | TOPSOIL 200mm<br>sand and gravel FILL<br>damp                             |            | 1       | AUGER |            |                            |                 |   |    |              |                                    |                                     |                                   |  | 38 44 18 0  |                   |     |    |            |    |    |     |
|               |   |            | 2       | SS    | 8          |                            |                 |   |    |              |                                    |                                     |                                   |  |   |                   |     |    |            |    |    |     |
| 319.1         |   |            |         |       |            |                            |                 |   |    |              |                                    |                                     |                                   |  |   |                   |     |    |            |    |    |     |
| 1.5           | Compact to Dense, brown Medium<br>Fine SAND, trace to some gravel<br>damp |            | 3       | SS    | 10         |                            |                 |   |    |              |                                    |                                     |                                   |  |   |                   |     |    |            |    |    |     |
|               |   |            | 4       | SS    | 31         |                            |                 |   |    |              |                                    |                                     |                                   |  |   |                   |     |    |            |    |    |     |
|               |   |            | 5       | SS    | 26         |                            |                 |   |    |              |                                    |                                     |                                   |  |   |                   |     |    |            |    |    |     |
|               |   |            | 6       | SS    | 38         |                            |                 |   |    |              |                                    |                                     |                                   |  |   |                   |     |    |            |    |    |     |
| 315.5         |   |            |         |       |            |                            |                 |   |    |              |                                    |                                     |                                   |  |   |                   |     |    |            |    |    |     |
| 5.1           | saturated   |            | 7       | SS    | 33         |                            |                 |   |    |              |                                    |                                     |                                   |  | 0 95 5 0  |                   |     |    |            |    |    |     |
|               |   |            | 8       | SS    | 100        |                            |                 |   |    |              |                                    |                                     |                                   |  |   |                   |     |    |            |    |    |     |
| 313.6         |   |            | 9       | SS    | 100        |                            |                 |   |    |              |                                    |                                     |                                   |  | 1 7 84 8  |                   |     |    |            |    |    |     |
| 7.0           | Very Dense, grey SILT, trace sand<br>saturated                            |            | 10      | SS    | 93         |                            |                 |   |    |              |                                    |                                     |                                   |  |   |                   |     |    |            |    |    |     |
|               |   |            | 11      | SS    | 53         |                            |                 |   |    |              |                                    |                                     |                                   |  |   |                   |     |    |            |    |    |     |
| 309.0         |   |            | 12      | SS    | 50         |                            |                 |   |    |              |                                    |                                     |                                   | 21.5                                     | 400 kPa   |                   |     |    |            |    |    |     |
| 11.6          | Hard, grey Silty CLAY<br>moist  |            | 13      | SS    | 82         |                            |                 |   |    |              |                                    |                                     |                                   | 21.9                                     | 0 0 48 52<br>403 kPa                              |                   |     |    |            |    |    |     |

Continued Next Page

+ 3, < 3. Numbers refer to Sensitivity 3% STRAIN AT FAILURE



# RECORD OF BOREHOLE No 98-11

2 OF 2

METRIC

W.P. 363-94-00 SITE 33-393 LOCATION E-S Ramp, 4811094N, 227458E ORIGINATED BY SW  
DIST 2 HWY 7 & 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY SY  
DATUM Geodetic DATE 21.01.99 - 05.02.99 CHECKED BY EYC

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT                                    |  |  | PLASTIC<br>LIMIT<br>w <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>w | LIQUID<br>LIMIT<br>w <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa<br>○ UNCONFINED + FIELD VANE<br>● QUICK TRIAXIAL x LAB VANE |  |  |                                    |                                     |                                   |  |  |
|               | Hard, grey Silty CLAY  |            |         |      |            |                            |                 |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            | 14      | SS   | 59         |                            | 304             |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            | 303             |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            | 15      | SS   | 70         |                            | 302             |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            | 301             |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            | 16      | SS   | 56         |                            | 300             |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            | 299             |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            | 298             |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            | 17      | SS   | 62         |                            | 297             |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            | 296             |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            | 18      | SS   | 66         |                            | 295             |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            | 294             |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            | 293             |  |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            | 292             |  |  |  |                                    |                                     |                                   |  |  |
| 296.0<br>24.6 | Very Dense, grey Sandy SILT TILL<br>damp                             |            | 19      | SS   | 135        |                            |                 |  |  |  |                                    |                                     |                                   |  |  |
| 291.6<br>29.0 | END OF BOREHOLE @ 29.0 m<br>NOTE: Water Level @ 5.1 m on<br>02/02/99 |            | 20      | SS   | 100/75mm   |                            |                 |  |  |  |                                    |                                     |                                   |  |  |

EXPRESS: 33-393 GPJ EXPRESS GDT: 24/08/99



# RECORD OF BOREHOLE No 98-12

1 OF 2

METRIC

W.P. 363-94-00 SITE 33-393 LOCATION E-S Ramp, 4811142N, 227407E ORIGINATED BY SW  
DIST 2 HWY 7 & 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY SY  
DATUM Geodetic DATE 06.02.99 - 06.02.99 CHECKED BY EYC

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  | PLASTIC<br>LIMIT<br>w <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>w | LIQUID<br>LIMIT<br>w <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |                                    |                                     |                                   |  |  |
| 319.1         |   |            |         |      |            |                            | 20 40 60 80 100 |   |  |                                    |                                     |                                   |  |  |
| 0.0           | sand and gravel FILL, 500 mm<br>Dense, dark brown to black sandy<br>silt FILL,<br>moist |            | 1       | SS   | 46         |                            |                 |   |  |                                    |                                     |                                   |  |  |
| 317.6         |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
| 1.5           | Dense to Very Dense, brown<br>SAND, some gravel<br>damp                                 |            | 2       | SS   | 47         |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            | 3       | SS   | 68         |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            | 4       | SS   | 56         |                            |                 |   |  |                                    |                                     |                                   |  |  |
| 315.6         | Fine SAND<br>saturated  |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
| 3.5           |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
| 314.7         | Hard, grey Silty CLAY<br>moist  |            | 5       | SS   | 53         |                            |                 |   |  |                                    |                                     |                                   |  |  |
| 4.4           |   |            | 6       | TW   |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            | 7       | SS   | 56         |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         | 8    | SS         | 59                         |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         | 9    | SS         | 51                         |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
|               |   |            |         |      |            |                            |                 |   |  |                                    |                                     |                                   |  |  |

EXPRESS, 33-393 GPJ EXPRESS GDT 24/08/99

Continued Next Page

+ 3, x 3 Numbers refer to Sensitivity 3% STRAIN AT FAILURE

135



# RECORD OF BOREHOLE No 98-12

2 OF 2

METRIC

W.P. 363-94-00 SITE 33-393 LOCATION E-S Ramp, 4811142N, 227407E ORIGINATED BY SW  
DIST 2 HWY 7 & 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY SY  
DATUM Geodetic DATE 06.02.99 - 06.02.99 CHECKED BY EYC

| SOIL PROFILE  |  |            | SAMPLES |             |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE<br>ELEVATION<br>DEPTH | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT                                    |    |     |  |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|--|------------|---------|-------------|------------|----------------------------|---------------------------------------|--|----|-----|--|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE        | "N" VALUES |                            |                                       | SHEAR STRENGTH kPa<br>○ UNCONFINED + FIELD VANE<br>● QUICK TRIAXIAL × LAB VANE |    |     |  |  |                                    |                                     |                                   |  |  |
|               |  |            |         |             |            | 20                         | 40                                    | 60   | 80 | 100 |  |  |                                    |                                     |                                   |  |  |
|               | Hard, grey Silty CLAY  |            |         |             |            |                            |                                       |  |    |     |  |  |                                    |                                     |                                   |  |  |
|               |  |            | 11      | SS          | 57         |                            |                                       |  |    |     |  |  |                                    |                                     |                                   |  |  |
|               |  |            | 12      | SS          | 53         |                            |                                       |  |    |     |  |  |                                    |                                     |                                   |  |  |
| 296.2         |  |            | 13      | SS100/25mm  |            |                            |                                       |  |    |     |  |  |                                    |                                     |                                   |  |  |
| 22.9          | Very Dense grey, Sandy SILT TILL damp                        |            | 14      | SS100/150mm |            |                            |                                       |  |    |     |  |  |                                    |                                     |                                   | 8 42 48 2                                |  |
| 293.0         |  |            | 15      | SS100/50mm  |            |                            |                                       |  |    |     |  |  |                                    |                                     |                                   |  |  |
| 26.1          | END OF BOREHOLE @ 26.1 m<br>NOTE: No Free Water @ Completion |            |         |             |            |                            |                                       |  |    |     |  |  |                                    |                                     |                                   |  |  |

+ 3, x 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE



METRIC

DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

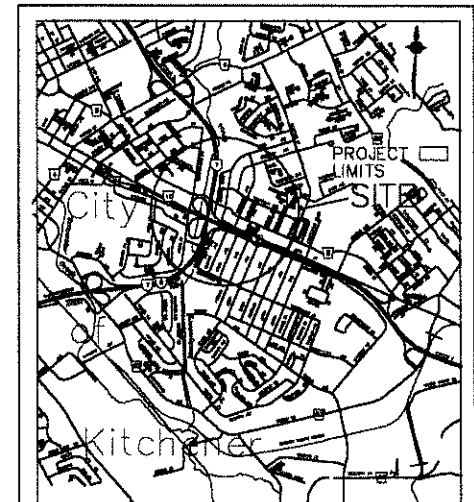
CONT No 2001-3011  
WP No 363-94-00



Proposed E-S Ramp Structure  
Hwy 8/Conestoga Parkway  
BORE HOLE LOCATIONS & SOIL STRATA

SHEET  
000

**AGRA Earth & Environmental**  
ENGINEERING GLOBAL SOLUTIONS



KEYPLAN

NTS

LEGEND

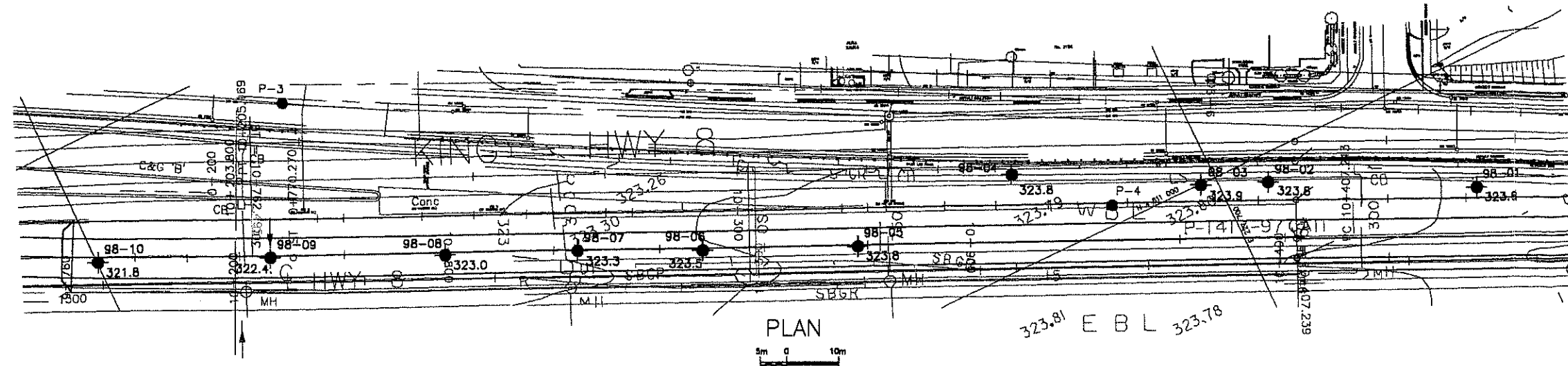
- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- Blows/0.3m (Std Pen Test, 475 J/blow)
- Blows/0.3m (60° Cone, 475 J/blow)
- W L at time of investigation
- Standpipe
- Approx. Location of HML Pole

| No.   | ELEVATION | CO-ORDINATES |         |
|-------|-----------|--------------|---------|
|       |           | NORTH        | EAST    |
| 98-01 | 323.8     | 4 810 977    | 227 745 |
| 98-02 | 323.8     | 4 810 995    | 227 708 |
| 98-03 | 323.9     | 4 811 000    | 227 697 |
| 98-04 | 323.8     | 4 811 017    | 227 685 |
| 98-05 | 323.8     | 4 811 018    | 227 632 |
| 98-06 | 323.5     | 4 811 030    | 227 605 |
| 98-07 | 323.3     | 4 811 040    | 227 583 |
| 98-08 | 323.0     | 4 811 050    | 227 561 |
| 98-09 | 322.4     | 4 811 084    | 227 530 |
| 98-10 | 321.8     | 4 811 077    | 227 500 |

NOTE:  
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

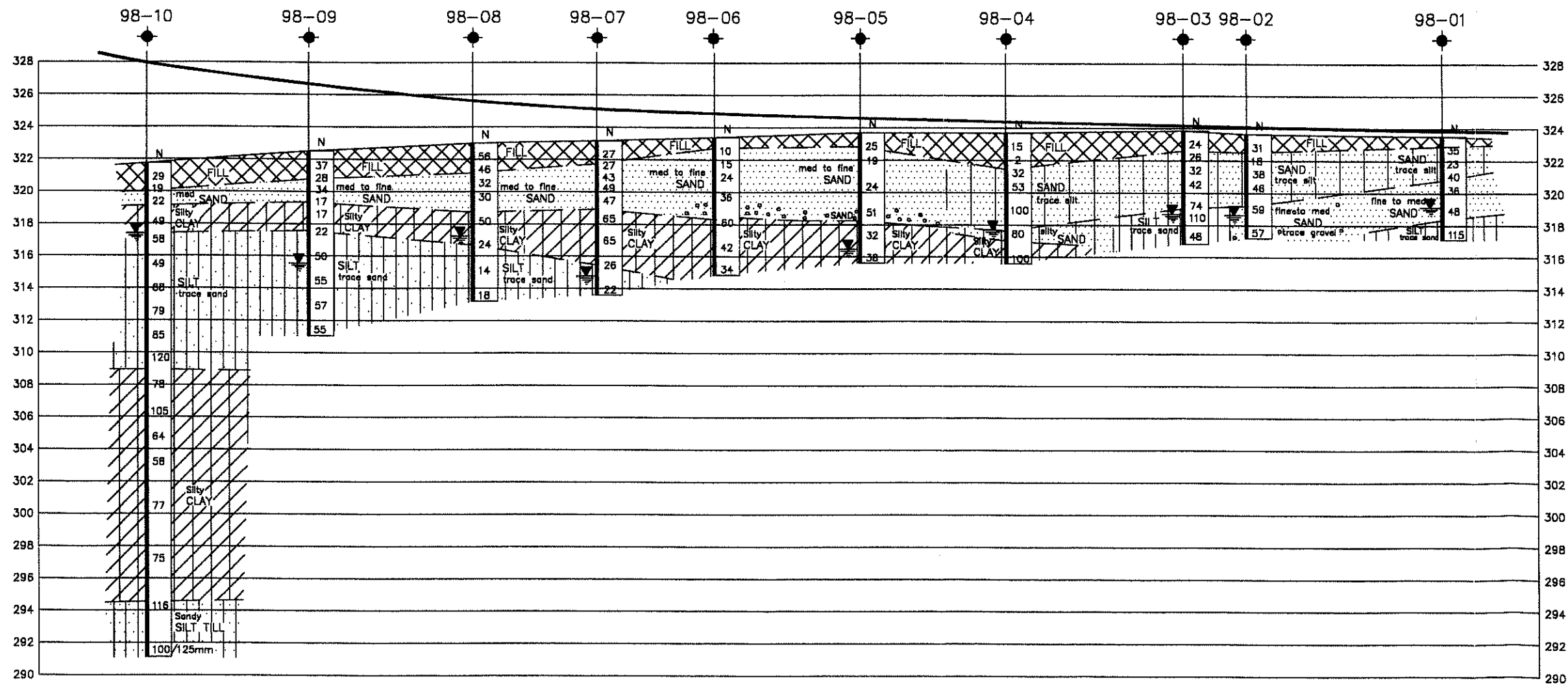
|                 |             |                |             |
|-----------------|-------------|----------------|-------------|
| REVISIONS       |             |                |             |
|                 |             |                |             |
|                 |             |                |             |
|                 |             |                |             |
|                 | DATE        | BY             | DISCUPTION  |
| GEOCRE 40PB-119 |             |                |             |
| HWY No. 7 & 8   |             |                | DIST 31     |
| SUBM'd 00       | CHECKED EYC | DATE June 1999 | SITE 33-393 |
| DRAWN LWM       | CHECKED     | APPROVED       | DWG 1       |

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section GC2.01 of OPS Gen. Cond.



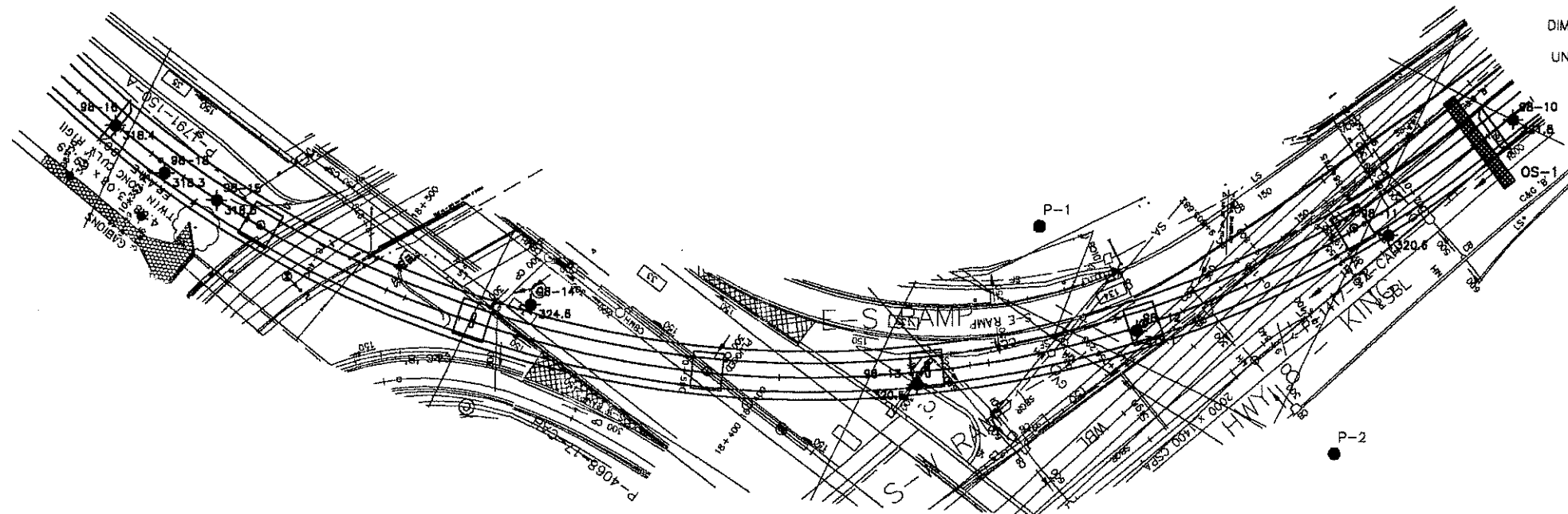
PLAN

5m 0 10m



5m 0 10m  
Horizontal





PLAN

0 5 10 15m

METRIC

DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

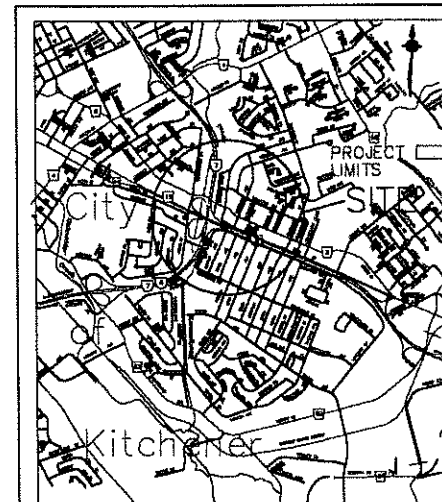
CONT No 2001-3011  
WP No 363-94-00



Proposed E-S Ramp Structure  
Hwy 8/Conestoga Parkway  
BORE HOLE LOCATIONS & SOIL STRATA

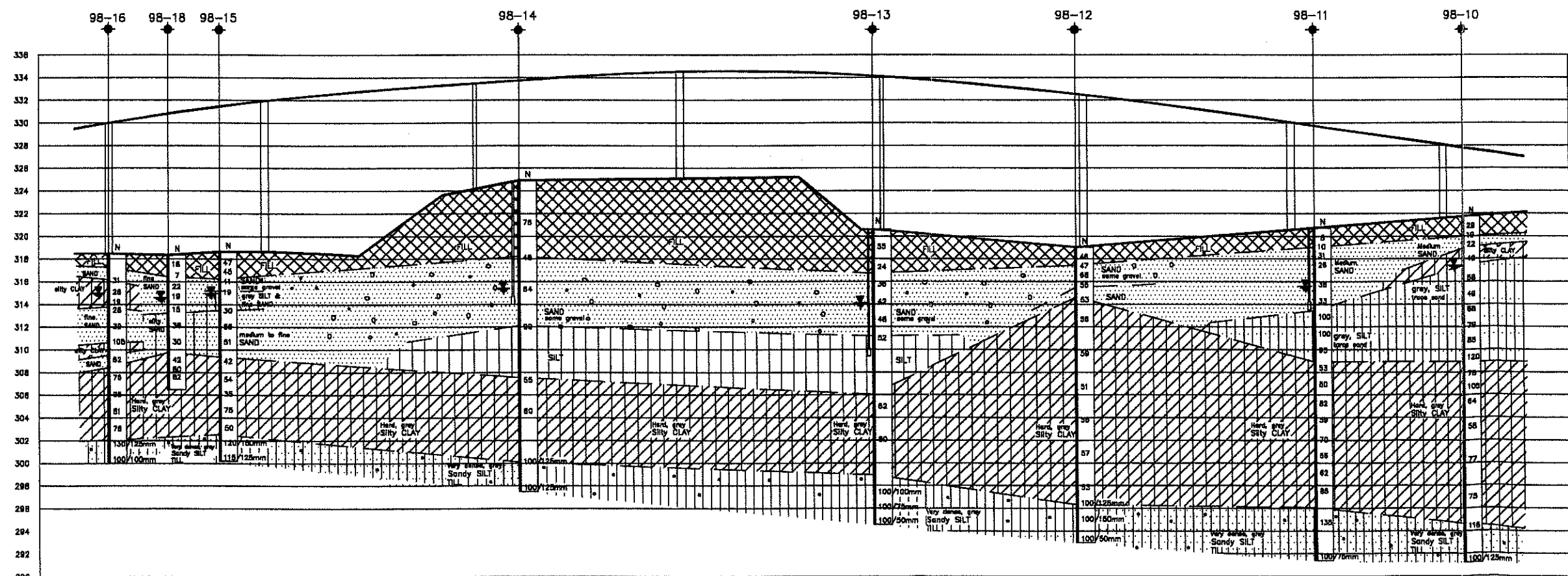
SHEET  
000

**AGRA Earth & Environmental**  
ENGINEERING GLOBAL SOLUTIONS



KEYPLAN

NTS



LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W L at time of Investigation
- Standpipe
- P-2 Approx. Location of HML Pole
- OS-1 Approx. Location of Overhead Sign

| No.   | ELEVATION | CO-ORDINATES |         |
|-------|-----------|--------------|---------|
|       |           | NORTH        | EAST    |
| 98-10 | 321.8     | 4 811 077    | 227 500 |
| 98-11 | 320.6     | 4 881 094    | 227 459 |
| 98-12 | 319.1     | 4 811 143    | 227 408 |
| 98-13 | 320.5     | 4 811 168    | 227 370 |
| 98-14 | 324.6     | 4 811 288    | 227 345 |
| 98-15 | 318.5     | 4 811 372    | 227 334 |
| 98-16 | 318.3     | 4 811 387    | 227 334 |
| 98-18 | 318.4     | 4 811 404    | 227 340 |

NOTE: The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section GC2.01 of OPS Gen. Cond.

|                  |             |                |             |
|------------------|-------------|----------------|-------------|
| REVISIONS        |             |                |             |
|                  |             |                |             |
|                  |             |                |             |
|                  |             |                |             |
|                  | DATE        | BY             | DISCRPTION  |
| GEOCREs 40PB-119 |             |                |             |
| HWY No.          | 7 & 8       |                | DIST 31     |
| SUBM'D 00        | CHECKED EYC | DATE June 1999 | SITE 33-393 |
| DRAWN LWM        | CHECKED     | APPROVED       | DWG 2       |



# APPENDIX "B"

## Borehole Log Sheets and Borehole Locations and Soil Strata Drawings

GEOCRES 40P8-118








# RECORD OF BOREHOLE No 98-01

1 OF 1

METRIC

W.P. 363-94-00 SITE 33-221 LOCATION King St. E. South of Arlington Blvd., 4810735N, 228310E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETTIC DATE 18.11.98 - 18.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE   |  |   | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |              |                  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br><br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |                   |            |
|----------------|--|---|---------|------|------------|----------------------------|-----------------|---|--------------|------------------|------------------------------------|-------------------------------------|-----------------------------------|--|--|-------------------|------------|
| ELEV.<br>DEPTH | DESCRIPTION  | STRAT PLOT  | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |              |                  |                                    |                                     |                                   |  |  | WATER CONTENT (%) |            |
|                |  |   |         |      |            |                            |                 | ○ UNCONFINED                                | + FIELD VANE | ● QUICK TRIAXIAL |                                    |                                     |                                   |  |  |                   | × LAB VANE |
|                |  |   |         |      |            |                            |                 |   |              |                  |                                    |                                     |                                   |  |  |                   |            |
| 327.4          |  |   |         |      |            | 20                         | 40              | 60  | 80           | 100              | 10                                 | 20                                  | 30                                |  |  |                   |            |
| 0.0            | ASPHALT 100mm<br>CRUSHED GRANULAR 200mm<br>Compact, dark brown fine sand to<br>silty sand FILL<br>damp |  |         |      |            |                            |                 |   |              |                  |                                    |                                     |                                   |  |  |                   |            |
| 326.0          |  |   | 1       | SS   | 13         |                            |                 |   |              |                  |                                    |                                     |                                   |  | 3 76 19 0  |                   |            |
| 1.4            | Compact, brown fine SAND, some<br>silt<br>damp   |  | 2       | SS   | 14         |                            |                 |   |              |                  |                                    |                                     |                                   |  | 1 66 11 0  |                   |            |
| 324.8          |  |   | 3       | SS   | 19         |                            |                 |   |              |                  |                                    |                                     |                                   |  |  |                   |            |
| 2.6            | Compact, brown medium to coarse<br>SAND<br>damp  |  | 4       | SS   | 34         |                            |                 |   |              |                  |                                    |                                     |                                   |  |  |                   |            |
| 324.3          |  |   |         |      |            |                            |                 |   |              |                  |                                    |                                     |                                   |  |  |                   |            |
| 3.1            | Dense, brown SAND and GRAVEL<br>damp   |  |         |      |            |                            |                 |   |              |                  |                                    |                                     |                                   |  |  |                   |            |
| 323.6          |  |   | 5       | SS   | 27         |                            |                 |   |              |                  |                                    |                                     |                                   |  | 0 40 60 0  |                   |            |
| 3.8            | Compact to dense, brown SANDY<br>SILT<br>damp  |  |         |      |            |                            |                 |   |              |                  |                                    |                                     |                                   |  |  |                   |            |
| 322.4          |  |   | 6       | SS   | 33         |                            |                 |   |              |                  |                                    |                                     |                                   |  |  |                   |            |
| 5.1            | END OF BOREHOLE @ 5.1m<br>NOTE: Borehole dry upon<br>completion  |   |         |      |            |                            |                 |   |              |                  |                                    |                                     |                                   |  |  |                   |            |

+ 3 3 Numbers refer to  
Sensitivity

3% STRAIN AT FAILURE



# RECORD OF BOREHOLE No 98-03

1 OF 1

METRIC

W.P. 363-94-00 SITE 33-221 LOCATION King St. E. South of Arlington Blvd., 4810774N, 228228E ORIGINATED BY S.W.  
 DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
 DATUM GEODETIC DATE 18.11.98 - 18.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION<br>SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | UNIT<br>WEIGHT<br>$\gamma$<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|---|------------|---------|------|------------|----------------------------|--------------------|---|----|----|----|-----|---|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                    | 20  | 40 | 60 | 80 | 100 |   |  |
| 327.2         | ASPHALT 120mm<br>CRUSHED GRANULAR 200mm<br>Compact, dark brown silty sand<br>and gravel FILL<br>moist |            |         |      |            |                            | 327                |   |    |    |    |     |   |  |
| 325.9         | Compact, dark brown silty sand<br>FILL<br>moist   |            | 1       | SS   | 26         |                            | 326                |   |    |    |    |     |   | 6 63 31 0  |
| 325.2         | Very loose, dark brown sand and<br>gravel FILL<br>moist   |            | 2       | SS   | 24         |                            | 325                |   |    |    |    |     |   |  |
| 324.4         | Compact, brown fine to medium<br>SAND<br>damp   |            | 3       | SS   | 3          |                            | 324                |   |    |    |    |     |   |  |
| 324.0         | Dense to very dense, brown<br>GRAVELLY SAND, trace silt<br>damp                                       |            | 4       | SS   | 52         |                            | 323                |   |    |    |    |     |   | 23 67 10 0   |
| 323.1         | Dense to very dense, light brown<br>SILTY FINE SAND to SANDY SILT<br>damp to moist                    |            | 5       | SS   | 42         |                            | 322                |   |    |    |    |     |   |  |
| 321.4         |   |            | 6       | SS   | 44         |                            |                    |   |    |    |    |     |   |  |
| 5.8           | END OF BOREHOLE @ 5.8m<br>NOTE: Borehole dry upon<br>completion                                       |            | 7       | SS   | 53         |                            |                    |   |    |    |    |     |   |  |

+ 3 x 3 Numbers refer to Sensitivity 3% STRAIN AT FAILURE



# RECORD OF BOREHOLE No 98-04

1 OF 1

METRIC

W.P. 363-94-00 SITE:33-221 LOCATION King St. E. South of Arlington Blvd., 4810784N, 228207E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 18.11.98 - 18.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |   | SAMPLES    |        |      | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | UNIT<br>WEIGHT<br>$\gamma$<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|--------|------|----------------------------|-----------------|---|----|----|----|-----|---|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER | TYPE |                            |                 | 20  | 40 | 60 | 80 | 100 |   |   |
| 327.1<br>0.0  | ASPHALT 120mm<br>CRUSHED GRANULAR 250mm<br>Compact, dark brown gravelly sand<br>FILL<br>moist |            |        |      |                            | 327             |   |    |    |    |     |   |   |
| 325.6<br>1.5  | Compact, dark brown fine sand,<br>some silt FILL<br>moist                                     |            | 1      | SS   | 12                         | 326             |   |    |    |    |     |   |   |
| 324.8<br>2.3  | Loose, brown sand, trace to some<br>gravel FILL<br>moist                                      |            | 2      | SS   | 13                         | 325             |   |    |    |    |     |   | 5 69 26 0   |
| 324.3<br>2.8  | Loose to compact, brown fine<br>SAND and SILT<br>moist to wet                                 |            | 3      | SS   | 5                          | 324             |   |    |    |    |     |   | 0 55 45 0   |
| 323.1<br>4.0  | Dense, brown SAND and GRAVEL  |            | 4      | SS   | 9                          | 323             |   |    |    |    |     |   |   |
| 322.3<br>4.3  | Dense to very dense, brown fine<br>SAND<br>wet<br>saturated                                   |            | 5      | SS   | 43                         | 322             |   |    |    |    |     |   |   |
| 320.5<br>6.6  | END OF BOREHOLE @ 6.6m<br>NOTE: Water level recorded @<br>4.8m upon completion                |            | 6      | SS   | 64                         | 321             |   |    |    |    |     |   |   |



# RECORD OF BOREHOLE No 98-07

1 OF 1

METRIC

W.P. 363-94-00 SITE:33-221 LOCATION King St. E. North of Arlington Blvd., 4810826N,228113E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 17.11.98 - 17.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE   |  | SAMPLES    |        |      | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC NATURAL LIQUID<br>LIMIT MOISTURE LIMIT<br>CONTENT |   |                | UNIT<br>WEIGHT<br>$\gamma$<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|----------------|--|------------|--------|------|----------------------------|-----------------|---|----|----|----|-----|---|---|----------------|---|---|
| ELEV.<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER | TYPE | "N" VALUES                 |                 | 20  | 40 | 60 | 80 | 100 | W <sub>p</sub>  | W | W <sub>L</sub> |   |   |
| 327.0          | ASPHALT 80mm<br>CRUSHED GRANULAR 200mm<br>Compact to loose, dark brown<br>gravelly sand and silty sand FILL<br>moist |            | 1      | SS   | 10                         | 326             |   |    |    |    |     |   |   |                |   | 0 73 27 0   |
| 324.7          |  |            | 2      | SS   | 4                          | 325             |   |    |    |    |     |   |   |                |   |   |
| 324.3          | wet  |            | 3      | SS   | 14                         | 324             |   |    |    |    |     |   |   |                |   |   |
| 2.6            | Compact, brown fine SAND to<br>SILTY SAND<br>wet   |            | 4      | SS   | 13                         | 323             |   |    |    |    |     |   |   |                |   |   |
| 323.3          |  |            | 5      | SS   | 8                          | 322             |   |    |    |    |     |   |   |                |   | 15 83 2 0   |
| 3.7            | Loose, brown SAND, some gravel,<br>trace silt<br>damp  |            | 6      | SS   | 7                          | 321             |   |    |    |    |     |   |   |                |   |   |
| 321.0          |  |            | 7      | SS   | 38                         | 320             |   |    |    |    |     |   |   |                |   |   |
| 6.0            | dense<br>damp  |            | 8      | SS   | 30                         | 319             |   |    |    |    |     |   |   |                |   |   |
| 318.7          |  |            |        |      |                            |                 |   |    |    |    |     |   |   |                |   |   |
| 8.3            | saturated  |            |        |      |                            |                 |   |    |    |    |     |   |   |                |   |   |
| 318.2          |  |            |        |      |                            |                 |   |    |    |    |     |   |   |                |   |   |
| 8.9            | END OF BOREHOLE @ 8.9m<br>NOTE: Water level recorded @<br>8.3m upon completion                                       |            |        |      |                            |                 |   |    |    |    |     |   |   |                |   |   |



## RECORD OF BOREHOLE No 98-08

1 OF 1

## METRIC

W.P. 363-94-00 SITE:33-221

LOCATION

-King St. E., South of Franklin St., 4810843N 228088E

ORIGINATED BY S.W.

DIST 2 HWY 7 and 8BOREHOLE TYPE Hollow Stem Auger

COMPILED BY S.W.

DATUM GEODETIC

DATE 17.11.98 - 17.11.98

CHECKED BY E.Y.C.

[illegible]

+ 3, x 3; Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

EXPRESS. 3-221.GPJ EXPRESS GDT 20/07/99

144



# RECORD OF BOREHOLE No 98-14

1 OF 1

METRIC

W.P. 363-94-00 SITE 33-221 LOCATION King St. E. North of Franklin St. 4810890N 227967E ORIGINATED BY S.W.  
 DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
 DATUM GEODETTIC DATE 21.11.98 - 21.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |   |            | SAMPLES |             |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|-------------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE        | "N" VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 326.6         | ASPHALT 100mm<br>CRUSHED GRANULAR 300mm<br>Compact, brown gravelly sand FILL                                    |            |         |             |            |                            | 326             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 325.8         | Compact to loose, dark brown fine<br>sand to silty sand FILL<br>moist   |            | 1       | SS          | 12         |                            | 325             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 2       | SS          | 6          |                            | 324             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 3       | SS          | 4          |                            | 323             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 4       | SS          | 4          |                            | 322             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 322.9         | Very dense, brown fine SAND to<br>SILTY SAND<br>damp  |            | 5       | SS          | 81         |                            | 321             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 6       | SS 90/225mm |            |                            | 320             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 7       | SS          | 81         |                            | 319             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 319.2         | saturated   |            | 8       | SS          | 53         |                            | 318             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 9       | SS          | 62         |                            | 317             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 315.9         | Very dense, grey medium to coarse<br>SAND, trace gravel<br>saturated  |            | 10      | SS          | 79         |                            | 316             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 314.9         | Very dense, grey SILT TILL, some<br>clay, trace sand, occasional gravel,<br>frequent medium sand seams<br>moist |            | 11      | SS 90/225mm |            |                            | 315             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 313.9         | END OF BOREHOLE @ 12.7m<br>NOTE: Water level recorded @<br>7.4m upon completion                                 |            |         |             |            |                            | 314             |   |    |    |    |     |                                    |                                     |                                   |                     |   |

EXPRESS: 3-221 GPJ EXPRESS.GDT 20/07/99



# RECORD OF BOREHOLE No 98-18

1 OF 1

METRIC

W.P. 363-94-00 SITE:33-221 LOCATION King St. E. North of Franklin St., 4810946N, 227848E  
 DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger  
 DATUM GEODETIC DATE 18.11.98 - 18.11.98  
 ORIGINATED BY S.W.  
 COMPILED BY S.W.  
 CHECKED BY E.Y.C.

| SOIL PROFILE   |   |            | SAMPLES |             |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>w | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|----------------|---|------------|---------|-------------|------------|----------------------------|-----------------|---|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH  | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE        | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |  |                                    |                                     |                                   |  |  |
| 325.8<br>0.0   | ASPHALT 110mm<br>CRUSHED GRANULAR 350mm<br>Compact, dark brown gravelly sand<br>FILL<br>Compact, dark brown silty sand<br>FILL<br>moist |            | 1       | SS          | 22         |                            |                 |   |  |                                    |                                     |                                   |  |  |
| 324.1<br>1.7   | Compact to very loose, brown fine<br>sand to silty sand FILL<br>damp  |            | 2       | SS          | 15         |                            |                 |   |  |                                    |                                     |                                   |  |  |
|                |   |            | 3       | SS          | 38         |                            |                 |   |  |                                    |                                     |                                   |  |  |
| 322.7<br>3.1   | Compact to very dense, brown<br>medium to fine SAND, trace to<br>some silt<br>damp  |            | 4       | SS          | 61         |                            |                 |   |  |                                    |                                     |                                   |  |  |
|                |   |            | 5       | SS          | 40         |                            |                 |   |  |                                    |                                     |                                   |  |  |
| 319.5<br>6.3   | Very dense, brown GRAVELLY<br>SAND<br>saturated   |            | 6       | SS          | 80         |                            |                 |   |  |                                    |                                     |                                   |  |  |
|                |   |            | 7       | AS          |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
| 316.9<br>318.9 | Very dense, grey Sandy SILT TILL  |            | 8       | SS 80/100mm |            |                            |                 |   |  |                                    |                                     |                                   |  |  |
| 9.2            | END OF BOREHOLE @ 9.2m<br>NOTE: Water level recorded @<br>6.4m upon completion  |            |         |             |            |                            |                 |   |  |                                    |                                     |                                   |  |  |



# RECORD OF BOREHOLE No 98-19

1 OF 1

METRIC

W.P. 363-94-00 SITE 33-221 LOCATION King St. E. North of Franklin St., 4810955N, 227828E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 19.11.98 - 19.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE   |   |             | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|----------------|---|-------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV.<br>DEPTH | DESCRIPTION   | STRAT. PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 325.6<br>0.0   | ASPHALT 100mm<br>CRUSHED GRANULAR 300mm<br>Compact, dark brown gravelly sand<br>FILL<br>Compact to loose, rust to dark<br>brown silty sand FILL, trace gravel<br>damp |             |         |      |            |                            | 325             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|                |   |             | 1       | SS   | 14         |                            | 324             |   |    |    |    |     |                                    |                                     |                                   |                     | 8 72 15 5   |
|                |   |             | 2       | SS   | 8          |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 323.2<br>2.4   | Compact to very dense, brown fine<br>SAND, frequent silty sand seams<br>damp  |             | 3       | SS   | 19         |                            | 323             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|                |   |             | 4       | SS   | 14         |                            | 322             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|                |   |             | 5       | SS   | 19         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     | 3 78 19 0   |
|                |   |             | 6       | SS   | 15         |                            | 321             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|                |   |             | 7       | SS   | 37         |                            | 320             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 319.3<br>6.3   | Dense to very dense, brown<br>medium to fine SAND<br>saturated  |             | 8       | SS   | 34         |                            | 319             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|                |   |             |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 317.5<br>8.1   | END OF BOREHOLE @ 8.1m<br>NOTE: Water level recorded @<br>8.3m (3/3/99)   |             | 9       | SS   | 66         |                            | 318             |   |    |    |    |     |                                    |                                     |                                   |                     |   |

+ 3, X 3, Numbers refer to 0 3% STRAIN AT FAILURE  
Sensitivity

EXPRESS 3-221 GPJ EXPRESS.GDT 22/07/99

147



# RECORD OF BOREHOLE No 98-20

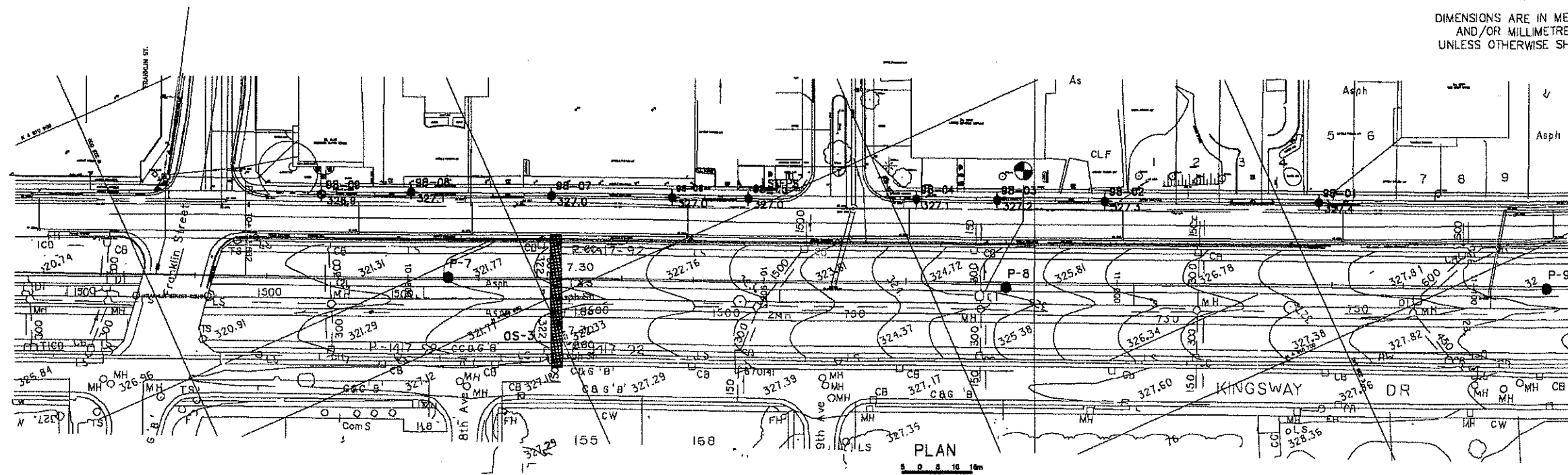
1 OF 1

METRIC

W.P. 363-94-00 SITE 33-221 LOCATION King St. E. North of Franklin St. 4810975N, 227788E ORIGINATED BY S.W.  
DIST 2 HWY 7 and 8 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.W.  
DATUM GEODETIC DATE 18.11.98 - 18.11.98 CHECKED BY E.Y.C.

| SOIL PROFILE  |                                    |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br><br>kN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br><br>GR SA SI CL |
|---------------|------------------------------------|------------|---------|------|------------|----------------------------|-----------------|---|----|----|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION                        | STRAT PLOT | NUMBER  | TYPE | "N" VALUES |                            |                 | SHEAR STRENGTH kPa                          |    |    |                                    |                                     |                                   |  |  |
| 325.3         |                                    |            |         |      |            |                            | 20              | 40  | 60 | 80 | 100                                |                                     |                                   |  |  |
| 0.0           | ASPHALT 100mm                      |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
| 324.6         | CRUSHED GRANULAR 300mm             |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
| 0.7           | Compact, dark brown gravelly sand  |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
| 323.9         | FILL                               |            | 1       | SS   | 18         |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
| 1.4           | Compact, dark brown sandy silt     |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
| 322.8         | FILL                               |            | 2       | SS   | 4          |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
| 2.5           | very moist to wet                  |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               | Loose to compact, dark brown silty |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               | sand FILL                          |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               | damp                               |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            | 3       | SS   | 25         |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            | 4       | SS   | 23         |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            | 5       | SS   | 44         |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |
|               |                                    |            |         |      |            |                            |                 |   |    |    |                                    |                                     |                                   |  |  |





METRIC

DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

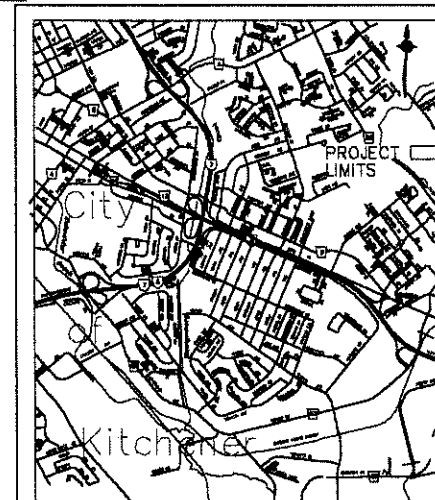
CONT No 2001-3011  
WP No 363-94-00



KING STREET RETAINING  
WALL  
BORE HOLE LOCATIONS & SOIL STRATA

SHEET  
000

**AGRA Earth & Environmental**  
ENGINEERING GLOBAL SOLUTIONS



KEYPLAN

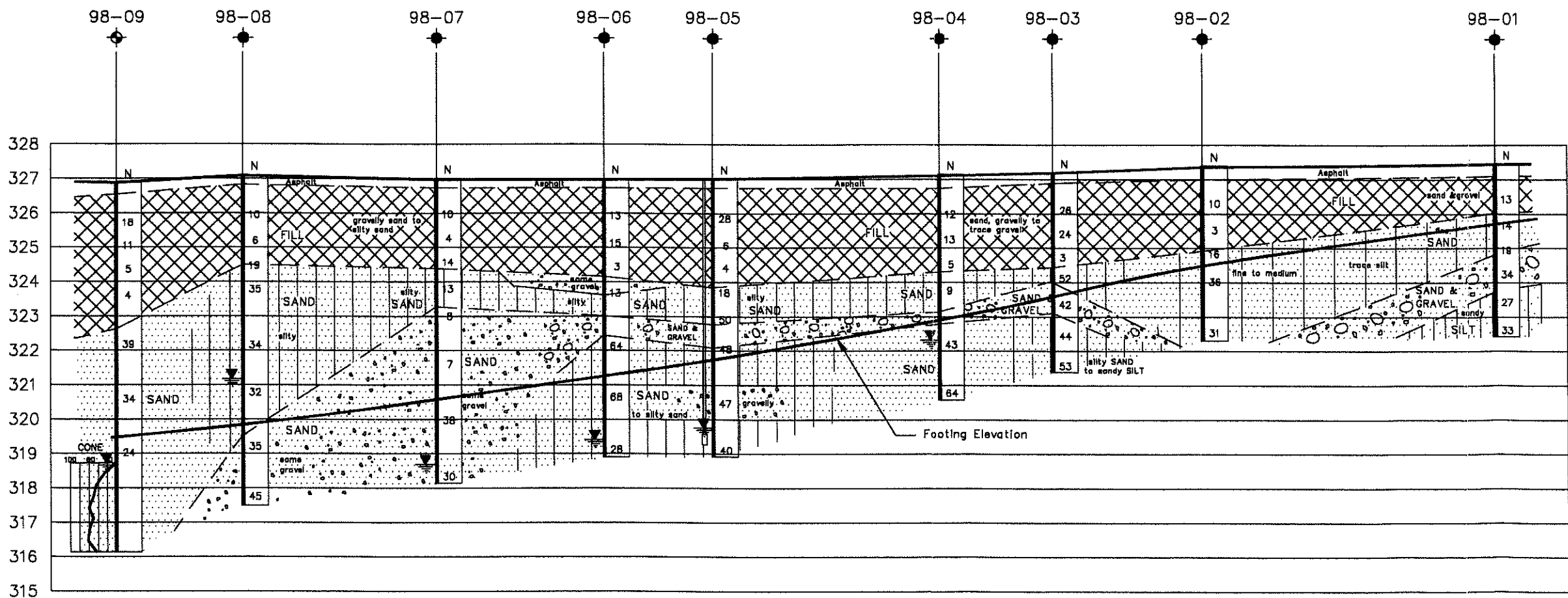
NTS

### LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- Blows/0.3m (Std Pen Test, 475 J/blow)
- Blows/0.3m (60° Cone, 475 J/blow)
- W L at time of investigation
- Standpipe
- Approx. Location of HML Pole
- Approx. Location of Overhead Sign

| No.   | ELEVATION | CO-ORDINATES |         |
|-------|-----------|--------------|---------|
|       |           | NORTH        | EAST    |
| 98-01 | 327.4     | 4 810 735    | 228 310 |
| 98-02 | 327.3     | 4 810 781    | 228 256 |
| 98-03 | 327.2     | 4 810 774    | 228 228 |
| 98-04 | 327.1     | 4 810 784    | 228 207 |
| 98-05 | 327.0     | 4 810 803    | 228 184 |
| 98-06 | 327.0     | 4 810 812    | 228 144 |
| 98-07 | 327.0     | 4 810 826    | 228 113 |
| 98-08 | 327.1     | 4 810 843    | 228 088 |
| 98-09 | 326.9     | 4 810 853    | 228 054 |

NOTE:  
The boundaries between soil strata have been established  
only at Borehole locations. Between Boreholes the boundaries  
are assumed from geological evidence.



5m 0 10m  
Horizontal

NOTE: The complete foundation investigation and design  
report for this project and other related documents may  
be examined at the Engineering Materials Office, Downsview.  
Information contained in this report and related documents  
is specifically excluded in accordance with the conditions of  
Section GC2.01 of OPS Gen. Cond.

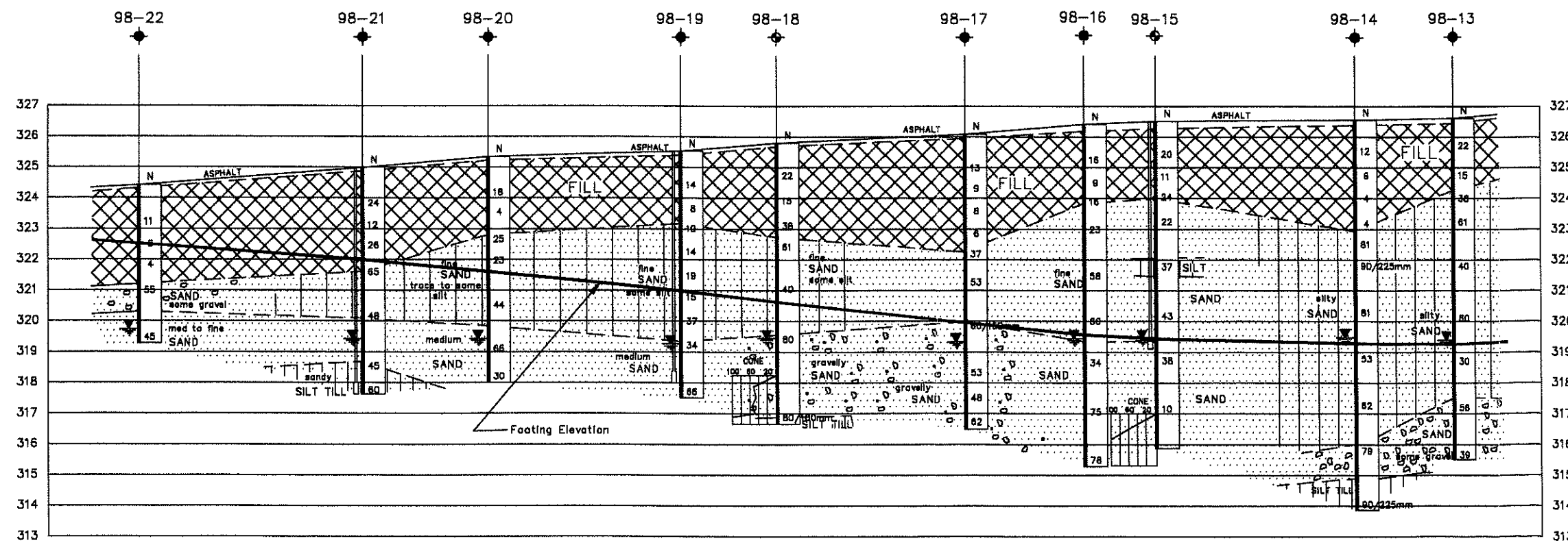
|                 |             |                |             |
|-----------------|-------------|----------------|-------------|
| REVISIONS       |             |                |             |
|                 |             |                |             |
|                 |             |                |             |
|                 |             |                |             |
|                 | DATE        | BY             | DISCRPTION  |
| GEOCRE 40PB-118 |             |                |             |
| HWY No.         |             | HWY 7 & 8      | DIST 31     |
| SUBM'D 00       | CHECKED EYC | DATE June 1999 | SITE 33-221 |
| DRAWN LWM       | CHECKED     | APPROVED       | DWG 3       |



DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

SHEET  
000

## PLAN



Horizontal

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section GC2.01 of OPS Gen. Cond.

|      |                                       |
|------|---------------------------------------|
|      | Bore Hole                             |
|      | Dynamic Cone Penetration Test (Cone)  |
|      | Bore Hole & Cone                      |
| N    | Blows/0.3m (Std Pen Test, 475 J/blow) |
| CONE | Blows/0.3m (60° Cone, 475 J/blow)     |
|      | W L at time of Investigation          |
|      | Standpipe                             |
| P-5  | Approx. Location of HML Pole          |
|      | Approx. Location of Overhead Sign     |

| No.   | ELEVATION | CO-ORDINATES |         |
|-------|-----------|--------------|---------|
|       |           | NORTH        | EAST    |
| 98-13 | 326.7     | 4 810 882    | 227 988 |
| 98-14 | 326.6     | 4 810 890    | 227 987 |
| 98-15 | 326.6     | 4 810 911    | 227 926 |
| 98-18 | 326.4     | 4 810 917    | 227 911 |
| 98-17 | 326.1     | 4 810 929    | 227 887 |
| 98-18 | 325.8     | 4 810 945    | 227 848 |
| 98-19 | 326.6     | 4 810 955    | 227 828 |
| 98-20 | 326.5     | 4 810 976    | 227 788 |
| 98-21 | 325.0     | 4 810 988    | 227 763 |
| 98-22 | 324.4     | 4 811 009    | 227 717 |

-- NOTE --

The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

|                  |             |                |             |
|------------------|-------------|----------------|-------------|
| REVIEWS          |             |                |             |
|                  |             |                |             |
|                  |             |                |             |
| DATE             | BY          | DISCRIPTION    |             |
| GEOCRE5 40P8-118 |             |                |             |
| HWY No.          |             | HWY 7 & 8      | DIST 31     |
| SUBM'D OD        | CHECKED EYC | DATE June 1999 | SITE 33-221 |
| DRAWN IWM        | CHECKED     | APPROVED       | DWG 4       |



## APPENDIX "C"

### Borehole Log Sheets and Borehole Locations and Soil Strata Drawing

GEOCRES 40P8-33



e. m. peto associates ltd.  
SOIL ENGINEERING SERVICE - TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Kitchener - Waterloo Expressway, System No. 6122N

Client: Dept. of Highways, Ontario, Casing: DX

Elevation: 1072.9, Compiled By: A. A. M.

Borehole No. 4, Boring Date: October 15, 1964

Checked by: B. 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 LAMERS       |
| S.T. THIN-WALLED SHELBY TUBE SAMPLE |
| S.E. VASH 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    |
| A.T.P.L. BETTER THAN PLASTIC LIMIT |
| D.T.P.L. DRIER THAN PLASTIC LIMIT  |
| A.P.L. ABOUT PLASTIC LIMIT         |





| SOIL DESCRIPTION                            | Color       | Consistency      | Moisture Content (%) | Specific Gravity | Unit Weight (pcf) | Void Ratio | Water Level & Remarks |
|---|-------------|------------------|----------------------|------------------|-------------------|------------|-----------------------|
| Ground surface                              |             |                  | 0.0                  |                  |                   |            | Comp. Probe           |
| 3" asphalt, sandy silt                      |             |                  | 0.3                  |                  |                   |            | 24                    |
| Mixed with med. sand, silt                  | Dark brown  | Very loose       | 2.4                  |                  |                   |            | 26                    |
| (III). Silty fine sand                      | Light brown | to loose         |                      |                  |                   |            | 1                     |
| Silty fine sand with                        | Brown       | Loose to         |                      |                  |                   |            | 5                     |
| grits (III)                                 |             | Compact          | 10.0                 |                  |                   |            | 10                    |
| Fine to medium sand                         | Light brown | Compact to dense |                      |                  |                   |            | 12                    |
| As above                                    | Ditto       | Compact          |                      |                  |                   |            | 46                    |
| As above                                    | Ditto       | Dense            |                      |                  |                   |            | 39                    |
| As above                                    | Ditto       | Very dense       |                      |                  |                   |            | 44                    |
| As above                                    | Ditto       | Very dense       |                      |                  |                   |            | 92                    |
| As above                                    | Ditto       | Very dense       |                      |                  |                   |            | 113                   |
| As above                                    | Ditto       | Very dense       |                      |                  |                   |            | 136                   |
| As above, with seams of coarse to med. sand | Ditto       | Compact          | 20.0                 |                  |                   |            | 13                    |
| Coarse to fine sand, gravelly seams         | Brown       | Very dense       |                      |                  |                   |            | 15.2                  |
| As above                                    | Ditto       | Dense            | 30.0                 |                  |                   |            | 11.7                  |
| Coarse to medium sand and gravel            | Ditto       | Very dense       | 10                   |                  |                   |            | 17.6                  |
| Clayey silt with grits and pebbles          | Grey        |                  | 37.6                 |                  |                   |            |                       |
| Layers of silty fine sand and sandy silt    | Grey        | Extremely Dense  | 40.0                 |                  |                   |            |                       |
| Sandy silt, grits and pebbles               | Grey        | Ditto            | 45.0                 |                  |                   |            |                       |
| fine sand pockets, layers                   |             |                  |                      |                  |                   |            |                       |
| Test Hole Terminated at 45.0'               |             |                  |                      |                  |                   |            |                       |



e. m. peto associates ltd.  
SOIL ENGINEERING SERVICE - TORONTO, ONTARIO

BORING LOG

Job Name: Kitchener - Waterloo Expressway  
System: Highway  
Client: Dept. of Highways, Ontario  
Elevation: 1073.1  
Borehole No.: 5  
Casing: BX  
Boring Date: Oct. 7th, 1964.  
Compiled By: A. A. M.  
Checked By: B. J.

| SAMPLE CONDITION  |             | SAMPLE TYPE                         |                                    | ABBREVIATIONS |  |
|---|-------------|-------------------------------------|------------------------------------|---------------|--|
|  | UNDISTURBED | A.L. AUGER SAMPLE                   | V.T. IN SITU VANE SHEAR TEST       |               |  |
|  | FAIR        | C.S. CASING SAMPLE                  | M. MOIST                           |               |  |
|  | DISTURBED   | S.S. 2" STANDARD SPLIT TUBE SAMPLE  | W.L. WATER LEVEL IN CASING         |               |  |
|  | LOST        | S.L. SPLIT BARREL WITH LINERS       | O.W. OPENING WATER TABLE IN BORE   |               |  |
|   |             | S.T. THIN-WALLED SHELBY TUBE SAMPLE | W.T.P.L. WETTER THAN PLASTIC LIMIT |               |  |
|   |             | W.L. WASH SAMPLE                    | D.T.P.L. DRIER THAN PLASTIC LIMIT  |               |  |
|   |             | R.C. ROCK CORE                      | A.P.L. ABOUT PLASTIC LIMIT         |               |  |

| SOIL DESCRIPTION   | DEPTH | MOISTURE  | WATER LEVEL | WATER LEVEL & REMARKS                        |
|--|-------|-----------|-------------|--|
| Ground surface   | 0'0"  |           |             | Comp. 11.8                                   |
| 2" of asphalt, 10" of concrete                           | 1'0"  |           |             | Prob. 15.2                                   |
| Fill (fine-medium sand some silt)                        | 1'0"  | Loose     |             | Wet 15.2                                     |
| 1' to medium sand  | 2'0"  | Compact   |             | Moist 28.5                                   |
| As above   | 3'0"  | Dense     |             | Moist 33.5                                   |
| As above   | 4'0"  | As above  |             | Moist 35.5                                   |
| As above   | 5'0"  | Compact   |             | Moist 37.5                                   |
| As above   | 6'0"  | Dense     |             | Quite moist, 38.5                            |
| Layer of silty fine sand                                 | 7'0"  |           |             | Wet 40.5                                     |
| Coarse to fine sand, seam of coarse sand and fine gravel | 8'0"  | Compact   |             | Saturated from 20' 8" 41.5                   |
| Coarse to fine sand some gravel                          | 9'0"  | Dense     |             | Saturated Start using wash water at 26' 42.5 |
| As above   | 10'0" | As above  |             | Saturated 43.5                               |
| Coarse to fine sand, some gravel                         | 11'0" | Hard      |             | Saturated 44.5                               |
| Sandy, clayey silt till                                  | 12'0" |           |             | Wet and W.T.P.L. 45.5                        |
| Silty clay, silt seams                                   | 13'0" |           |             |  |
| Sandy silt till  | 14'0" | Very hard |             | Moist. 46.5                                  |
| Test Hole terminated at 41'6"                            |       |           |             |  |



# e. m. peto associates ltd.

SOIL ENGINEERING SERVICE, TORONTO, ONTARIO

BORERHOLE LOG

Location: Kitchener - Waterloo Expressway Job No. 64228  
 System: Dept. of Highways, Ontario Borehole No. 8  
 Date: Oct. 13 - 14, 1964  
 Compiled By: A. A. N. Checked By: D. L.

**SAMPLE CONDITION**  
☐ UNDISTURBED  
☐ FAIR  
☒ DISTURBED  
☐ LOSE

**SAMPLE TYPE**  
☐ AUGER SAMPLE  
☐ CASING SAMPLE  
☐ STANDARD SPLIT TUBE SAMPLE  
☐ SPLIT BARREL WITH LINERS  
☐ THIN-WALLED MIGHTY TUBE SAMPLE  
☐ W.C. SAMPLE  
☐ ROCK CORE

**ABBREVIATIONS**  
 V.T. IN SITU VANE SHEAR TEST  
 M. MOIST  
 W.L. WATER LEVEL IN CASING  
 G.W. GROUND WATER TABLE IN BORE  
 P.T.P. DEEPER THAN PLASTIC LIMIT  
 D.T.P. DEEPER THAN PLASTIC LIMIT  
 A.P.L. ABOUT PLASTIC LIMIT

| SOIL DESCRIPTION                     | DEPTH (ft)   | WATER CONTENT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX | UNSATURATED WATER CONTENT (%) | WATER LEVEL & REMARKS |
|--------------------------------------|--------------|-------------------|------------------|------------------|-------------------------------|-----------------------|
| Ground surface                       | 0.0          |                   |                  |                  |                               |                       |
| Asphalt                              | 0.0 - 0.5    |                   |                  |                  |                               |                       |
| Sandy gravel                         | 0.5 - 1.0    |                   |                  |                  |                               |                       |
| Very silty fine sand, to light brown | 1.0 - 1.5    | 15                | 25               | 10               | 1.5                           | Quite moist           |
| Low silty sand                       | 1.5 - 2.0    | 15                | 25               | 10               | 1.5                           |                       |
| Fine sand                            | 2.0 - 2.5    | 15                | 25               | 10               | 1.5                           |                       |
| Light brown                          | 2.5 - 3.0    | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 3.0 - 3.5    | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 3.5 - 4.0    | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 4.0 - 4.5    | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 4.5 - 5.0    | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 5.0 - 5.5    | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 5.5 - 6.0    | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 6.0 - 6.5    | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 6.5 - 7.0    | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 7.0 - 7.5    | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 7.5 - 8.0    | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 8.0 - 8.5    | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 8.5 - 9.0    | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 9.0 - 9.5    | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 9.5 - 10.0   | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 10.0 - 10.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 10.5 - 11.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 11.0 - 11.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 11.5 - 12.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 12.0 - 12.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 12.5 - 13.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 13.0 - 13.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 13.5 - 14.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 14.0 - 14.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 14.5 - 15.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 15.0 - 15.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 15.5 - 16.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 16.0 - 16.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 16.5 - 17.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 17.0 - 17.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 17.5 - 18.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 18.0 - 18.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 18.5 - 19.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 19.0 - 19.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 19.5 - 20.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 20.0 - 20.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 20.5 - 21.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 21.0 - 21.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 21.5 - 22.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 22.0 - 22.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 22.5 - 23.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 23.0 - 23.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 23.5 - 24.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 24.0 - 24.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 24.5 - 25.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 25.0 - 25.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 25.5 - 26.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 26.0 - 26.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 26.5 - 27.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 27.0 - 27.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 27.5 - 28.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 28.0 - 28.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 28.5 - 29.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 29.0 - 29.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 29.5 - 30.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 30.0 - 30.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 30.5 - 31.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 31.0 - 31.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 31.5 - 32.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 32.0 - 32.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 32.5 - 33.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 33.0 - 33.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 33.5 - 34.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 34.0 - 34.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 34.5 - 35.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 35.0 - 35.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 35.5 - 36.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 36.0 - 36.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 36.5 - 37.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 37.0 - 37.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 37.5 - 38.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 38.0 - 38.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 38.5 - 39.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 39.0 - 39.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 39.5 - 40.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 40.0 - 40.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 40.5 - 41.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 41.0 - 41.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 41.5 - 42.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 42.0 - 42.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 42.5 - 43.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 43.0 - 43.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 43.5 - 44.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 44.0 - 44.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 44.5 - 45.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 45.0 - 45.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 45.5 - 46.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 46.0 - 46.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 46.5 - 47.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 47.0 - 47.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 47.5 - 48.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 48.0 - 48.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 48.5 - 49.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 49.0 - 49.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 49.5 - 50.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 50.0 - 50.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 50.5 - 51.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 51.0 - 51.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 51.5 - 52.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 52.0 - 52.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 52.5 - 53.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 53.0 - 53.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 53.5 - 54.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 54.0 - 54.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 54.5 - 55.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 55.0 - 55.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 55.5 - 56.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 56.0 - 56.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 56.5 - 57.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 57.0 - 57.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 57.5 - 58.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 58.0 - 58.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 58.5 - 59.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 59.0 - 59.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 59.5 - 60.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 60.0 - 60.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 60.5 - 61.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 61.0 - 61.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 61.5 - 62.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 62.0 - 62.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 62.5 - 63.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 63.0 - 63.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 63.5 - 64.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 64.0 - 64.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 64.5 - 65.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 65.0 - 65.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 65.5 - 66.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 66.0 - 66.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 66.5 - 67.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 67.0 - 67.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 67.5 - 68.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 68.0 - 68.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 68.5 - 69.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 69.0 - 69.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 69.5 - 70.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 70.0 - 70.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 70.5 - 71.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 71.0 - 71.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 71.5 - 72.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 72.0 - 72.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 72.5 - 73.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 73.0 - 73.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 73.5 - 74.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 74.0 - 74.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 74.5 - 75.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 75.0 - 75.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 75.5 - 76.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 76.0 - 76.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 76.5 - 77.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 77.0 - 77.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 77.5 - 78.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 78.0 - 78.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 78.5 - 79.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 79.0 - 79.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 79.5 - 80.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 80.0 - 80.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 80.5 - 81.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 81.0 - 81.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 81.5 - 82.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 82.0 - 82.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 82.5 - 83.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 83.0 - 83.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 83.5 - 84.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 84.0 - 84.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 84.5 - 85.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 85.0 - 85.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 85.5 - 86.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 86.0 - 86.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 86.5 - 87.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 87.0 - 87.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 87.5 - 88.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 88.0 - 88.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 88.5 - 89.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 89.0 - 89.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 89.5 - 90.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 90.0 - 90.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 90.5 - 91.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 91.0 - 91.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 91.5 - 92.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 92.0 - 92.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 92.5 - 93.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 93.0 - 93.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 93.5 - 94.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 94.0 - 94.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 94.5 - 95.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 95.0 - 95.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 95.5 - 96.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 96.0 - 96.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 96.5 - 97.0  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 97.0 - 97.5  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 97.5 - 98.0  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 98.0 - 98.5  | 15                | 25               | 10               | 1.5                           |                       |
| As above                             | 98.5 - 99.0  | 15                | 25               | 10               | 1.5                           |                       |
| Ditto                                | 99.0 - 99.5  | 15                | 25               | 10               | 1.5                           |                       |
| Compacted                            | 99.5 - 100.0 | 15                | 25               | 10               | 1.5                           |                       |



**e. m. peto associates ltd.**  
SOIL ENGINEERING SERVICE - TORONTO, ONTARIO

**BOREHOLE LOG**

Job Name: Kitchener - Waterloo Expressway System, Job No. 6422H Borehole No. 7  
Client: Department of Highways, Ontario Casing IX Boring Date: October 8 - 9, 1964.  
Elevation: 1067.4 Compiled By: A. A. M. Checked By: H. L.

| SAMPLE CONDITION |             | SAMPLE TYPE                        |                                    | ABBREVIATIONS |  |
|------------------|-------------|------------------------------------|------------------------------------|---------------|--|
|                  | UNDISTURBED | A.S. AUGER SAMPLE                  | V.T. IN SITU VANE SHEAR TEST       |               |  |
|                  | FAIR        | C.S. CASING SAMPLE                 | M. MOIST                           |               |  |
|                  | DISTURBED   | S.L. 7" STANDARD SPLIT TUBE SAMPLE | W.L. WATER LEVEL IN CASING         |               |  |
|                  | LOST        | S.L. SPLIT BARREL WITH LINER       | W.T. GROUND WATER TABLE IN SOIL    |               |  |
|                  |             | S.T. THINWALLED SHEAR TUBE SAMPLE  | W.T.P.L. WETTER THAN PLASTIC LIMIT |               |  |
|                  |             | W.S. WASH SAMPLE                   | D.T.P.L. DRIER THAN PLASTIC LIMIT  |               |  |
|                  |             | R.C. ROCK CORE                     | A.P.L. ABOVE PLASTIC LIMIT         |               |  |

| SOIL DESCRIPTION                              | Color       | Consistency     | Depth (Feet) | Sample No. | Moisture (%) | WATER LEVEL & REMARKS                    |
|---|-------------|-----------------|--------------|------------|--------------|--|
| Ground surface                                |             |                 | 0.0          |            |              |  |
| Asphalt and concrete                          |             |                 | 0.0          |            |              |  |
| Coarse to fine sand (fill)                    | Roast brown | Very loose      | 0.0 - 1.0    | 1          | SS 5         | 11.0 (Quite moist.)                      |
| Silty fine sand                               | Brown       | to loose        | 1.0 - 2.0    | 2          | SS 5         |  |
| Fine sand                                     | Light brown | Compact         | 2.0 - 3.0    | 3          | SS 23        | 4.0 Moist                                |
| As above                                      | Ditto       | Ditto           | 3.0 - 4.0    | 4          | SS 27        | 6.5 Moist                                |
| Medium to fine sand                           | Ditto       | Compact         | 4.0 - 5.0    | 5          | SS 29        | 1.8 Moist.                               |
| As above                                      | Ditto       | to dense        | 5.0 - 6.0    | 6          | SS 44        | 2.3 Moist.                               |
| As above                                      | As above    | As above        | 6.0 - 7.0    | 7          | CS 45        | 8.0 Coarse moist.                        |
|   |             |                 | 7.0 - 8.0    |            |              | Saturated from 17'                       |
| Coarse to medium sand and gravel              | Brown       | Ditto           | 8.0 - 9.0    | 8          | SS 36        | 18.1 Saturated.                          |
|   |             |                 | 9.0 - 10.0   |            |              |  |
| Silty clay, few grits & pebbles, silt pockets | Grey        | Very hard       | 10.0 - 11.0  | 9          | SS 101       | 13.5 D.T.P.L. LL-47.5% PL-19.5% PI-28.0% |
| Sandy silt till                               |             |                 | 11.0 - 12.0  |            |              |  |
| Silty sand till, silt pockets                 | Grey        | Extremely Dense | 12.0 - 13.0  | 10         | SS 146       | Wet                                      |
|   |             |                 | 13.0 - 14.0  |            |              |  |
|   |             |                 | 14.0 - 15.0  |            |              |  |
|   |             |                 | 15.0 - 16.0  |            |              |  |
|   |             |                 | 16.0 - 17.0  |            |              |  |
|   |             |                 | 17.0 - 18.0  |            |              |  |
|   |             |                 | 18.0 - 19.0  |            |              |  |
|   |             |                 | 19.0 - 20.0  |            |              |  |
|   |             |                 | 20.0 - 21.0  |            |              |  |
|   |             |                 | 21.0 - 22.0  |            |              |  |
|   |             |                 | 22.0 - 23.0  |            |              |  |
|   |             |                 | 23.0 - 24.0  |            |              |  |
|   |             |                 | 24.0 - 25.0  |            |              |  |
|   |             |                 | 25.0 - 26.0  |            |              |  |
|   |             |                 | 26.0 - 27.0  |            |              |  |
|   |             |                 | 27.0 - 28.0  |            |              |  |
|   |             |                 | 28.0 - 29.0  |            |              |  |
|   |             |                 | 29.0 - 30.0  |            |              |  |
|   |             |                 | 30.0 - 31.0  |            |              |  |
|   |             |                 | 31.0 - 32.0  |            |              |  |
|   |             |                 | 32.0 - 33.0  |            |              |  |
|   |             |                 | 33.0 - 34.0  |            |              |  |
|   |             |                 | 34.0 - 35.0  |            |              |  |
|   |             |                 | 35.0 - 36.0  |            |              |  |
|   |             |                 | 36.0 - 37.0  |            |              |  |
|   |             |                 | 37.0 - 38.0  |            |              |  |
|   |             |                 | 38.0 - 39.0  |            |              |  |
|   |             |                 | 39.0 - 40.0  |            |              |  |
|   |             |                 | 40.0 - 41.0  |            |              |  |
|   |             |                 | 41.0 - 42.0  |            |              |  |
|   |             |                 | 42.0 - 43.0  |            |              |  |
|   |             |                 | 43.0 - 44.0  |            |              |  |
|   |             |                 | 44.0 - 45.0  |            |              |  |
|   |             |                 | 45.0 - 46.0  |            |              |  |
|   |             |                 | 46.0 - 47.0  |            |              |  |
|   |             |                 | 47.0 - 48.0  |            |              |  |
|   |             |                 | 48.0 - 49.0  |            |              |  |
|   |             |                 | 49.0 - 50.0  |            |              |  |
|   |             |                 | 50.0 - 51.0  |            |              |  |
|   |             |                 | 51.0 - 52.0  |            |              |  |
|   |             |                 | 52.0 - 53.0  |            |              |  |
|   |             |                 | 53.0 - 54.0  |            |              |  |
|   |             |                 | 54.0 - 55.0  |            |              |  |
|   |             |                 | 55.0 - 56.0  |            |              |  |
|   |             |                 | 56.0 - 57.0  |            |              |  |
|   |             |                 | 57.0 - 58.0  |            |              |  |
|   |             |                 | 58.0 - 59.0  |            |              |  |
|   |             |                 | 59.0 - 60.0  |            |              |  |
|   |             |                 | 60.0 - 61.0  |            |              |  |
|   |             |                 | 61.0 - 62.0  |            |              |  |
|   |             |                 | 62.0 - 63.0  |            |              |  |
|   |             |                 | 63.0 - 64.0  |            |              |  |
|   |             |                 | 64.0 - 65.0  |            |              |  |
|   |             |                 | 65.0 - 66.0  |            |              |  |
|   |             |                 | 66.0 - 67.0  |            |              |  |
|   |             |                 | 67.0 - 68.0  |            |              |  |
|   |             |                 | 68.0 - 69.0  |            |              |  |
|   |             |                 | 69.0 - 70.0  |            |              |  |
|   |             |                 | 70.0 - 71.0  |            |              |  |
|   |             |                 | 71.0 - 72.0  |            |              |  |
|   |             |                 | 72.0 - 73.0  |            |              |  |
|   |             |                 | 73.0 - 74.0  |            |              |  |
|   |             |                 | 74.0 - 75.0  |            |              |  |
|   |             |                 | 75.0 - 76.0  |            |              |  |
|   |             |                 | 76.0 - 77.0  |            |              |  |
|   |             |                 | 77.0 - 78.0  |            |              |  |
|   |             |                 | 78.0 - 79.0  |            |              |  |
|   |             |                 | 79.0 - 80.0  |            |              |  |
|   |             |                 | 80.0 - 81.0  |            |              |  |
|   |             |                 | 81.0 - 82.0  |            |              |  |
|   |             |                 | 82.0 - 83.0  |            |              |  |
|   |             |                 | 83.0 - 84.0  |            |              |  |
|   |             |                 | 84.0 - 85.0  |            |              |  |
|   |             |                 | 85.0 - 86.0  |            |              |  |
|   |             |                 | 86.0 - 87.0  |            |              |  |
|   |             |                 | 87.0 - 88.0  |            |              |  |
|   |             |                 | 88.0 - 89.0  |            |              |  |
|   |             |                 | 89.0 - 90.0  |            |              |  |
|   |             |                 | 90.0 - 91.0  |            |              |  |
|   |             |                 | 91.0 - 92.0  |            |              |  |
|   |             |                 | 92.0 - 93.0  |            |              |  |
|   |             |                 | 93.0 - 94.0  |            |              |  |
|   |             |                 | 94.0 - 95.0  |            |              |  |
|   |             |                 | 95.0 - 96.0  |            |              |  |
|   |             |                 | 96.0 - 97.0  |            |              |  |
|   |             |                 | 97.0 - 98.0  |            |              |  |
|   |             |                 | 98.0 - 99.0  |            |              |  |
|   |             |                 | 99.0 - 100.0 |            |              |  |



**e. m. peto associates ltd.**  
SOIL ENGINEERING SERVICE - TORONTO, ONTARIO

BORING LOG

Job Name: Kitchener-Waterloo Expressway Job No.: 64228 Borehole No.: 13  
Client: Dept. of Highways, Ontario Casing: BX Drilling Date: October 28, 1968  
Street: 1075 S Compiled By: A.A.M. Checked By: B.L.

| SAMPLE CONDITION                                |  | SAMPLE TYPE                        |  | ABBREVIATIONS                      |  |
|---|--|------------------------------------|--|------------------------------------|--|
| <input checked="" type="checkbox"/> UNDISTURBED |  | A.S. ALIQUOT SAMPLE                |  | V.T. IN SITU VANE UNSAT (REV)      |  |
| <input checked="" type="checkbox"/> PAIR        |  | C.S. CASTING SAMPLE                |  | D.L. DEPTH                         |  |
| <input checked="" type="checkbox"/> DISTURBED   |  | S.S. 1" STANDARD SPLIT TUBE SAMPLE |  | V.L. WATER LEVEL IN Casing         |  |
| <input checked="" type="checkbox"/> LOST        |  | S.L. SPLIT BARREL WITH LINERS      |  | V.T. GROUND WATER TABLE IN BORING  |  |
|   |  | S.T. THINWALLED SHELDY TUBE SAMPLE |  | V.T.P.L. DEPTER THAN PLASTIC LIMIT |  |
|   |  | S.L. SAND SAMPLE                   |  | S.T.P.L. DRIER THAN PLASTIC LIMIT  |  |
|   |  | R.C. ROCK CORE                     |  | A.P.L. ABOUT PLASTIC LIMIT         |  |

| SOIL DESCRIPTION               | DEPTH | TYPE  | WATER CONTENT (%) | WATER SAMPLE & REMARKS |
|--------------------------------|-------|-------|-------------------|------------------------|
| Ground surface                 | 0.00  |       |                   |                        |
| 2" of asphalt, 1" of concrete  | 0.09  |       |                   |                        |
| Sandy loam                     | 0.10  | Loose | 85                | 8                      |
| Sandy silt odd grits           | 0.10  | Loose | 85                | 17                     |
| Silty fine sand and sandy silt | 0.10  | Loose | 85                | 39                     |
| Silty fine sand                | 0.10  | Loose | 85                | 40                     |
| Fine to med. sand              | 0.10  | Dense | 85                | 39                     |
| As above                       | 0.10  | Loose | 85                | 49                     |
| As above                       | 0.10  | Loose | 85                | 47                     |
| As above                       | 0.10  | Loose | 85                | 51                     |
| As above                       | 0.10  | Loose | 85                | 53                     |
| As above                       | 0.10  | Loose | 85                | 55                     |
| As above                       | 0.10  | Loose | 85                | 57                     |
| As above                       | 0.10  | Loose | 85                | 59                     |
| As above                       | 0.10  | Loose | 85                | 61                     |
| As above                       | 0.10  | Loose | 85                | 63                     |
| As above                       | 0.10  | Loose | 85                | 65                     |
| As above                       | 0.10  | Loose | 85                | 67                     |
| As above                       | 0.10  | Loose | 85                | 69                     |
| As above                       | 0.10  | Loose | 85                | 71                     |
| As above                       | 0.10  | Loose | 85                | 73                     |
| As above                       | 0.10  | Loose | 85                | 75                     |
| As above                       | 0.10  | Loose | 85                | 77                     |
| As above                       | 0.10  | Loose | 85                | 79                     |
| As above                       | 0.10  | Loose | 85                | 81                     |
| As above                       | 0.10  | Loose | 85                | 83                     |
| As above                       | 0.10  | Loose | 85                | 85                     |
| As above                       | 0.10  | Loose | 85                | 87                     |
| As above                       | 0.10  | Loose | 85                | 89                     |
| As above                       | 0.10  | Loose | 85                | 91                     |
| As above                       | 0.10  | Loose | 85                | 93                     |
| As above                       | 0.10  | Loose | 85                | 95                     |
| As above                       | 0.10  | Loose | 85                | 97                     |
| As above                       | 0.10  | Loose | 85                | 99                     |
| As above                       | 0.10  | Loose | 85                | 101                    |
| As above                       | 0.10  | Loose | 85                | 103                    |
| As above                       | 0.10  | Loose | 85                | 105                    |
| As above                       | 0.10  | Loose | 85                | 107                    |
| As above                       | 0.10  | Loose | 85                | 109                    |
| As above                       | 0.10  | Loose | 85                | 111                    |
| As above                       | 0.10  | Loose | 85                | 113                    |
| As above                       | 0.10  | Loose | 85                | 115                    |
| As above                       | 0.10  | Loose | 85                | 117                    |
| As above                       | 0.10  | Loose | 85                | 119                    |
| As above                       | 0.10  | Loose | 85                | 121                    |
| As above                       | 0.10  | Loose | 85                | 123                    |
| As above                       | 0.10  | Loose | 85                | 125                    |
| As above                       | 0.10  | Loose | 85                | 127                    |
| As above                       | 0.10  | Loose | 85                | 129                    |
| As above                       | 0.10  | Loose | 85                | 131                    |
| As above                       | 0.10  | Loose | 85                | 133                    |
| As above                       | 0.10  | Loose | 85                | 135                    |
| As above                       | 0.10  | Loose | 85                | 137                    |
| As above                       | 0.10  | Loose | 85                | 139                    |
| As above                       | 0.10  | Loose | 85                | 141                    |
| As above                       | 0.10  | Loose | 85                | 143                    |
| As above                       | 0.10  | Loose | 85                | 145                    |
| As above                       | 0.10  | Loose | 85                | 147                    |
| As above                       | 0.10  | Loose | 85                | 149                    |
| As above                       | 0.10  | Loose | 85                | 151                    |
| As above                       | 0.10  | Loose | 85                | 153                    |
| As above                       | 0.10  | Loose | 85                | 155                    |
| As above                       | 0.10  | Loose | 85                | 157                    |
| As above                       | 0.10  | Loose | 85                | 159                    |
| As above                       | 0.10  | Loose | 85                | 161                    |
| As above                       | 0.10  | Loose | 85                | 163                    |
| As above                       | 0.10  | Loose | 85                | 165                    |
| As above                       | 0.10  | Loose | 85                | 167                    |
| As above                       | 0.10  | Loose | 85                | 169                    |
| As above                       | 0.10  | Loose | 85                | 171                    |
| As above                       | 0.10  | Loose | 85                | 173                    |
| As above                       | 0.10  | Loose | 85                | 175                    |
| As above                       | 0.10  | Loose | 85                | 177                    |
| As above                       | 0.10  | Loose | 85                | 179                    |
| As above                       | 0.10  | Loose | 85                | 181                    |
| As above                       | 0.10  | Loose | 85                | 183                    |
| As above                       | 0.10  | Loose | 85                | 185                    |
| As above                       | 0.10  | Loose | 85                | 187                    |
| As above                       | 0.10  | Loose | 85                | 189                    |
| As above                       | 0.10  | Loose | 85                | 191                    |
| As above                       | 0.10  | Loose | 85                | 193                    |
| As above                       | 0.10  | Loose | 85                | 195                    |
| As above                       | 0.10  | Loose | 85                | 197                    |
| As above                       | 0.10  | Loose | 85                | 199                    |
| As above                       | 0.10  | Loose | 85                | 201                    |
| As above                       | 0.10  | Loose | 85                | 203                    |
| As above                       | 0.10  | Loose | 85                | 205                    |
| As above                       | 0.10  | Loose | 85                | 207                    |
| As above                       | 0.10  | Loose | 85                | 209                    |
| As above                       | 0.10  | Loose | 85                | 211                    |
| As above                       | 0.10  | Loose | 85                | 213                    |
| As above                       | 0.10  | Loose | 85                | 215                    |
| As above                       | 0.10  | Loose | 85                | 217                    |
| As above                       | 0.10  | Loose | 85                | 219                    |
| As above                       | 0.10  | Loose | 85                | 221                    |
| As above                       | 0.10  | Loose | 85                | 223                    |
| As above                       | 0.10  | Loose | 85                | 225                    |
| As above                       | 0.10  | Loose | 85                | 227                    |
| As above                       | 0.10  | Loose | 85                | 229                    |
| As above                       | 0.10  | Loose | 85                | 231                    |
| As above                       | 0.10  | Loose | 85                | 233                    |
| As above                       | 0.10  | Loose | 85                | 235                    |
| As above                       | 0.10  | Loose | 85                | 237                    |
| As above                       | 0.10  | Loose | 85                | 239                    |
| As above                       | 0.10  | Loose | 85                | 241                    |
| As above                       | 0.10  | Loose | 85                | 243                    |
| As above                       | 0.10  | Loose | 85                | 245                    |
| As above                       | 0.10  | Loose | 85                | 247                    |
| As above                       | 0.10  | Loose | 85                | 249                    |
| As above                       | 0.10  | Loose | 85                | 251                    |
| As above                       | 0.10  | Loose | 85                | 253                    |
| As above                       | 0.10  | Loose | 85                | 255                    |
| As above                       | 0.10  | Loose | 85                | 257                    |
| As above                       | 0.10  | Loose | 85                | 259                    |
| As above                       | 0.10  | Loose | 85                | 261                    |
| As above                       | 0.10  | Loose | 85                | 263                    |
| As above                       | 0.10  | Loose | 85                | 265                    |
| As above                       | 0.10  | Loose | 85                | 267                    |
| As above                       | 0.10  | Loose | 85                | 269                    |
| As above                       | 0.10  | Loose | 85                | 271                    |
| As above                       | 0.10  | Loose | 85                | 273                    |
| As above                       | 0.10  | Loose | 85                | 275                    |
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| As above                       | 0.10  | Loose | 85                | 285                    |
| As above                       | 0.10  | Loose | 85                | 287                    |
| As above                       | 0.10  | Loose | 85                | 289                    |
| As above                       | 0.10  | Loose | 85                | 291                    |
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| As above                       | 0.10  | Loose | 85                | 299                    |
| As above                       | 0.10  | Loose | 85                | 301                    |
| As above                       | 0.10  | Loose | 85                | 303                    |
| As above                       | 0.10  | Loose | 85                | 305                    |
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| As above                       | 0.10  | Loose | 85                | 317                    |
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| As above                       | 0.10  | Loose | 85                | 371                    |
| As above                       | 0.10  | Loose | 85                | 373                    |
| As above                       | 0.10  | Loose | 85                | 375                    |
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| As above                       | 0.10  | Loose | 85                | 381                    |
| As above                       | 0.10  | Loose | 85                | 383                    |
| As above                       | 0.10  | Loose | 85                | 385                    |
| As above                       | 0.10  | Loose | 85                | 387                    |
| As above                       | 0.10  | Loose | 85                | 389                    |
| As above                       | 0.10  | Loose | 85                | 391                    |
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| As above                       | 0.10  | Loose | 85                | 397                    |
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| As above                       | 0.10  | Loose | 85                | 405                    |
| As above                       | 0.10  | Loose | 85                | 407                    |
| As above                       | 0.10  | Loose | 85                | 409                    |
| As above                       | 0.10  | Loose | 85                | 411                    |
| As above                       | 0.10  | Loose | 85                | 413                    |
| As above                       | 0.10  | Loose | 85                | 415                    |
| As above                       | 0.10  | Loose | 85                | 417                    |
| As above                       | 0.10  | Loose | 85                | 419                    |
| As above                       | 0.10  | Loose | 85                | 421                    |
| As above                       | 0.10  | Loose | 85                | 423                    |
| As above                       | 0.10  | Loose | 85                | 425                    |
| As above                       | 0.10  | Loose | 85                | 427                    |
| As above                       | 0.10  | Loose | 85                | 429                    |
| As above                       | 0.10  | Loose | 85                | 431                    |
| As above                       | 0.10  | Loose | 85                | 433                    |
| As above                       | 0.10  | Loose | 85                | 435                    |
| As above                       | 0.10  | Loose | 85                | 437                    |
| As above                       | 0.10  | Loose | 85                | 439                    |
| As above                       | 0.10  | Loose | 85                | 441                    |
| As above                       | 0.10  | Loose | 85                | 443                    |
| As above                       | 0.10  | Loose | 85                | 445                    |
| As above                       | 0.10  | Loose | 85                | 447                    |
| As above                       | 0.10  | Loose | 85                | 449                    |
| As above                       | 0.10  | Loose | 85                | 451                    |
| As above                       | 0.10  | Loose | 85                | 453                    |
| As above                       | 0.10  | Loose | 85                | 455                    |
| As above                       | 0.10  | Loose | 85                | 457                    |
| As above                       | 0.10  | Loose | 85                | 459                    |
| As above                       | 0.10  | Loose | 85                | 461                    |
| As above                       | 0.10  | Loose | 85                | 463                    |
| As above                       | 0.10  | Loose | 85                | 465                    |
| As above                       | 0.10  | Loose | 85                | 467                    |
| As above                       | 0.10  | Loose | 85                | 469                    |
| As above                       | 0.10  | Loose | 85                | 471                    |
| As above                       | 0.10  | Loose | 85                | 473                    |
| As above                       | 0.10  | Loose | 85                | 475                    |
| As above                       | 0.10  | Loose | 85                | 477                    |
| As above                       | 0.10  | Loose | 85                | 479                    |
| As above                       | 0.10  | Loose | 85                | 481                    |
| As above                       | 0.10  | Loose | 85                | 483                    |
| As above                       | 0.10  | Loose | 85                | 485                    |
| As above                       | 0.10  | Loose | 85                | 487                    |
| As above                       | 0.10  | Loose | 85                | 489                    |
| As above                       | 0.10  | Loose | 85                | 491                    |
| As above                       | 0.10  | Loose | 85                | 493                    |
| As above                       | 0.10  | Loose | 85                | 495                    |
| As above                       | 0.10  | Loose | 85                | 497                    |
| As above                       | 0.10  | Loose | 85                | 499                    |
| As above                       | 0.10  | Loose | 85                | 501                    |
| As above                       | 0.10  | Loose | 85                | 503                    |
| As above                       | 0.10  | Loose | 85                | 505                    |
| As above                       | 0.10  | Loose | 85                | 507                    |
| As above                       | 0.10  | Loose | 85                | 509                    |
| As above                       | 0.10  | Loose | 85                | 511                    |
| As above                       | 0.10  | Loose | 85                | 513                    |
| As above                       | 0.10  | Loose | 85                | 515                    |
| As above                       | 0.10  | Loose | 85                | 517                    |
| As above                       | 0.10  | Loose | 85                | 519                    |
| As above                       | 0.10  | Loose | 85                | 521                    |
| As above                       | 0.10  | Loose | 85                | 523                    |
| As above                       | 0.10  | Loose | 85                | 525                    |
| As above                       | 0.10  | Loose | 85                | 527                    |
| As above                       | 0.10  | Loose | 85                | 529                    |
| As above                       | 0.10  | Loose | 85                | 531                    |
| As above                       | 0.10  | Loose | 85                | 533                    |
| As above                       | 0.10  | Loose | 85                | 535                    |
| As above                       | 0.10  | Loose | 85                | 537                    |
| As above                       | 0.10  | Loose | 85                | 539                    |
| As above                       | 0.10  | Loose | 85                | 541                    |
| As above                       | 0.10  | Loose | 85                | 543                    |
| As above                       | 0.10  | Loose | 85                | 545                    |
| As above                       | 0.10  | Loose | 85                | 547                    |
| As above                       | 0.10  | Loose | 85                | 549                    |
| As above                       | 0.10  | Loose | 85                | 551                    |
| As above                       | 0.10  | Loose | 85                | 553                    |
| As above                       | 0.10  | Loose | 85                | 555                    |
| As above                       | 0.10  | Loose | 85                | 557                    |
| As above                       | 0.10  | Loose | 85                | 559                    |
| As above                       | 0.10  | Loose | 85                | 561                    |
| As above                       | 0.10  | Loose | 85                | 563                    |
| As above                       | 0.10  | Loose | 85                | 565                    |
| As above                       | 0.10  | Loose | 85                | 567                    |
| As above                       | 0.10  | Loose | 85                | 569                    |
| As above                       | 0.10  | Loose | 85                | 571                    |
| As above                       | 0.10  | Loose | 85                | 573                    |
| As above                       | 0.10  | Loose | 85                | 575                    |
| As above                       | 0.10  | Loose | 85                | 577                    |
| As above                       | 0.10  | Loose | 85                | 579                    |
| As above                       | 0.10  | Loose | 85                | 581                    |
| As above                       | 0.10  | Loose | 85                | 583                    |
| As above                       | 0.10  | Loose | 85                | 585                    |
| As above                       | 0.10  | Loose | 85                | 587                    |
| As above                       | 0.10  | Loose | 85                | 589                    |
| As above                       | 0.10  | Loose | 85                | 591                    |
| As above                       | 0.10  | Loose | 85                | 593                    |
| As above                       | 0.10  | Loose |                   |                        |



**e. m. peto associates ltd.**  
SOIL ENGINEERING SERVICE - TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Kitchener-Waterloo Expressway Job No.: 6422 Borehole No.: 16  
Client: Dept. of Highways of Ontario Casing: 1 1/2" Boring Date: October 22 - 23, 1964  
Elevation: 1075.7 Compiled By: A. A. M. Checked By: D. L.

| SAMPLE CONDITION         |             | SAMPLE TYPE                        |  | ABBREVIATIONS |                            |
|--------------------------|-------------|------------------------------------|--|---------------|----------------------------|
| <input type="checkbox"/> | UNDISTURBED | S.L. SPLIT SAMPLE                  |  | V.T.          | IN SITU VANE SHEAR TEST    |
| <input type="checkbox"/> | FAW         | C.L. CASING SAMPLE                 |  | W             | WATER                      |
| <input type="checkbox"/> | DISTURBED   | S.L. STANDARD SPLIT TUBE SAMPLE    |  | W.L.          | WATER LEVEL IN CASING      |
| <input type="checkbox"/> | LOST        | S.L. SPLIT SAMP. WITH LINER        |  | W.T.          | GROUND WATER TABLE IN SOIL |
|                          |             | S.T. THIN-WALLED SPLIT TUBE SAMPLE |  | W.T.P.L.      | WETTER THAN PLASTIC LIMIT  |
|                          |             | N.L. RASH SAMPLE                   |  | S.T.P.L.      | DRYER THAN PLASTIC LIMIT   |
|                          |             | R.C. ROCK CORE                     |  | A.P.L.        | ABOUT PLASTIC LIMIT        |

| SOIL DESCRIPTION                                       | LOG                 | Remarks             | Depth (ft) | Moisture (%) | Wet Weight (lb) | Wet Volume (cu ft) | Wet Density (pcf) | Wet Unit Weight (pcf) | Wet Level & Remarks    |
|--|---------------------|---------------------|------------|--------------|-----------------|--------------------|-------------------|-----------------------|------------------------|
| Ground surface   |                     |                     | 0.0        |              |                 |                    |                   |                       | No wash water used.    |
| 1" asphalt, 10" crushed                                |                     |                     | 1.2        |              |                 |                    |                   |                       |                        |
| Fill (sandy silt and silty fine sand; stones, pebbles) | Dark brown to brown | Very loose to loose | 1.2        | 45           | 4               | 10.9               |                   |                       | Moist.                 |
| Clayey fine sand                                       | Brown               | Loose to compact    | 6.0        | 55           | 11              | 15.4               |                   |                       | O. moist & W. T. P. L. |
| Fine to med. sand                                      | Light brown         | Compact             |            | 55           | 26              | 3.5                |                   |                       | Moist                  |
| As above   | Light brown         | Compact             |            | 55           | 26              | 3.5                |                   |                       | Moist                  |
| As above, seams of                                     | Ditto               | Ditto               |            | 55           | 22              | 3.1                |                   |                       | Moist                  |
| Very fine sand, layers of fine gravel                  | Ditto               |                     |            | 55           | 20              | 2.9                |                   |                       | Moist                  |
| Coarse to med. sand                                    | Ditto               |                     |            | 55           | 20              | 2.9                |                   |                       | Moist                  |
| As above   |                     |                     |            | 55           | 20              | 2.9                |                   |                       | Moist                  |
| 4" silty fine sand seam at                             | 5'3" Brown          | Ditto               |            | 55           | 24              | 17.3               |                   |                       | Wet                    |
| Fine to medium sand, some light brown                  |                     |                     |            | 55           | 24              | 17.3               |                   |                       | Moist                  |
| As above   |                     |                     |            | 55           | 24              | 17.3               |                   |                       | Moist                  |
| As above   |                     |                     |            | 55           | 24              | 17.3               |                   |                       | Moist                  |
| Fine to medium sand                                    | Ditto               | Ditto               |            | 55           | 25              | 4.0                |                   |                       | Moist                  |
| As above   |                     |                     |            | 55           | 25              | 4.0                |                   |                       | Moist                  |
| Fine sand  | Brown               | Ditto               |            | 55           | 24              | 21.4               |                   |                       | Wet Saturated from 21' |
| As above   |                     |                     |            | 55           | 24              | 21.4               |                   |                       | Wet Saturated from 21' |
| As above   | Ditto               | Dense               | 31.4       | 55           | 37              | 16.8               |                   |                       | Saturated              |
| Test Hole Terminated at 31.4'                          |                     |                     |            |              |                 |                    |                   |                       |                        |



e. m. peto associates ltd.  
SOIL ENGINEERING SERVICE - TORONTO, ONTARIO

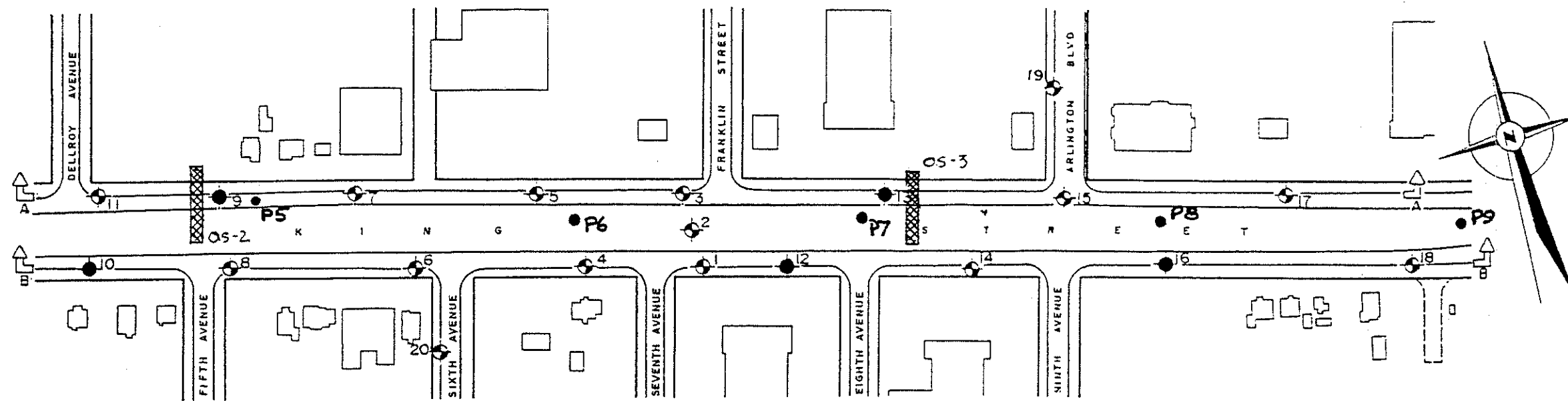
BOREHOLE LOG

Job Name: Kitchener-Waterloo Expressway, Sub No. 64224  
Client: Sydenham Dept. of Highways, Ontario, Casing: UX  
Borehole No. 1077.9, Compiled By: A. A. M., Boring Date: Oct. 23, 1964, Checked By: H. L.

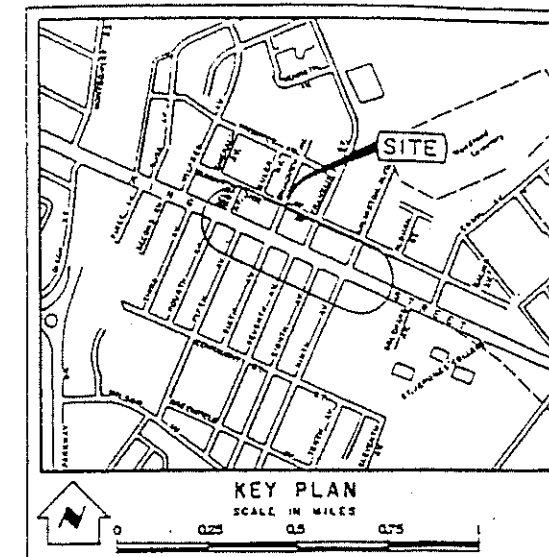
| SAMPLE CONDITION                                | SAMPLE TYPE                          | ABBREVIATIONS                      |
|---|--------------------------------------|------------------------------------|
| <input checked="" type="checkbox"/> UNDISTURBED | A.L. AUGER SAMPLE                    | V.T. IN SITU VANE SHEAR TEST       |
| <input checked="" type="checkbox"/> F.A.M.      | C.L. CASING SAMPLE                   | M. MOIST                           |
| <input checked="" type="checkbox"/> DISTURBED   | S.L. 1" STANDARD SPLIT TUBE SAMPLE   | W.L. WATER LEVEL IN CASING         |
| <input checked="" type="checkbox"/> LOSE        | L.L. SPLIT BARREL WITH LINERS        | V.T. GROUND WATER TABLE IN SOIL    |
|   | T.T. THIN WALL PD SHELBY TUBE SAMPLE | W.T.P.L. BETTER THAN PLASTIC LIMIT |
|   | V.S. WASH SAMPLE                     | B.T.P.L. BETTER THAN PLASTIC LIMIT |
|   | R.C. ROCK CORE                       | A.P.L. ABOUT PLASTIC LIMIT         |

| SOIL DESCRIPTION  | COLOUR                      | Consistency      | Depth (ft) | Moisture (%) | Wet Weight (lb) | Wet Volume (cu ft) | Wet Density (lb/cu ft) | Wet Unit Weight (lb/cu ft) | WATER LEVEL & REMARKS     |
|---|-----------------------------|------------------|------------|--------------|-----------------|--------------------|------------------------|----------------------------|---------------------------|
| Ground surface.   |                             |                  | 0.0        |              |                 |                    |                        |                            | No wash water used.       |
| 2" of asphalt, sandy gravel.                                    |                             |                  | 1.4        |              |                 |                    |                        |                            |                           |
| 1.5 ft. Silty fine sand, silt and pebbles. Fine sand, few silt. | Russet brown<br>Light brown | Compact          | 2.4        | 55           | 15              | 10.3               |                        |                            | Quite moist<br>Moist      |
| 2. Fine to medium sand  | Light brown                 | Ditto            | 3.6        | 55           | 21              | 15.3               |                        |                            | Moist                     |
| 3. Fine to medium sand, silt, brown                             | Light brown                 | Ditto            |            | 55           | 22              | 18.3               |                        |                            | Wet to saturated<br>Moist |
| 4. As above   | Ditto                       | Compaction Dense |            | 55           | 32              | 1.4                |                        |                            | Moist                     |
| 5. As above   | Ditto                       | Dense            |            | 55           | 36              | 2.5                |                        |                            | Moist                     |
| 6. As above   | Ditto                       | Dense            |            | 55           | 33              | 11.8               |                        |                            | Moist                     |
| 7. As above   | Ditto                       | Dense            | 20.0       | 55           | 47              | 6.3                |                        |                            | Moist                     |
| 8. As above   | Brown                       | Ditto            | 26.6       | 55           | 33              | 20.6               |                        |                            | Wet from 26"              |
| Test Hole Terminated at 26.6'                                   |                             |                  |            |              |                 |                    |                        |                            |                           |





PLAN  
SCALE IN FEET  
100 50 0 100 200



KEY PLAN  
SCALE IN MILES  
0 0.25 0.5 0.75

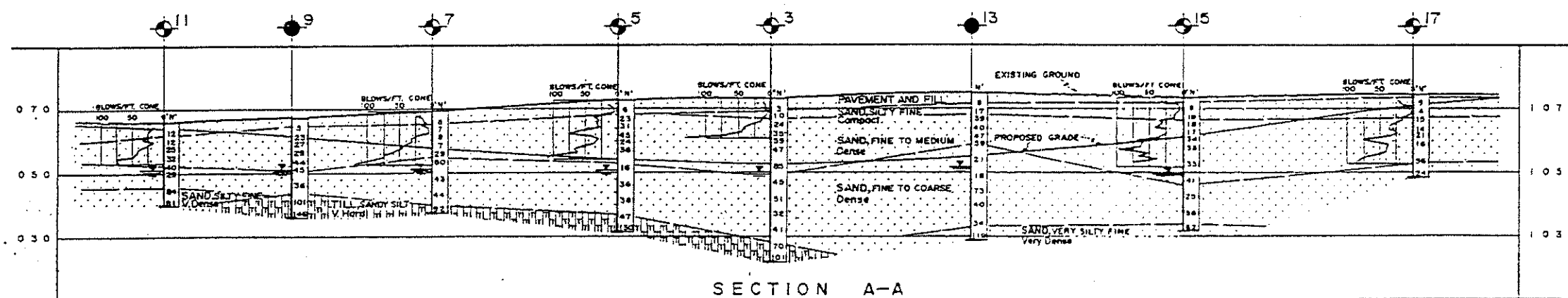
# LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation.
- P5 Approx. Location of H&M
- OS-2 Approx. Location of Overhead Sign

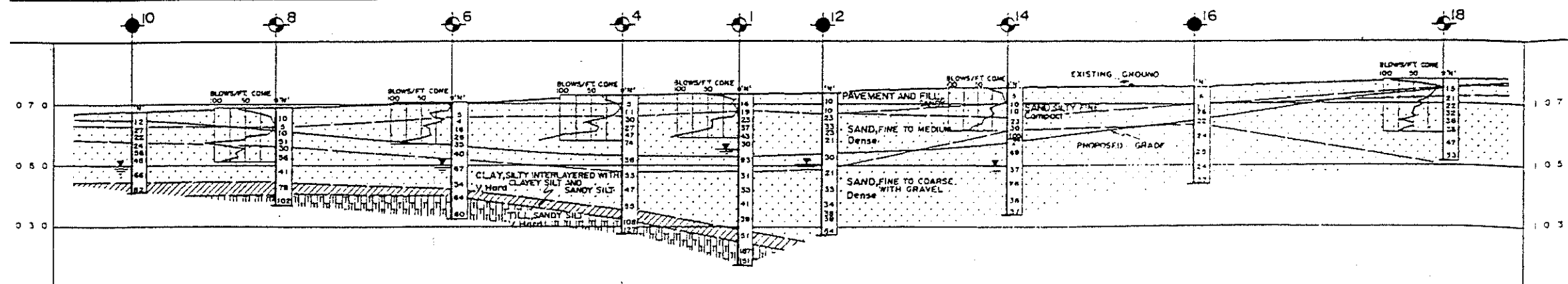
| NO. | ELEVATION | COORDINATES         |
|-----|-----------|---------------------|
| 1   | 1073.0    | 191 514 N 216 900 E |
| 2   | 1071.7    | 191 577 N 216 303 E |
| 3   | 1073.0    | 191 741 N 216 901 E |
| 4   | 1072.2    | 191 590 N 216 724 E |
| 5   | 1072.4    | 191 834 N 216 588 E |
| 6   | 1063.9    | 191 800 N 216 473 E |
| 7   | 1068.9    | 191 948 N 216 423 E |
| 8   | 1068.1    | 191 975 N 216 212 E |
| 9   | 1065.7    | 192 037 N 216 230 E |
| 10  | 1066.7    | 192 009 N 214 987 E |
| 11  | 1065.4    | 192 115 N 216 054 E |
| 12  | 1073.3    | 191 560 N 217 024 E |
| 13  | 1072.8    | 191 614 N 217 188 E |
| 14  | 1074.6    | 191 438 N 217 308 E |
| 15  | 1073.0    | 191 484 N 217 488 E |
| 16  | 1075.0    | 191 314 N 217 588 E |
| 17  | 1074.4    | 191 342 N 217 912 E |
| 18  | 1077.2    | 191 137 N 217 952 E |
| 19  | 1075.3    | 191 643 N 217 538 E |
| 20  | 1069.2    | 191 638 N 216 450 E |

# NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.



SECTION A-A



SECTION B-B

SCALE IN FEET  
VERTICAL 10 5 0 10 20 30 40 50  
HORIZONTAL 0 50 100 200

# NOTES

1. Plan has been extracted from the Foundation Report and is not based on a site survey. Accordingly, it should be considered as approximate.

| REVISIONS | DATE | BY | DESCRIPTION |
|-----------|------|----|-------------|
|           |      |    |             |
|           |      |    |             |
|           |      |    |             |

E. M. PETO ASSOC. LTD.

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH DIVISION - FOUNDATION SECTION

KITCHENER-WATERLOO EXPRESSWAY  
KING ST. & SEVENTH AVE(FRANKLIN)

KING'S HIGHWAY NO. 9 DIST. NO. 4  
CO. OF WATERLOO  
TWP. OF WATERLOO LOT CON.

# BORE HOLE LOCATIONS & SOIL STRATA

| SUBMIT         | CHECKED | W.P. NO.  | 621-64 | M.R. DRAWING NO.   |
|----------------|---------|-----------|--------|--------------------|
| DRAWN          | CHECKED | JOB NO.   | 64228  |                    |
| DATE DEC. 1964 |         | SITE NO.  | 33-221 | BRIDGE DRAWING NO. |
| APPROVED       |         | CONT. NO. | 65-311 | D-5634-2           |



# APPENDIX "D"

## TABLES



**TABLE 1**  
**LOCATIONS AND ELEVATIONS OF HIGH MAST LIGHTING & OVERHEAD SIGNS**

**HWY 8**

**HIGH MAST LIGHTING PROPOSED LOCATION & ELEVATIONS**

| HML Pole | Northing    | Easting    | Original Ground Elevation | Proposed Elevation | Reference         |
|----------|-------------|------------|---------------------------|--------------------|-------------------|
| P1       | 4811177.445 | 227421.297 | 319.9                     | 319.9              | Existing Ground   |
| P2       | 4811081.552 | 227401.518 | 320.9                     | 320.9              | Existing Ground   |
| P3       | 4811090.712 | 227542.615 | 322.5                     | 324.4              | Proposed platform |
| P4       | 4811004.491 | 227679.132 | 323.9                     | 325.1              | Top of tall wall  |
| P5       | 4810941.661 | 227814.172 | 322.6                     | 323.7              | Top of tall wall  |
| P6       | 4810876.460 | 227948.407 | 321.0                     | 321.9              | Top of tall wall  |
| P7       | 4810816.316 | 228079.140 | 321.7                     | 322.7              | Top of tall wall  |
| P8       | 4810751.945 | 228221.190 | 325.4                     | 326.3              | Top of tall wall  |
| P9       | 4810689.608 | 228358.748 | 328.4                     | 329.4              | Top of tall wall  |

**OVERHEAD SIGN STRUCTURES - ALONG HWY 8 NEW NBL**

|      | Sta    | Alignment | Median Footing |            | Ref                            | Outside Footing |                                 |
|------|--------|-----------|----------------|------------|--------------------------------|-----------------|---------------------------------|
|      |        |           | O.G. Elev      | Prop Elev. |                                | O.G. Elev       | Prop Elev.                      |
| OS-1 | 10+174 | King-8    | N/A            | N/A        | Supported on ramp E S abutment | 321.7           | 322.2                           |
| OS-2 | 10+445 | Hwy 8 New | 323.6          | 324.6      | top of tall wall               | 324.7           | 325.0                           |
| OS-3 | 10+845 | Hwy 8 New | 322.2          | 323.2      | top of tall wall               | N/A             | supported on new Retaining Wall |
| OS-4 | 11+235 | Hwy 8 New | 329.3          | 330.3      | top of tall wall               | 329.1           | 330.6                           |



**Table 2, Design Soil Parameters**

| Foundation Location   | Elevation (m)                    |                                  | Type of Soil                       | Relative Density Or Consistency                              | $\phi$<br>(degrees) | qu<br>(kPa)        | $\gamma$<br>(kN/m <sup>3</sup> ) | Anticipated Ground Water Elevation (m) |
|---|----------------------------------|----------------------------------|------------------------------------|--|---------------------|--------------------|----------------------------------|--|
|   | From                             | To                               |                                    |  |                     |                    |                                  |  |
| HML P1<br>BH98-12<br>E-S Ramp   | 319.9<br>317.6<br>314.7          | 317.6<br>314.7<br>296.2          | FILL<br>SAND<br>Silty CLAY         | Compact<br>Dense/Very Dense<br>Hard                          | 30<br>33<br>-       | -<br>-<br>600      | 19.5<br>20.5<br>22.0             | $\pm$ 314.0                            |
| HML P2<br>BH98-11&98-12<br>E-S Ramp   | 320.9<br>318.0                   | 318.0<br>309.0                   | FILL<br>SAND                       | Loose/Compact<br>Compact/Very Dense                          | 29<br>33            | -<br>-             | 19.0<br>20.5                     | $\pm$ 315.5                            |
| HML P3<br>BH98-09<br>E-S Ramp   | 324.4<br>320.7<br>319.5<br>317.8 | 320.7<br>319.5<br>317.8<br>311.2 | FILL<br>SAND<br>Silty CLAY<br>SILT | Compact<br>Compact/Dense<br>Very Stiff<br>Compact/Very Dense | 30<br>31<br>-<br>33 | -<br>-<br>300<br>- | 19.5<br>19.9<br>20.5<br>20.5     | $\pm$ 315.6                            |
| HML P4<br>BH98-03&98-04<br>E-S Ramp   | 323.9<br>321.5<br>316.8          | 321.5<br>316.8<br>315.8          | FILL<br>SAND<br>Silty CLAY         | VeryLoose/Compact<br>Dense/Very Dense<br>Hard                | 28<br>33<br>-       | -<br>-<br>600      | 18.0<br>20.5<br>22.0             | $\pm$ 318.5                            |
| HML P5<br>BH98-18&98-19<br>King St.<br>BH 9, Peto Assoc.                          | 322.6<br>322.1<br>319.3          | 322.1<br>319.3<br>316.5          | FILL<br>SAND<br>SAND               | Compact<br>Compact/Dense<br>Dense/Very Dense                 | 30<br>31<br>35      | -<br>-<br>-        | 19.5<br>19.9<br>22.0             | $\pm$ 319.4                            |
| HML P6<br>BH98-14, King St.<br>BH4 & 5,<br>Peto Assoc.                            | 321.0<br>320.6<br>315.0          | 320.6<br>315.0<br>313.0          | FILL<br>SAND<br>SILT TILL          | Compact<br>Dense<br>Very Dense                               | 30<br>33<br>35      | -<br>-<br>-        | 19.5<br>20.5<br>22.0             | $\pm$ 319.4                            |
| HML P7<br>BH98-07&98-08<br>King St.<br>BH 13, Peto Assoc.                         | 321.7<br>320.8                   | 320.8<br>314.0                   | FILL<br>SAND                       | Compact<br>Compact/Very Dense                                | 30<br>33            | -<br>-             | 19.5<br>20.5                     | $\pm$ 319.4                            |
| HML P8<br>BH98-03&98-04,<br>King St.<br>BH 16, Peto Assoc.                        | 325.4<br>324.5                   | 324.5<br>315.0                   | FILL<br>SAND to<br>SILT            | Very Loose/Compact<br>Compact/Very Dense                     | 28<br>33            | -<br>-             | 18.0<br>21.0                     | $\pm$ 322.3                            |
| HML P9<br>BH98-01, King St.<br>BH 18, Peto Assoc.                                 | 328.4<br>326.0                   | 326.0<br>319.0                   | FILL<br>SAND to<br>SILT            | Compact<br>Compact/Dense                                     | 30<br>32            | -<br>-             | 19.5<br>20.5                     | $\pm$ 320.0                            |
| OS1, Median   | n/a                              | n/a                              |                                    |  |                     |                    |                                  |  |
| OS1, Outside<br>BH98-10, E-S<br>Ramp  | 322.2<br>320.0<br>319.2<br>317.5 | 320.0<br>319.2<br>317.5<br>309.0 | FILL<br>SAND<br>Silty Clay<br>SILT | Compact<br>Compact<br>Hard<br>Dense/VeryDense                | 30<br>30<br>-<br>33 | -<br>-<br>500<br>- | 19.5<br>19.5<br>21.5<br>20.5     | $\pm$ 317.5                            |
| OS2, Median &<br>Outside<br>BH98-19&98-20,<br>King St.<br>BH 8 & 9<br>Peto Assoc. | 323.6<br>323.0                   | 323.0<br>310.0                   | FILL<br>SAND                       | VeryLoose/Compact<br>Compact/Dense                           | 28<br>31            | -<br>-             | 18.0<br>20.0                     | $\pm$ 319.4                            |
| OS3, Median &<br>Outside<br>BH98-07, King St.<br>BH 13, Peto Assoc.               | 322.2<br>321.3                   | 321.3<br>314.0                   | FILL<br>SAND                       | Compact<br>Loose/Dense                                       | 30<br>31            | -<br>-             | 19.5<br>20.0                     | $\pm$ 319.4                            |
| OS4, Median &<br>Outside<br>BH98-01, King St.<br>BH 18, Peto Assoc.               | 329.3<br>326.0                   | 326.0<br>319.0                   | FILL<br>SAND to<br>SILT            | Compact<br>Compact/Dense                                     | 30<br>32            | -<br>-             | 19.5<br>20.0                     | $\pm$ 320.0                            |



**NOISE BARRIER INVESTIGATION REPORT  
W.P. 363-94-00  
HIGHWAY 8  
FROM THE CONESTOGA PARKWAY SOUTHERLY TO  
FERGUS AVENUE INCLUDING RECONSTRUCTION OF  
THE HIGHWAY 8 / CONESTOGA INTERCHANGE**

**Submitted To:**

**Morrison Hershfield  
4 Lansing Square  
North York, Ontario  
M2J 1T1**

**Submitted By:**

**AGRA Earth & Environmental Limited  
610 Newbold Street, Unit 6&7  
London, Ontario  
N6E 2T6**

**August 1999  
TK98-10-3**



August 5, 1999  
Reference No.: TK98-10-3

Morrison Hershfield  
4 Lansing Square  
North York, Ontario  
M2J 1T1

**Attention: Mr. Stanley Ma**

**RE: W.P. 363-94-00  
HIGHWAY 8 - NOISE BARRIERS  
From the Conestoga Parkway southerly to Fergus Avenue, including  
Reconstruction of the Highway 8/Conestoga Interchange**

Noise barrier installations for this project are proposed at the following locations:

- New S-E Ramp - north side, STA 10 + 175 to STA 10 + 471 (joining noise barrier constructed under MTO Contract 98-05)
- Existing W-S Ramp - south side STA 10 + 100 (joining noise barrier constructed under MTO Contract 98-05) to STA 10 + 350

A field investigation was completed by AGRA for the above sites during the months of November and December 1998.

Each borehole was logged with regard to the soil classification of each layer, the moisture conditions and free water location, if present, and the density or cohesiveness of each layer. Soil samples were taken which were representative of each layer and later selected samples were analyzed in the laboratory. The log of boreholes and the sample results, for each location, are attached to this report.

#### **New S-E Ramp STA 10 + 175 to STA 10 + 471**

Three (3) boreholes were drilled along the proposed noise barrier alignment at this location. Boreholes were placed from 10 + 400± to 10 + 470± where the footings will be established in the parent subsoils. The remainder of the proposed noise barrier alignment will be located within the proposed embankment construction where the footings will be established within constructed earth fill.

In general, the soils were logged as 200mm of topsoil over 1.3 to 1.5 metres of compact to dense sand and gravel or sandy silt with traces of gravel fill material over 1.4 to 2.0 metres of compact to very dense silty fine sand or sandy silt till to a total depth of 3.5 metres. One borehole logged a dense silty clay at 3.1 metres depth. No free water was observed in any of the boreholes at the time of investigations.



**Soil Design Parameters**

For design purposes, the following soil design parameters for this length are provided:

**STA to STA**

10 + 175± - 10 + 471±

**Soil Design Parameter**

$\phi = 30$  degrees  
Bulk Unit Density 19.0 KN/m<sup>3</sup>

\* Based on embankment fill material compacted to 95% density.

**Existing W-S Ramp STA 10 + 100 to STA 10 + 350**

Eleven (11) boreholes were drilled along the proposed noise barrier alignment at this location. Boreholes were placed from STA 10 + 100± to STA 10 + 380± where the footings will be established in the parent subsoils.

In general, the soils were logged as 200mm of topsoil or 120mm (avg.) hot mix over 225mm (avg.) of crushed granular over 0.3 to 2.8 metres of sand and gravel or silty sand fill material over 0.8 to 2.7 metres of compact to very dense medium to fine sand or gravelly sand with some silt. Compact to very dense grey sandy silt or silty clay 0.1 to 0.8 metres thick was observed in the lower level of two (2) boreholes. No free water was observed in any of the boreholes at the time of investigation.

**Soil Design Parameters**

For design purposes, the following soil design parameters for this length are provided:

**STA to STA**

10 + 100± - 10 + 350±

**Soil Design Parameter**

$\phi = 32$  degrees  
Bulk Unit Density = 20 KN/m<sup>3</sup>

Submitted by:  
AGRA Earth & Environmental Limited

C.M. Bond, P.Eng.

Reviewed by:  
AGRA Earth & Environmental Limited

Eric Chung, P.Eng.



**NOISE BARRIER BOREHOLE LOG DATA  
W.P. 363-94-00. HIGHWAY 7 & 8 INTERCHANGE  
WEST TO SOUTH RAMP**

Chainage and Offset referenced from W-S Ramp Alignment

**TOWNSHIP OF WATERLOO**

10 + 128, 9.5 Rt. (Elev. 320.3)

|     |   |     |   |
|-----|---|-----|---|
| 0   | - | 200 | Tps.  |
| 200 | - | 1.7 | Dk Br Sa and Gr (fill) <u>SW-101</u>          |
| 1.7 | - | 3.1 | Dk Br Sa (fill) tr gr, stk tps. <u>SW-102</u> |
| 3.1 | - | 3.5 | Br FSa, compact, tr. si <u>SW-103</u>         |

No free water at completion

10 + 155, 8.5 Rt. (Elev. 320.8)

|     |   |     |                                      |
|-----|---|-----|--------------------------------------|
| 0   | - | 130 | Asph                                 |
| 130 | - | 300 | Cr Gran                              |
| 300 | - | 900 | Sa and Gr (fill) <u>SW-104</u>       |
| 900 | - | 2.4 | Dk Br Med - FSa (fill) <u>SW-105</u> |
| 2.4 | - | 3.5 | Br Sa compact, tr gr <u>SW-106</u>   |

No free water at completion

10 + 188, 7.5m Rt. (Elev. 321.1)

|     |   |     |  |
|-----|---|-----|--|
| 0   | - | 140 | Asph   |
| 140 | - | 300 | Cr Gran                                      |
| 300 | - | 1.1 | Sa and Gr (fill) <u>SW-107</u>               |
| 1.1 | - | 2.7 | Dk Br Sa (fill) tr gr <u>SW-108</u>          |
| 2.7 | - | 3.4 | Br Med - FSa compact some silt <u>SW-109</u> |

No free water at completion

10 + 209, 8.0 Rt. (Elev. 321.5)

|     |   |     |  |
|-----|---|-----|--|
| 0   | - | 120 | Asph                                       |
| 120 | - | 300 | Cr Gran                                    |
| 300 | - | 800 | Sa and Gr (fill)                           |
| 800 | - | 3.2 | Br Sa compact tr gr <u>SW-110</u>          |
| 3.2 | - | 3.5 | Br Sa and Gr, V dense, tr si <u>SW-111</u> |

No free water at completion

10 + 230, 7.0 Rt. (Elev. 321.8)

|     |   |     |                                   |
|-----|---|-----|-----------------------------------|
| 0   | - | 120 | Asph                              |
| 120 | - | 400 | Cr Gran                           |
| 400 | - | 900 | Sa and Gr (fill) <u>SW-112</u>    |
| 900 | - | 2.4 | Dk Br Sa (fill) <u>SW-113</u>     |
| 2.4 | - | 3.2 | Br Sa compact <u>SW-114</u>       |
| 3.2 | - | 3.5 | Br Gr (ly) Sa, compact, some silt |

No free water at completion



10 + 253, 7.0 Rt. (Elev. 332.2)

|                             |   |     |   |
|-----------------------------|---|-----|---|
| 0                           | - | 130 | Asph  |
| 130                         | - | 300 | Cr Gran                                       |
| 300                         | - | 900 | Sa and Gr (fill) <u>SW-115</u>                |
| 900                         | - | 1.8 | Dk Br Si Sa and gr mixed (fill) <u>SW-116</u> |
| 1.8                         | - | 2.3 | Br Sa Si, Loose                               |
| 2.3                         | - | 2.6 | Br Sa, compact                                |
| 2.6                         | - | 2.7 | Br Sa and Gr, compact <u>SW-117</u>           |
| 2.7                         | - | 3.2 | Br Si Cl, dense                               |
| 3.2                         | - | 3.5 | Gr Sa Si, V dense, some Cl <u>SW-118</u>      |
| No free water at completion |   |     |   |

10 + 282, 7.0 Rt. (Elev. 322.5)

|                             |   |     |  |
|-----------------------------|---|-----|--|
| 0                           | - | 120 | Asph   |
| 120                         | - | 400 | Cr Gran  |
| 400                         | - | 2.4 | Si Sa and Gr (fill) some wood pieces <u>SW-119</u> |
| 2.4                         | - | 3.1 | Br Sa, Loose                                       |
| 3.1                         | - | 3.4 | Br Sa and Gr, compact <u>SW-120</u>                |
| 3.4                         | - | 3.5 | Cr Si and Cl, compact, tr sa <u>SW-121</u>         |
| No free water at completion |   |     |  |

10 + 304, 7.0 Rt. (Elev. 322.9)

|                             |   |     |   |
|-----------------------------|---|-----|---|
| 0                           | - | 140 | Asph                                    |
| 140                         | - | 1.7 | Cr Gran, sa and gr (fill) <u>SW-122</u> |
| 1.7                         | - | 3.1 | Br FSa, Loose, some silt <u>SW-123</u>  |
| 3.1                         | - | 3.5 | Br Med Sa, compact <u>SW-124</u>        |
| No free water at completion |   |     |   |

10 + 329, 6.5 Rt. (Elev. 323.2)

|                             |   |     |  |
|-----------------------------|---|-----|--|
| 0                           | - | 100 | Asph   |
| 100                         | - | 1.7 | Cr Gran, sa and gr (fill) <u>SW-125</u>      |
| 1.7                         | - | 2.0 | Br Sa and Gr, compact                        |
| 2.0                         | - | 3.5 | Br Med - FSa, compact, tr silt <u>SW-126</u> |
| No free water at completion |   |     |  |

10 + 350, 6.5 Rt. (Elev. 323.5)

|                             |   |     |  |
|-----------------------------|---|-----|--|
| 0                           | - | 100 | Asph   |
| 100                         | - | 400 | Cr Gran  |
| 400                         | - | 1.7 | Sa and Gr (fill) <u>SW-127</u>                 |
| 1.7                         | - | 2.3 | Br Gr (1y) Sa V dense, some silt <u>SW-128</u> |
| 2.3                         | - | 3.5 | Br Sa, compact, tr gr <u>SW-129</u>            |
| No free water at completion |   |     |  |



10 + 380, 6.5 Rt. (Elev. 323.8)

|     |   |     |  |
|-----|---|-----|--|
| 0   | - | 100 | Asph   |
| 100 | - | 400 | Cr Gran  |
| 400 | - | 900 | Sa and Gr (fill) <u>SW-130</u>                         |
| 900 | - | 1.8 | Dk Br Si Sa - Sa Si (fill) <u>SW-131</u>               |
| 1.8 | - | 2.9 | Br Sa and Gr, compact - V dense, tr silt <u>SW-132</u> |
| 2.9 | - | 3.5 | Br FSa, compact <u>SW-133</u>                          |

No free water at completion



Sample ResultsSW-101

w @ 0.6m - 10.0  
w @ 1.5m - 13.0

SW-102

w @ 2.3m - 5.0

SW-103

SP  
% Pass      4.75 mm      95.5  
                 2.00 mm      94.1  
                 600 µm      78.4  
                 75 µm      5.8

w @ 3.1m - 2.8

LSFH

SW-104

w @ 0.8m - 10.0

SW-105

w @ 1.5m - 10.0

SW-106

SP-SM  
% Pass      4.75 mm      92.4  
                 2.00 mm      89.1  
                 600 µm      69.9  
                 75 µm      8.4

w @ 2.4m - 4.0

w @ 3.0m - 3.9

LSFH

SW-107

w @ 0.5m - 4.8

SW-108

w @ 1.5 m - 8.5  
w @ 2.4 m - 5.0

SW-109

SM

% Pass  
                 4.75 mm      93.0  
                 2.00 mm      91.4  
                 600 µm      75.3  
                 75 µm      18.1

LSFH

SW-110

w @ 0.7 m - 2.0  
w @ 1.5 m - 2.5  
w @ 2.5 m - 3.2

SW-111

SW-SM

% Pass  
                 4.75 mm      68.2  
                 2.00 mm      59.9  
                 600 µm      42.7  
                 75 µm      9.3

w @ 3.2 - 3.3

LSFH

SW-112

w @ 0.7 m - 8.9

SW-113

w @ 1.4 m - 10.0  
w @ 2.3 m - 7.6



**SW-114**

SM

% Pass

|             |      |
|-------------|------|
| 4.75 mm     | 82.6 |
| 2.00 mm     | 77.8 |
| 600 $\mu$ m | 45.2 |
| 75 $\mu$ m  | 11.5 |
| w =         | 7.4  |

LSFH

**SW-115**

w @ 0.8 - 9.8

**SW-116**

w @ 1.6 - 8.5

**SW-117**

SP

% Pass

|             |      |
|-------------|------|
| 4.75 mm     | 69.9 |
| 2.00 mm     | 66.4 |
| 600 $\mu$ m | 21.7 |
| 75 $\mu$ m  | 1.5  |

w @ 3.3 - 6.3

LSFH

**SW-118**

MS

% Pass

|             |      |
|-------------|------|
| 4.75 mm     | 96.0 |
| 2.00 mm     | 95.3 |
| 600 $\mu$ m | 93.3 |
| 75 $\mu$ m  | 83.5 |

LSFH

**SW-119**

w @ 0.7 - 8.5

w @ 1.5 - 9.0

w @ 2.3 - 4.5

**SW-120**

GW-GM

% Pass

|             |      |
|-------------|------|
| 4.75 mm     | 42.8 |
| 2.00 mm     | 34.7 |
| 600 $\mu$ m | 18.9 |
| 75 $\mu$ m  | 8.9  |

w = 3.7

LSFH

**SW-121**

ML

% Pass

|             |      |
|-------------|------|
| 600 $\mu$ m | 99.7 |
| 75 $\mu$ m  | 95.3 |
| w =         | 16.0 |

**SW-122**

w @ 0.8 - 3.5

w @ 1.5 - 9.5

**SW-123**

SP-SM

% Pass

|             |      |
|-------------|------|
| 4.75 mm     | 96.1 |
| 2.00 mm     | 95.8 |
| 600 $\mu$ m | 92.8 |
| 75 $\mu$ m  | 11.4 |

w @ 2.3 - 7.5

**SW-124**

w @ 3.1 - 4.0

**SW-125**

w @ 0.7 - 4.0

w @ 1.5 - 3.5



**SW-126**

SP

% Pass

|               |      |
|---------------|------|
| 4.75 mm       | 99.6 |
| 2.00 mm       | 99.2 |
| 600 µm        | 89.4 |
| 75 µm         | 6.1  |
| w @ 2.3 - 2.8 |      |
| w @ 3.0 - 2.8 |      |

**SW-127**

w @ 0.8 - 6.5

**SW-128**

SW-GW

% Pass

|         |      |
|---------|------|
| 4.75 mm | 63.7 |
| 2.00 mm | 53.7 |
| 600 µm  | 29.8 |
| 75 µm   | 5.7  |

w @ 1.8 - 1.8

w @ 2.3 - 2.5

**SW-129**

w @ 3.1 - 1.8

**SW-130**

w @ 0.7 - 19.9

**SW-131**

w @ 1.4 - 6.0

**SW-132**

SW

% Pass

|               |      |
|---------------|------|
| 4.75 mm       | 51.8 |
| 2.00 mm       | 40.9 |
| 600 µm        | 23.6 |
| 75 µm         | 8.7  |
| w @ 2.3 - 2.0 |      |

LSFH

**SW-133**

w @ 3.0 - 2.5



**NOISE BARRIER BOREHOLE LOG DATA  
W.P. 363-94-00, HIGHWAY 7 & 8 INTERCHANGE  
SOUTH TO EAST RAMP**

Chainage and offset referenced from E-S Ramp Alignment

TOWNSHIP OF WATERLOO

10 + 418, 22.0 Rt. (Elev. 320.0)

|     |   |     |  |
|-----|---|-----|--|
| 0   | - | 200 | Tps                                      |
| 200 | - | 1.5 | Br Sa and Gr (Fill), dense <u>SW-134</u> |
| 1.5 | - | 3.5 | Br Si FSa, compact <u>SW-135</u>         |

No free water at completion

10 + 433, 22.0 Rt. (Elev. 320.1)

|     |   |     |  |
|-----|---|-----|--|
| 0   | - | 200 | Tps  |
| 200 | - | 1.7 | Br Sa and Gr (Fill), compact <u>SW-136</u>       |
| 1.7 | - | 3.2 | Gr Br Sa Si Till, dense to V dense <u>SW-137</u> |
| 3.2 | - | 3.5 | Gr Sa Si V dense                                 |

No free water at completion

10 + 470, 21.5 Rt. (Elev. 319.9)

|     |   |     |   |
|-----|---|-----|---|
| 0   | - | 200 | Tps   |
| 200 | - | 1.2 | Dk Br Sa Si (fill), tr gr, dense <u>SW-138</u>    |
| 1.2 | - | 1.7 | Br Sa and Si (fill), tr gr, compact <u>SW-139</u> |
| 1.7 | - | 3.1 | Gr Br Si Till, dense <u>SW-140</u>                |
| 3.1 | - | 3.5 | Gr Si Cl, dense                                   |

No free water at completion



**Sample Results****SW-134**

w @ 0.8 - 6.5

**SW-135**

ML

% Pass

2.00 mm 100.0

600  $\mu$ m 97.975  $\mu$ m 52.5

w @ 2.3 - 13.0

w @ 3.0 - 13.5

**SW-136**

w @ 0.7 - 3.0

**SW-137**

ML

% Pass

2.00 mm 100.0

600  $\mu$ m 95.075  $\mu$ m 80.3

w @ 1.8 - 9.9

w @ 2.3 - 15.0

w @ 3.1 - 15.5

LSFH

**SW-138**

w @ 0.7 - 8.8

**SW-139**

w @ 1.5 - 15.0

**SW-140**

CL

% Pass

2.00 mm 100.0

600  $\mu$ m 97.075  $\mu$ m 93.5w<sub>L</sub> = 30.7I<sub>p</sub> = 12.7

w @ 2.3 - 14.5

w @ 3.0 - 17.5

LSFH



