

**APPENDIX 'A'**  
**GEO TECHNICAL REPORT**

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**ST. JAMES CIVIC CENTRE**

**GEOTECHNICAL REPORT FOR  
ASPHALT PAVEMENT RESURFACING**

**2055 NESS AVENUE, WINNIPEG**

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**Prepared for:**

**City of Winnipeg  
Public Works Department  
Winnipeg, Manitoba**

**City Project No.: 40993  
CEL Project No.: WE 05 047 00 WE**

**June 2005**



**COCHRANE ENGINEERING LTD.**

**600 – 5 DONALD STREET  
WINNIPEG, MB R3L 2T4**

**ENGINEERS, SCIENTISTS & PROJECT MANAGERS**

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## **1.0 SUMMARY**

A pavement investigation was conducted for the proposed Asphalt Pavement reconstruction of the south, east and north parking lots of the St. James Civic Centre to assess the general subsurface conditions. It was requested that pavement recommendations designed to heavy-duty and light-duty parking lot standards for the proposed Asphalt Pavement Reconstruction be provided. Fourteen testholes drilled to 3.05m depth revealed a general soil profile consisting of a layer of an average 50mm asphalt over an average of 250mm granular fill consisting of either limestone or granular (A-base) fill followed by 150mm to 1m of clay fill (average is about 300mm) over a 150 to 600mm of grey-black clay. This thin clay layer was followed by an olive-grey silt layer in some testholes that ranged from 150 to 600mm over the lower brown, stiff clay which extended to the depth explored at 3m below grade. The clay fill and the silt layers are sporadic which means, not uniform layer. Moist conditions were observed from the silt layers.

Based upon the subsurface conditions encountered, the pavement recommendations for light duty and heavy-duty traffic at the proposed Asphalt Overlay is discussed in Section 6 of this report.

## **2.0 INTRODUCTION**

### **2.1 SCOPE OF WORK**

As part of our Engineering Services Proposal, a subsurface investigation was conducted for the proposed Asphalt Pavement Reconstruction of the south, east and north parking lots of the St. James Civic Centre, 2055 Ness Avenue, Winnipeg. The purpose of this work was to establish the soil and groundwater conditions at the site and provide pavement recommendations as well as comments on potential problems. Authorization to proceed with the work was provided by Mr. Lou Chubenko of the City of Winnipeg.

## **2.2 EXISTING PARKING LOTS**

The existing parking lots at the south, east and north contain numerous alligator cracks, occasional upheaval and trace of raveling (only at south parking lot). The asphalted west parking lot is in good condition.

## **3.0 FIELD INVESTIGATION**

The field investigation was undertaken on May 13, 2005. A truck-mounted drill rig with a continuous flight auger was used to drill a total of 14 testholes to a depth of 3m below grade. The testhole locations are shown on the site plan (Figure 1) in Appendix A.

The subsoils encountered were visually classified to the full extent in the testhole and representative soil samples were recovered at regular depth intervals. Pocket penetrometer tests were conducted on cohesive soil to determine the approximate unconfined compressive strength and Standard Penetration Testing(SPT) was conducted as well to determine the relative density. In addition, particle size analysis as well as Atterberg limit tests were conducted on representative samples for classification. Any groundwater seepage and sloughing encountered in the testholes were noted.

## **4.0 FIELD / LABORATORY TESTING**

In the field, random pocket penetrometer and SPT testing were conducted in the testhole to determine the strength and relative density of the soil. The average shear strength ( $C_u$ ) of the subgrade clay is about 50 kPa. In addition, the average SPT(N) blows of the clay fill/grey-black clay (10) followed by silt layer(3) is about 6.5 blows per 0.3m (foot) which translates to at least a CBR number of 1.9 based on a soil strength relationship. Typically, the CBR number obtained at the laboratory for Winnipeg Clay is between 2 and 4. Detailed descriptions of the soil profiles in each testhole are shown on the attached testhole logs, TH1 to TH14 in Appendix B.

Based on particle size analysis, the samples obtained from TH1 at 1m and TH5, 0.8 to 1.2m were classified as clayey silt material, ML and silty clay, CH. Test results are shown in Appendix C.

## **5.0 SUBSURFACE CONDITIONS**

### **5.1 SOIL PROFILE/GROUNDWATER**

The general soil profile revealed an average layer 50mm asphalt over an average of 250mm granular fill consisting of either limestone or granular (A-base) fill followed by 150mm to 1m of clay fill (average is about 300mm) over a 150 to 600mm of grey-black clay. This thin clay layer was followed by an olive-grey silt layer in some testholes that ranged from 150 to 600mm over the lower brown, stiff clay which extended to the depth explored at 3m below grade. The clay fill and the silt layers are sporadic or not in uniform layers. Moist conditions were observed from the silt layers.

## **6.0 DISCUSSION AND PAVEMENT RECOMMENDATIONS**

Under a light duty traffic, an assumption was made that the pavement will be subjected to a much lesser load in terms of average daily traffic (ADT) of 500 car/van traffic at 12-hour usage with 2% light truck traffic, truck factor of 0.39 and a 15 year design. The light duty traffic translates to wheel loads of 3000 kg each for a maximum of 15,000 kg. Hence, the Equivalent Single Axle Load (ESAL) for light duty traffic is approximately 26,910.

Based on the SPT test and approximate  $C_u$ , the considered value of a Resilient Modulus with an approximate CBR of 1.9 is 10.4 MPa (1520 psi). A CBR of 1.9 was selected since the subgrade (grey-black clay or clay fill) was closely followed by a soft silt layer.

Corresponding calculations for the heavy duty ESAL considering 25 trucks per day, 80% heavy vehicle usage and a truck factor of about 2.39(5-axle tractor semi-trailer with a maximum gross load of 36,500 kg) results in a value of about 261,705 for flexible pavement.

The pavement design was checked with the same subgrade support value and ESALs using AASHTO method. The required structural number (SN) for light duty and heavy duty traffic is 3.19 and 4.58, respectively using a reliability of 85%, overall deviation of 0.5, initial serviceability of 4.2, terminal service of 2.0 and layer coefficients of 0.42 for HMA, 0.14 for granular base and 0.12 for granular subbase preferably limestone.

The recommended pavement construction at this site should be as follows:

**Pavement Structure**

|             | <b>Light Duty Traffic Thicknesses</b> | <b>Heavy Duty Traffic Thicknesses</b> | <b>% Compaction</b> |
|-------------|---------------------------------------|---------------------------------------|---------------------|
| Asphalt     | 50 mm                                 | 75 mm                                 | 97% Marshall        |
| Base Course | 150 mm                                | 175 mm                                | 100% STD Proctor    |
| Subbase     | 300 mm                                | 400 mm                                | 100% STD Proctor    |

The granular base course and subbase materials should include organic-free, non-frozen, aggregate conforming to the City of Winnipeg gradation limits (CW 3110). The subbase material is preferably 150 mm crushed max. limestone aggregate. The subgrade (clay fill/clay) should be compacted to 95% STD Proctor Density.

Where soft silt/clay but dry spots are encountered at the subgrade level, construction traffic should be restricted. Soft spots should be covered with geotextile followed by geogrid and the recommended pavement structure. Any saturated subgrade conditions should be dried off quickly by excavation of sump pit or installation of permanent subdrains (600mm below the subgrade level) connected to positive outlet (catch basin) prior to placing the granular fill structure. Otherwise, the procedure of subcutting and replacing with 150mm down crush limestone over a non-woven geotextile with geogrid will be attempted. The depth of the subcut would entirely depend on the saturation of the subgrade. At these locations, the placing of granular fill should follow the geotextile specifications for soft grounds spot.

Sieve analysis and compaction testing of the granular base and subgrade materials should be conducted by qualified geotechnical personnel to ensure that the materials supplied and percent compactions are in accordance with design specifications. For the hot mix asphaltic concrete, gradation analysis of the aggregates (i.e. stone, fines and additive), compaction testing and sampling of at least one representative hot mix asphalt mixture (during



construction) for laboratory Marshall testing should be undertaken. This would provide data to confirm that the asphaltic concrete pavement complies with the project specification. Hot mix asphaltic concrete should not be placed at ambient temperatures lower than +4°C. During placement, the temperature of the paving mix should be in the range of +120°C to +150°C and compaction should not take place at paving mix temperatures lower than +85°C.

## 7.0 ADDITIONAL CONSIDERATIONS

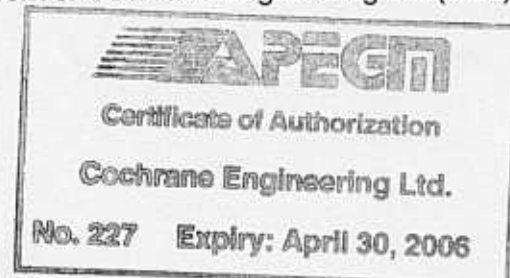
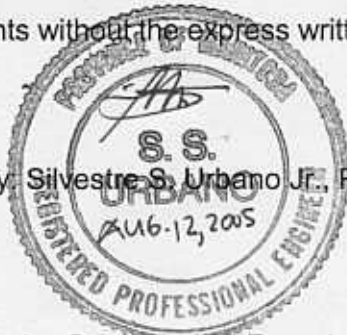
Adequate site drainage should be provided for the proposed Asphalt Reconstruction. For maintenance purposes, it may be necessary to reseal any cracks prior to winter season to minimize the entrance of water to the pavement structure.

## 8.0 CLOSURE

The findings and recommendations provided in this report were prepared in accordance with generally accepted professional engineering principles and practices. The recommendations are based on the results of field and laboratory investigations. If conditions encountered during construction appear to be different than those shown by the testholes at this site, this office should be notified immediately in order that the recommendations can be reviewed.

This report has been prepared by Cochrane Engineering Ltd.(CEL) for the benefit of the client to whom it is addressed. The information and data contained herein represent CEL's best professional judgement in light of the knowledge and information available to CEL at the time of preparation. Except as required by law, this report and the information and data contained herein are to be treated as confidential and may be used and relied upon only by the client, its officers and employees. Cochrane Engineering Ltd. denies any liability whatsoever to other parties who may obtain access to this report for any injury, loss or damage suffered by such parties arising from their use of, or reliance upon, this report or any of its contents without the express written consent of Cochrane Engineering Ltd.(CEL) and the client.

Prepared by: Silvestre S. Urbano Jr., P.Eng.



**APPENDIX A**

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**Site Plan**

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 Richmond, B.C. V6V 2G9  
 TEL: (604) 273-2222  
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ENGINEERS & ARCHITECTS • CIVIL ENGINEERS  
 LANDSCAPE ARCHITECTS • PLANNING CONSULTANTS  
 ENVIRONMENTAL ENGINEERS • SURVEYORS



Scale:

Consultants:

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| DATE       | DESCRIPTION             | BY          | CHECKED     |
|------------|-------------------------|-------------|-------------|
| 1998-05-15 | ISSUED FOR PERMIT       | J. COCHRANE | J. COCHRANE |
| 1998-05-15 | ISSUED FOR CONSTRUCTION | J. COCHRANE | J. COCHRANE |

| ISS. REV. | DATE | APP. | DESCRIPTION |
|-----------|------|------|-------------|
| 1         |      |      |             |

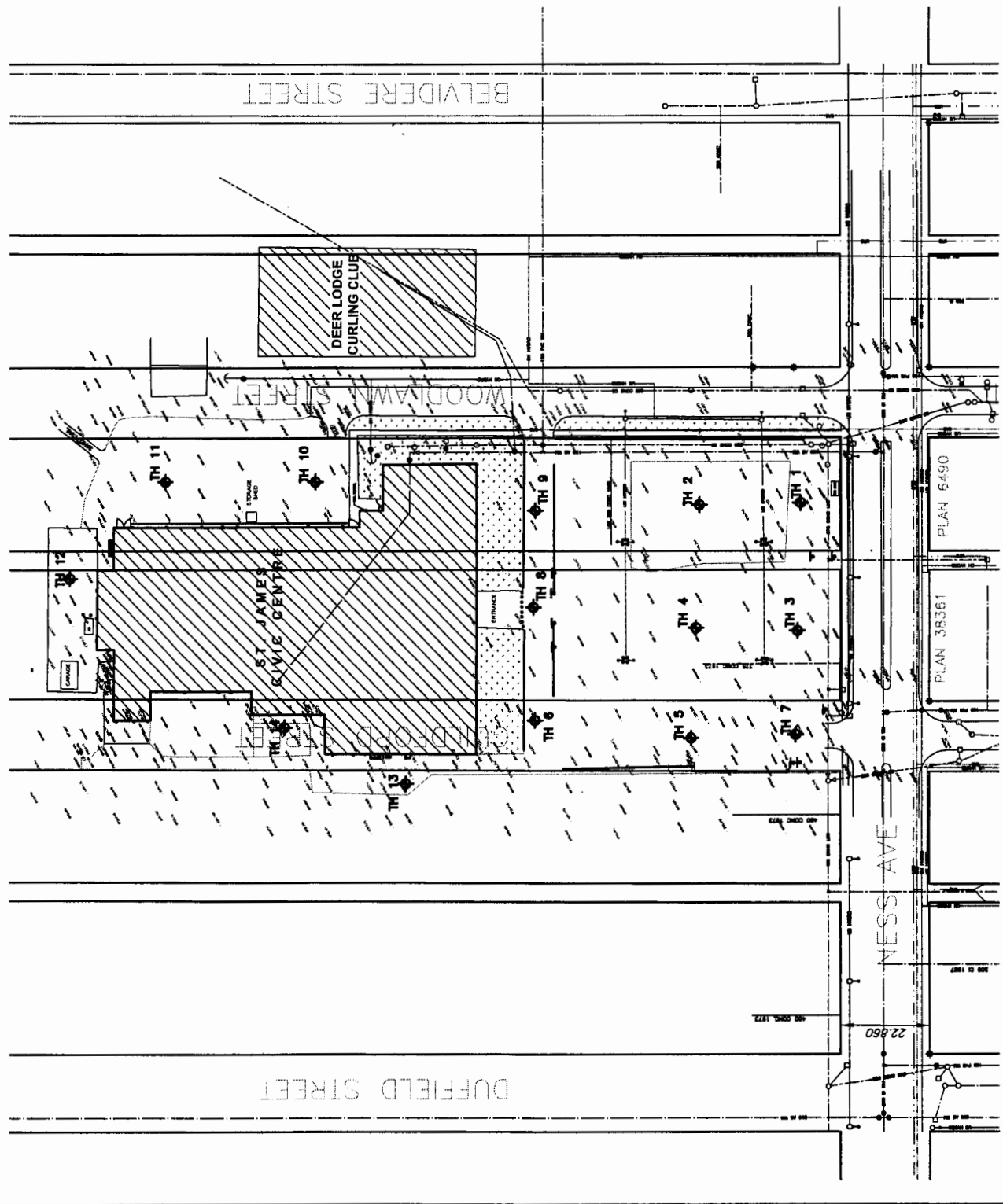
PROJECT: ST. JAMES CIVIC CENTRE PARKING LOT

CIVIL

| DESIGNED    | DRAWN       | CHECKED     | DATE       |
|-------------|-------------|-------------|------------|
| J. COCHRANE | J. COCHRANE | J. COCHRANE | 1998-05-15 |

WE03047 C101

ACAD NO. 08047101



PLAN 6490

PLAN 38361

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**APPENDIX B**

**Testhole Logs**

**Project No:** WE-05-047-00-WE

**Testhole No.:** TH1

**Project:** St. James Civic Centre

**Client:** City of Winnipeg

**Enclosure:**

**Location:** 2055 Ness Avenue, Winnipeg

**Engineer:** SSU

| SUBSURFACE PROFILE |        |   |                | SAMPLE             |                              |  |
|--------------------|--------|---|----------------|--------------------|------------------------------|--|
| Depth              | Symbol | Description                                     | Depth/Elev., m | PP(kPa)            | SPT, N-VALUE<br>(BLOWS/0.3M) | Water Content %                            |
|                    |        |   |                | ■ 50 150 250 350 ■ |                              | ● Wp  -----  Wl ●<br>20 60 100 140 180 220 |
| 0                  |        | Ground Surface                                  | 100            |                    |                              |  |
| 0                  |        | <b>GRANULAR FILL</b>                            |                |                    |                              |  |
| 0.5                |        | 20mm down limestone mixed with some clay        |                |                    | 6                            |  |
| 1                  |        | <b>CLAY FILL</b>                                | 99.4           |                    |                              |  |
| 1.5                |        | mixed grey and black clay, trace of fine gravel |                |                    | 8                            |  |
| 2                  |        | <b>CLAY</b>                                     |                |                    |                              |  |
| 2.5                |        | stiff, grey-black, trace of organic             |                |                    | 8                            |  |
| 3                  |        | <b>SILT</b>                                     |                |                    |                              |  |
| 3.5                |        | olive-grey, moist to wet, trace of clay         |                |                    |                              |  |
| 4                  |        | <b>CLAY</b>                                     |                |                    |                              |  |
| 4.5                |        | stiff, brown, fissured; silty at 1.8 to 2m.     |                |                    |                              |  |
| 5                  |        | TESTHOLE WAS DRY AFTER COMPLETION OF DRILLING.  |                |                    |                              |  |
| 6                  |        |   |                |                    |                              |  |
| 7                  |        |   |                |                    |                              |  |
| 8                  |        |   |                |                    |                              |  |
| 9                  |        |   |                |                    |                              |  |
| 10                 |        |   | 97             |                    |                              |  |
| 10                 |        | End of Testhole                                 |                |                    |                              |  |
| 11                 |        |   |                |                    |                              |  |
| 12                 |        |   |                |                    |                              |  |
| 13                 |        |   |                |                    |                              |  |
| 14                 |        |   |                |                    |                              |  |
| 15                 |        |   |                |                    |                              |  |
| 16                 |        |   |                |                    |                              |  |
| 17                 |        |   |                |                    |                              |  |
| 18                 |        |   |                |                    |                              |  |
| 19                 |        |   |                |                    |                              |  |
| 20                 |        |   |                |                    |                              |  |

Drill Method: S/S Auger

Cochrane Eng. Ltd.  
#600-5 Donald Street  
Winnipeg, MB.  
R3L 2T4

Elevation: 100.0 (Assumed)

Drill Date: 05/13/05

Checked by: SSU

Hole Size: 125mm

Sheet: 1 of 1

**Project No:** WE-05-047-00-WE

**Testhole No.:** TH1

**Project:** St. James Civic Centre

**Client:** City of Winnipeg

**Enclosure:**

**Location:** 2055 Ness Avenue, Winnipeg

**Engineer:** SSU

| SUBSURFACE PROFILE |        |  |               | SAMPLE         |                              |   |
|--------------------|--------|--|---------------|----------------|------------------------------|---|
| Depth<br>ft<br>m   | Symbol | Description  | Depth/Elev.,m | PP(kPa)        | SPT, N-VALUE<br>(BLOWS/0.3M) | Water Content %<br>● Wp   — 0 —   Wl ●<br>20 60 100 140 180 220 |
|                    |        |  |               | 50 150 250 350 |                              |   |
| 0                  |        | Ground Surface   | 100           |                |                              |   |
| 0                  |        | <b>GRANULAR FILL</b>   |               |                |                              |   |
| 1                  |        | 20mm down limestone mixed with some clay   |               |                | 6                            |   |
| 2                  |        | <b>CLAY FILL</b>   | 99.4          |                | 8                            |   |
| 2                  |        | mixed grey and black clay, trace of fine gravel  |               |                |                              |   |
| 3                  |        | <b>CLAY</b>  |               |                | 8                            |   |
| 3                  |        | stiff, grey-black, trace of organic  |               |                |                              |   |
| 4                  |        | <b>SILT</b>  |               |                |                              |   |
| 4                  |        | olive-grey, moist to wet, trace of clay  |               |                |                              |   |
| 5                  |        |  |               |                |                              |   |
| 6                  |        |  |               |                |                              |   |
| 7                  |        |  |               |                |                              |   |
| 8                  |        | <b>CLAY</b>  |               |                |                              |   |
| 8                  |        | stiff, brown, fissured; silty at 1.8 to 2m.<br>TESTHOLE WAS DRY AFTER<br>COMPLETION OF DRILLING. |               |                |                              |   |
| 9                  |        |  |               |                |                              |   |
| 10                 |        |  |               |                |                              |   |
| 11                 |        |  |               |                |                              |   |
| 12                 |        |  |               |                |                              |   |
| 13                 |        |  |               |                |                              |   |
| 14                 |        |  |               |                |                              |   |
| 15                 |        |  | 95.4          |                |                              |   |
| 15                 |        | End of Testhole  |               |                |                              |   |
| 16                 |        |  |               |                |                              |   |
| 17                 |        |  |               |                |                              |   |
| 18                 |        |  |               |                |                              |   |
| 19                 |        |  |               |                |                              |   |
| 20                 |        |  |               |                |                              |   |

Drill Method: S/S Auger

Cochrane Eng. Ltd.  
#600-5 Donald Street  
Winnipeg, MB.  
R3L 2T4

Elevation: 100.0 (Assumed)

Drill Date: 05/13/05

Checked by: SSU

Hole Size: 125mm

Sheet: 1 of 1

**Project No:** WE-05-047-00-WE

**Testhole No.:** TH2

**Project:** St. James Civic Centre

**Client:** City of Winnipeg

**Enclosure:**

**Location:** 2055 Ness Avenue, Winnipeg

**Engineer:** SSU

| SUBSURFACE PROFILE |        |  |                | SAMPLE  |                           | Water Content %<br>● Wp  -----  WI ●<br>20 60 100 140 180 220 |
|--------------------|--------|--|----------------|---------|---------------------------|---|
| Depth              | Symbol | Description  | Depth/Elev., m | PP(kPa) | SPT, N-VALUE (BLOWS/0.3M) |   |
| 0                  |        | Ground Surface   | 100            |         |                           |   |
| 0                  |        | <b>GRANULAR FILL</b><br>20mm down limestone(100mm) followed by<br>150mm granular base course material                                  | 99.7           |         |                           |   |
| 1                  |        | <b>CLAY FILL</b><br>mixed grey and black clay, silty   |                |         |                           |   |
| 2                  |        |  |                |         |                           |   |
| 3                  |        |  |                |         |                           |   |
| 4                  |        |  | 98.8           |         |                           |   |
| 5                  |        |  |                | 150     |                           |   |
| 6                  |        | <b>CLAY</b><br>stiff, olive-grey, fissured; brown below 1.5m;<br>silty at 1.8 to 2m. TESTHOLE WAS DRY<br>AFTER COMPLETION OF DRILLING. |                |         |                           |   |
| 7                  |        |  |                | 175     |                           |   |
| 8                  |        |  |                |         |                           |   |
| 9                  |        |  |                |         |                           |   |
| 10                 |        |  | 97             | 125     |                           |   |
| 11                 |        | End of Testhole  |                |         |                           |   |
| 12                 |        |  |                |         |                           |   |
| 13                 |        |  |                |         |                           |   |
| 14                 |        |  |                |         |                           |   |
| 15                 |        |  |                |         |                           |   |
| 16                 |        |  |                |         |                           |   |
| 17                 |        |  |                |         |                           |   |
| 18                 |        |  |                |         |                           |   |
| 19                 |        |  |                |         |                           |   |
| 20                 |        |  |                |         |                           |   |

Drill Method: S/S Auger

Cochrane Eng. Ltd.  
#600-5 Donald Street  
Winnipeg, MB.  
R3L 2T4

Elevation: 100.0 (Assumed)

Drill Date: 05/13/05

Checked by: SSU

Hole Size: 125mm

Sheet: 1 of 1

**Project No:** WE-05-047-00-WE

**Testhole No.:** TH3

**Project:** St. James Civic Centre

**Client:** City of Winnipeg

**Enclosure:**

**Location:** 2055 Ness Avenue, Winnipeg

**Engineer:** SSU

| SUBSURFACE PROFILE |        |   |               | SAMPLE  |                           | Water Content % |
|--------------------|--------|---|---------------|---------|---------------------------|-----------------|
| Depth              | Symbol | Description   | Depth/Elev.,m | PP(kPa) | SPT, N-VALUE (BLOWS/0.3M) |                 |
| 0                  |        | Ground Surface  | 100           |         |                           |                 |
| 0                  |        | ASPHALT(50mm)   | 99.7          |         |                           |                 |
| 1                  |        | GRANULAR FILL<br>20mm down granular base course material  |               |         |                           |                 |
| 3                  |        | CLAY<br>grey-black, stiff, trace of organic, fissured   | 99.1          |         |                           |                 |
| 5                  |        | SILT<br>olive-grey, moist to wet, soft; frost from 1.2 to 1.5m  | 98.5          |         |                           |                 |
| 7                  |        | CLAY<br>frost down to 2.3m, brown; stiff below 2.3m, fissured. TESTHOLE WAS DRY AFTER COMPLETION OF DRILLING. |               | 150     |                           |                 |
| 10                 |        | End of Testhole   | 97            | 150     |                           |                 |
| 11                 |        |   |               |         |                           |                 |
| 12                 |        |   |               |         |                           |                 |
| 13                 |        |   |               |         |                           |                 |
| 14                 |        |   |               |         |                           |                 |
| 15                 |        |   |               |         |                           |                 |
| 16                 |        |   |               |         |                           |                 |
| 17                 |        |   |               |         |                           |                 |
| 18                 |        |   |               |         |                           |                 |
| 19                 |        |   |               |         |                           |                 |
| 20                 |        |   |               |         |                           |                 |

Drill Method: S/S Auger

Cochrane Eng. Ltd.  
#600-5 Donald Street  
Winnipeg, MB.  
R3L 2T4

Elevation: 100.0 (Assumed)

Drill Date: 05/13/05

Checked by: SSU

Hole Size: 125mm

Sheet: 1 of 1



Project No: WE-05-047-00-WE

Testhole No.: TH4

Project: St. James Civic Centre

Client: City of Winnipeg

Enclosure:

Location: 2055 Ness Avenue, Winnipeg

Engineer: SSU

| SUBSURFACE PROFILE |        |   |                | SAMPLE  |                           | Water Content %<br>● Wp  -----  WI ●<br>20 60 100 140 180 220 |
|--------------------|--------|---|----------------|---------|---------------------------|---|
| Depth              | Symbol | Description   | Depth/Elev., m | PP(kPa) | SPT, N-VALUE (BLOWS/0.3M) |   |
| 0                  |        | Ground Surface  | 100            |         |                           |   |
| 0                  |        | ASPHALT(44mm)   | 99.7           |         |                           |   |
| 1                  |        | GRANULAR FILL<br>20mm down granular base course material  | 99.4           |         |                           |   |
| 2                  |        | CLAY FILL<br>grey-black and brown, mixed, trace of fine gravel  |                |         |                           |   |
| 3                  |        | CLAY<br>grey-black, trace of organic, stiff; frost from 1 to 2.3m, brown; stiff below 2.3m, fissured.<br>TESTHOLE WAS DRY AFTER COMPLETION OF DRILLING. |                |         |                           |   |
| 4                  |        |   |                |         |                           |   |
| 5                  |        |   |                |         |                           |   |
| 6                  |        |   |                |         |                           |   |
| 7                  |        |   |                | 125     |                           |   |
| 8                  |        |   |                |         |                           |   |
| 9                  |        |   |                |         |                           |   |
| 10                 |        | End of Testhole   | 97             | 75      |                           |   |
| 11                 |        |   |                |         |                           |   |
| 12                 |        |   |                |         |                           |   |
| 13                 |        |   |                |         |                           |   |
| 14                 |        |   |                |         |                           |   |
| 15                 |        |   |                |         |                           |   |
| 16                 |        |   |                |         |                           |   |
| 17                 |        |   |                |         |                           |   |
| 18                 |        |   |                |         |                           |   |
| 19                 |        |   |                |         |                           |   |
| 20                 |        |   |                |         |                           |   |

Drill Method: S/S Auger

Cochrane Eng. Ltd.  
#600-5 Donald Street  
Winnipeg, MB.  
R3L 2T4

Elevation: 100.0 (Assumed)

Drill Date: 05/13/05

Checked by: SSU

Hole Size: 125mm

Sheet: 1 of 1

Project No: WE-05-047-00-WE

Testhole No.: TH5

Project: St. James Civic Centre

Client: City of Winnipeg

Enclosure:

Location: 2055 Ness Avenue, Winnipeg

Engineer: SSU

| SUBSURFACE PROFILE |        |   |               | SAMPLE  |                           | Water Content % |  |
|--------------------|--------|---|---------------|---------|---------------------------|-----------------|--|
| Depth              | Symbol | Description   | Depth/Elev.,m | PP(kPa) | SPT, N-VALUE (BLOWS/0.3M) |                 |  |
| 0                  |        | Ground Surface  | 100           |         |                           |                 |  |
| 0                  |        | ASPHALT(100mm)  | 99.7          |         |                           |                 |  |
| 1                  |        | GRANULAR FILL   |               |         | 10                        |                 |  |
| 2                  |        | 20mm down granular base course material   |               |         |                           |                 |  |
| 3                  |        |   |               |         | 6                         |                 |  |
| 4                  |        | <b>CLAY</b><br>grey-black, trace of organic, stiff; olive-grey at 0.8m; frost from 1 to 2.1m; brown at 1.8m; stiff below 2.1m, fissured. TESTHOLE WAS DRY AFTER COMPLETION OF DRILLING. |               |         |                           |                 |  |
| 5                  |        |   |               |         |                           |                 |  |
| 6                  |        |   |               |         |                           |                 |  |
| 7                  |        |   |               |         | 150                       |                 |  |
| 8                  |        |   |               |         |                           |                 |  |
| 9                  |        |   |               |         |                           |                 |  |
| 10                 |        | End of Testhole   | 97            | 75      |                           |                 |  |
| 11                 |        |   |               |         |                           |                 |  |
| 12                 |        |   |               |         |                           |                 |  |
| 13                 |        |   |               |         |                           |                 |  |
| 14                 |        |   |               |         |                           |                 |  |
| 15                 |        |   |               |         |                           |                 |  |
| 16                 |        |   |               |         |                           |                 |  |
| 17                 |        |   |               |         |                           |                 |  |
| 18                 |        |   |               |         |                           |                 |  |
| 19                 |        |   |               |         |                           |                 |  |
| 20                 |        |   |               |         |                           |                 |  |

Drill Method: S/S Auger

Cochrane Eng. Ltd.  
 #600-5 Donald Street  
 Winnipeg, MB.  
 R3L 2T4

Elevation: 100.0 (Assumed)

Drill Date: 05/13/05

Checked by: SSU

Hole Size: 125mm

Sheet: 1 of 1

Project No: WE-05-047-00-WE

Testhole No.: TH6

Project: St. James Civic Centre

Client: City of Winnipeg

Enclosure:

Location: 2055 Ness Avenue, Winnipeg

Engineer: SSU

| SUBSURFACE PROFILE |        |   |               | SAMPLE         |                              |   |
|--------------------|--------|---|---------------|----------------|------------------------------|---|
| Depth<br>ft<br>m   | Symbol | Description   | Depth/Elev.,m | PP(kPa)        | SPT, N-VALUE<br>(BLOWS/0.3M) | Water Content %<br>● Wp   0   Wl ●<br>20 60 100 140 180 220 |
|                    |        |   |               | 50 150 250 350 |                              |   |
| 0                  |        | Ground Surface  | 100           |                |                              |   |
| 0                  |        | ASPHALT(50mm)   | 99.7          |                |                              |   |
| 1                  |        | GRANULAR FILL   |               |                |                              |   |
| 2                  |        | 20mm down limestone base course material  | 99.2          |                | 4                            |   |
| 3                  |        | CLAY FILL   |               |                |                              |   |
| 4                  |        | grey-black and brown, mixed, trace of fine gravel   | 98.9          |                | 3                            |   |
| 5                  |        | SILT  |               |                |                              |   |
| 6                  |        | olive-grey, moist to wet, soft, trace of clay   |               |                |                              |   |
| 7                  |        | CLAY  |               |                |                              |   |
| 8                  |        | olive grey, frost down to 2.1m; brown at 1.5m; stiff below 2.1m, fissured. TESTHOLE WAS DRY AFTER COMPLETION OF DRILLING. |               |                |                              |   |
| 9                  |        |   |               |                |                              |   |
| 10                 |        |   | 97            |                |                              |   |
| 11                 |        | End of Testhole   |               |                |                              |   |
| 12                 |        |   |               |                |                              |   |
| 13                 |        |   |               |                |                              |   |
| 14                 |        |   |               |                |                              |   |
| 15                 |        |   |               |                |                              |   |
| 16                 |        |   |               |                |                              |   |
| 17                 |        |   |               |                |                              |   |
| 18                 |        |   |               |                |                              |   |
| 19                 |        |   |               |                |                              |   |
| 20                 |        |   |               |                |                              |   |

Drill Method: S/S Auger

Cochrane Eng. Ltd.  
#600-5 Donald Street  
Winnipeg, MB.  
R3L 2T4

Elevation: 100.0 (Assumed)

Drill Date: 05/13/05

Checked by: SSU

Hole Size: 125mm

Sheet: 1 of 1

Project No: WE-05-047-00-WE

Testhole No.: TH7

Project: St. James Civic Centre

Client: City of Winnipeg

Enclosure:

Location: 2055 Ness Avenue, Winnipeg

Engineer: SSU

| SUBSURFACE PROFILE |        |  |                | SAMPLE  |                           |                 |
|--------------------|--------|--|----------------|---------|---------------------------|-----------------|
| Depth              | Symbol | Description  | Depth/Elev., m | PP(kPa) | SPT, N-VALUE (BLOWS/0.3M) | Water Content % |
| 0                  |        | Ground Surface   | 100            |         |                           |                 |
| 0                  |        | ASPHALT(125mm)   | 99.7           |         |                           |                 |
| 1                  |        | <b>GRANULAR FILL</b><br>20mm down limestone(75mm) base course material followed by a mixture(150mm) of clay and granular material  |                |         |                           |                 |
| 2                  |        |  |                |         |                           |                 |
| 3                  |        | <b>CLAY</b><br>grey-black, stiff, trace of organic; olive grey at 0.6m, silty, soft; frost from 1.1m to 2.1m; brown at 1.2m; stiff below 2.1m, fissured.<br>TESTHOLE WAS DRY AFTER COMPLETION OF DRILLING. |                |         |                           |                 |
| 4                  |        |  |                |         |                           |                 |
| 5                  |        |  |                |         |                           |                 |
| 6                  |        |  |                |         |                           |                 |
| 7                  |        |  |                |         | 125                       |                 |
| 8                  |        |  |                |         |                           |                 |
| 9                  |        |  |                |         |                           |                 |
| 10                 |        |  |                | 97      | 75                        |                 |
| 11                 |        | End of Testhole  |                |         |                           |                 |
| 12                 |        |  |                |         |                           |                 |
| 13                 |        |  |                |         |                           |                 |
| 14                 |        |  |                |         |                           |                 |
| 15                 |        |  |                |         |                           |                 |
| 16                 |        |  |                |         |                           |                 |
| 17                 |        |  |                |         |                           |                 |
| 18                 |        |  |                |         |                           |                 |
| 19                 |        |  |                |         |                           |                 |
| 20                 |        |  |                |         |                           |                 |

Drill Method: S/S Auger

Cochrane Eng. Ltd.  
 #600-5 Donald Street  
 Winnipeg, MB.  
 R3L 2T4

Elevation: 100.0 (Assumed)

Drill Date: 05/13/05

Checked by: SSU

Hole Size: 125mm

Sheet: 1 of 1

**Project No:** WE-05-047-00-WE

**Testhole No.:** TH8

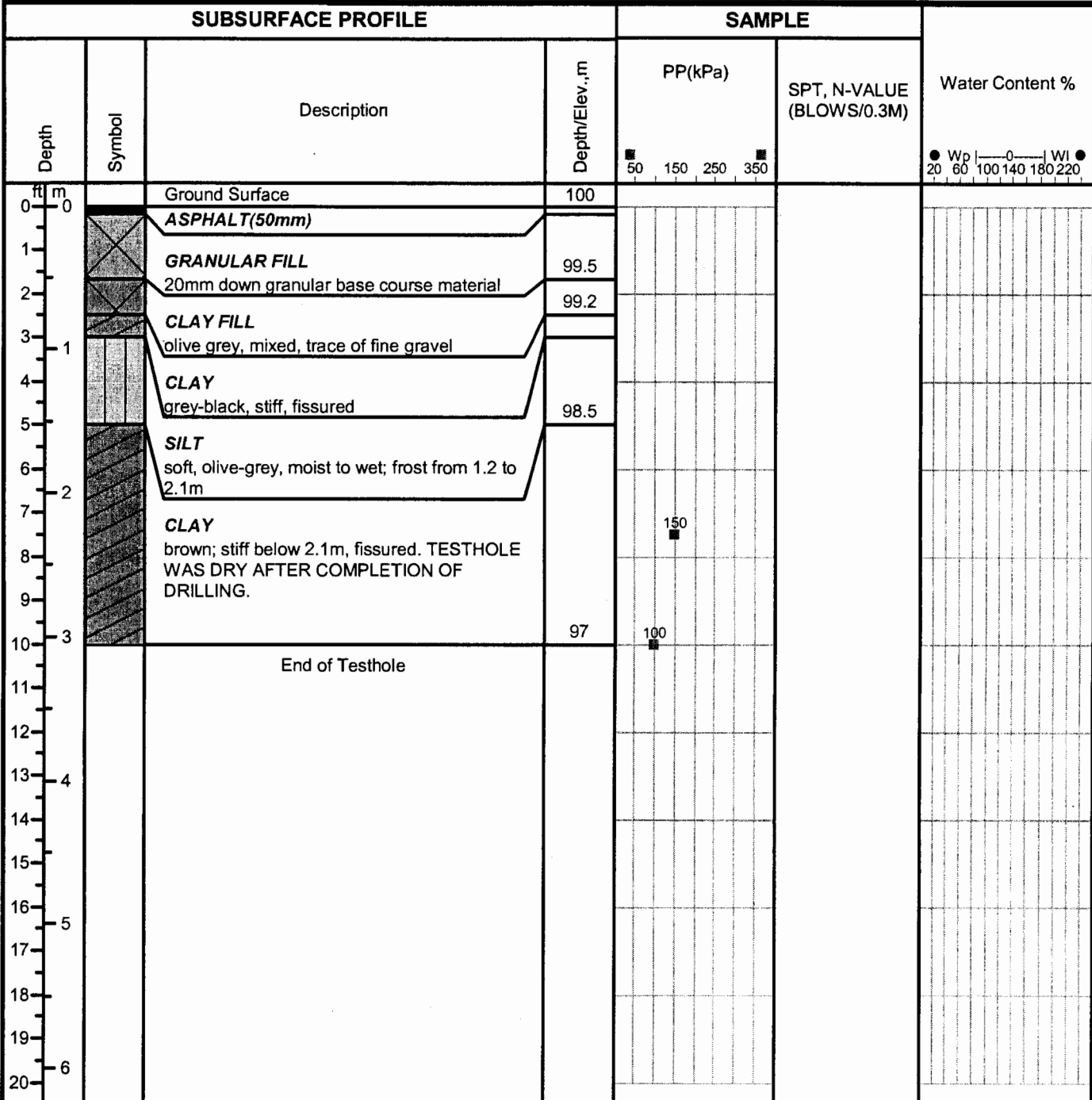
**Project:** St. James Civic Centre

**Client:** City of Winnipeg

**Enclosure:**

**Location:** 2055 Ness Avenue, Winnipeg

**Engineer:** SSU



Drill Method: S/S Auger

Cochrane Eng. Ltd.  
#600-5 Donald Street  
Winnipeg, MB.  
R3L 2T4

Elevation: 100.0 (Assumed)

Drill Date: 05/13/05

Checked by: SSU

Hole Size: 125mm

Sheet: 1 of 1

Project No: WE-05-047-00-WE

Testhole No.: TH9

Project: St. James Civic Centre

Client: City of Winnipeg

Enclosure:

Location: 2055 Ness Avenue, Winnipeg

Engineer: SSU

| SUBSURFACE PROFILE |        |  |                | SAMPLE  |                              | Water Content %<br>● Wp   0   WI ●<br>20 60 100 140 180 220 |
|--------------------|--------|--|----------------|---------|------------------------------|---|
| Depth              | Symbol | Description  | Depth/Elev., m | PP(kPa) | SPT, N-VALUE<br>(BLOWS/0.3M) |   |
| 0                  |        | Ground Surface   | 100            |         |                              |   |
|                    |        | ASPHALT(50mm)  | 99.7           |         |                              |   |
| 1                  |        | GRANULAR FILL<br>20mm down granular base course material   |                |         |                              |   |
| 2                  |        | CLAY FILL<br>olive grey and grey-black, mixed, trace of fine gravel and silt material  | 99.1           |         |                              |   |
| 3                  |        | CLAY<br>50mm of grey-black clay, stiff; olive grey at 1m, silty, firm; frost from 1.2 to 2.1m; brown at 1.5m; stiff below 2.1m, fissured. TESTHOLE WAS DRY AFTER COMPLETION OF DRILLING. |                |         |                              |   |
| 4                  |        |  |                |         |                              |   |
| 5                  |        |  |                |         |                              |   |
| 6                  |        |  |                |         |                              |   |
| 7                  |        |  |                |         | 125                          |   |
| 8                  |        |  |                |         |                              |   |
| 9                  |        |  |                |         |                              |   |
| 10                 |        | End of Testhole  | 97             | 100     |                              |   |
| 11                 |        |  |                |         |                              |   |
| 12                 |        |  |                |         |                              |   |
| 13                 |        |  |                |         |                              |   |
| 14                 |        |  |                |         |                              |   |
| 15                 |        |  |                |         |                              |   |
| 16                 |        |  |                |         |                              |   |
| 17                 |        |  |                |         |                              |   |
| 18                 |        |  |                |         |                              |   |
| 19                 |        |  |                |         |                              |   |
| 20                 |        |  |                |         |                              |   |

Drill Method: S/S Auger

Cochrane Eng. Ltd.  
#600-5 Donald Street  
Winnipeg, MB.  
R3L 2T4

Elevation: 100.0 (Assumed)

Drill Date: 05/13/05

Checked by: SSU

Hole Size: 125mm

Sheet: 1 of 1

Project No: WE-05-047-00-WE

Testhole No.: TH10

Project: St. James Civic Centre

Client: City of Winnipeg

Enclosure:

Location: 2055 Ness Avenue, Winnipeg

Engineer: SSU

| SUBSURFACE PROFILE |        |  |               | SAMPLE           |                              |  |
|--------------------|--------|--|---------------|------------------|------------------------------|--|
| Depth              | Symbol | Description  | Depth/Elev.,m | PP(kPa)          | SPT, N-VALUE<br>(BLOWS/0.3M) | Water Content %                          |
|                    |        |  |               | ■ 50 150 250 350 |                              | ● Wp   0   WI ●<br>20 60 100 140 180 220 |
| 0                  |        | Ground Surface   | 100           |                  |                              |  |
| 0                  |        | ASPHALT(75mm)  |               |                  |                              |  |
| 1                  |        | GRANULAR FILL  |               |                  |                              |  |
| 2                  |        | 20mm down limestone base course material   | 99.2          |                  |                              |  |
| 3                  |        | CLAY FILL  |               |                  |                              |  |
| 4                  |        | olive grey and grey-black, mixed, trace of fine gravel and silt material   |               |                  |                              |  |
| 5                  |        | CLAY   |               |                  |                              |  |
| 6                  |        | grey-black, trace of organic, stiff  |               |                  |                              |  |
| 7                  |        | SILT   | 98.2          |                  |                              |  |
| 8                  |        | olive grey, soft, wet  |               |                  |                              |  |
| 9                  |        | CLAY   |               | 150              |                              |  |
| 10                 |        | frost down to 2.1m, olive grey, silty; brown at 1.8m; stiff below 2.1m, fissured. TESTHOLE WAS DRY AFTER COMPLETION OF DRILLING. |               |                  |                              |  |
| 11                 |        |  | 97            | 100              |                              |  |
| 12                 |        | End of Testhole  |               |                  |                              |  |
| 13                 |        |  |               |                  |                              |  |
| 14                 |        |  |               |                  |                              |  |
| 15                 |        |  |               |                  |                              |  |
| 16                 |        |  |               |                  |                              |  |
| 17                 |        |  |               |                  |                              |  |
| 18                 |        |  |               |                  |                              |  |
| 19                 |        |  |               |                  |                              |  |
| 20                 |        |  |               |                  |                              |  |

Drill Method: S/S Auger

Cochrane Eng. Ltd.  
#600-5 Donald Street  
Winnipeg, MB.  
R3L 2T4

Elevation: 100.0 (Assumed)

Drill Date: 05/13/05

Checked by: SSU

Hole Size: 125mm

Sheet: 1 of 1

**Project No:** WE-05-047-00-WE

**Testhole No.:** TH11

**Project:** St. James Civic Centre

**Client:** City of Winnipeg

**Enclosure:**

**Location:** 2055 Ness Avenue, Winnipeg

**Engineer:** SSU

| SUBSURFACE PROFILE |        |   |                | SAMPLE                  |                              |                 |
|--------------------|--------|---|----------------|-------------------------|------------------------------|-----------------|
| Depth              | Symbol | Description   | Depth/Elev., m | PP(kPa)                 | SPT, N-VALUE<br>(BLOWS/0.3M) | Water Content % |
|                    |        |   |                | 50    150    250    350 |                              |                 |
| 0                  |        | Ground Surface  | 100            |                         |                              |                 |
| 0                  |        | <b>ASPHALT(50mm)</b>  |                |                         |                              |                 |
| 1                  |        | <b>GRANULAR FILL</b>  | 99.6           |                         |                              |                 |
| 2                  |        | 20mm down limestone base course material  | 99.4           |                         |                              |                 |
| 3                  |        | <b>CLAY FILL</b>  |                |                         |                              |                 |
| 4                  |        | olive grey and grey-black, mixed, trace of fine gravel and silt material  |                |                         |                              |                 |
| 5                  |        | <b>CLAY</b>   |                |                         |                              |                 |
| 6                  |        | grey-black, trace of organic, stiff   | 98.3           |                         |                              |                 |
| 7                  |        | <b>SILT</b>   |                |                         |                              |                 |
| 8                  |        | olive grey, soft, wet; frost at 1.1m; clayey at 1.2 to 1.4m   |                | 100                     |                              |                 |
| 9                  |        | <b>CLAY</b>   |                |                         |                              |                 |
| 10                 |        | frost down to 2.1m, olive grey; brown at 1.8m; stiff below 2.1m, fissured. TESTHOLE WAS DRY AFTER COMPLETION OF DRILLING. | 97             | 75                      |                              |                 |
| 11                 |        | End of Testhole   |                |                         |                              |                 |
| 12                 |        |   |                |                         |                              |                 |
| 13                 |        |   |                |                         |                              |                 |
| 14                 |        |   |                |                         |                              |                 |
| 15                 |        |   |                |                         |                              |                 |
| 16                 |        |   |                |                         |                              |                 |
| 17                 |        |   |                |                         |                              |                 |
| 18                 |        |   |                |                         |                              |                 |
| 19                 |        |   |                |                         |                              |                 |
| 20                 |        |   |                |                         |                              |                 |

Drill Method: S/S Auger

Cochrane Eng. Ltd.  
#600-5 Donald Street  
Winnipeg, MB.  
R3L 2T4

Elevation: 100.0 (Assumed)

Drill Date: 05/13/05

Checked by: SSU

Hole Size: 125mm

Sheet: 1 of 1



Project No: WE-05-047-00-WE

Testhole No.: TH12

Project: St. James Civic Centre

Client: City of Winnipeg

Enclosure:

Location: 2055 Ness Avenue, Winnipeg

Engineer: SSU

| SUBSURFACE PROFILE |        |   |               | SAMPLE  |                           | Water Content % |
|--------------------|--------|---|---------------|---------|---------------------------|-----------------|
| Depth              | Symbol | Description   | Depth/Elev.,m | PP(kPa) | SPT, N-VALUE (BLOWS/0.3M) |                 |
| 0                  |        | Ground Surface  | 100           |         |                           |                 |
| 0                  |        | <b>ASPHALT(37.5mm)</b>  |               |         |                           |                 |
| 1                  |        | <b>GRANULAR FILL</b>  | 99.5          |         |                           |                 |
| 2                  |        | 20mm down limestone base course material; slight seepage at layer's base  | 99.2          |         |                           |                 |
| 3                  |        | <b>CLAY FILL</b>  |               |         |                           |                 |
| 4                  |        | olive grey and grey-black, mixed, trace of fine gravel and silt material  |               |         |                           |                 |
| 5                  |        | <b>CLAY</b>   | 98.3          |         |                           |                 |
| 6                  |        | grey-black, trace of organic, stiff   |               |         |                           |                 |
| 7                  |        | <b>SILT</b>   |               | 100     |                           |                 |
| 8                  |        | olive grey, soft, wet; frost at 1m; tan-brown at 1m   |               |         |                           |                 |
| 9                  |        | <b>CLAY</b>   |               |         |                           |                 |
| 10                 |        | frost down to 2.1m, olive grey; brown at 1.8m; stiff below 2.1m, fissured. TESTHOLE WAS DRY AFTER COMPLETION OF DRILLING. | 97            | 75      |                           |                 |
| 11                 |        | End of Testhole   |               |         |                           |                 |
| 12                 |        |   |               |         |                           |                 |
| 13                 |        |   |               |         |                           |                 |
| 14                 |        |   |               |         |                           |                 |
| 15                 |        |   |               |         |                           |                 |
| 16                 |        |   |               |         |                           |                 |
| 17                 |        |   |               |         |                           |                 |
| 18                 |        |   |               |         |                           |                 |
| 19                 |        |   |               |         |                           |                 |
| 20                 |        |   |               |         |                           |                 |

Drill Method: S/S Auger

Cochrane Eng. Ltd.  
#600-5 Donald Street  
Winnipeg, MB.  
R3L 2T4

Elevation: 100.0 (Assumed)

Drill Date: 05/13/05

Checked by: SSU

Hole Size: 125mm

Sheet: 1 of 1

Project No: WE-05-047-00-WE

Testhole No.: TH13

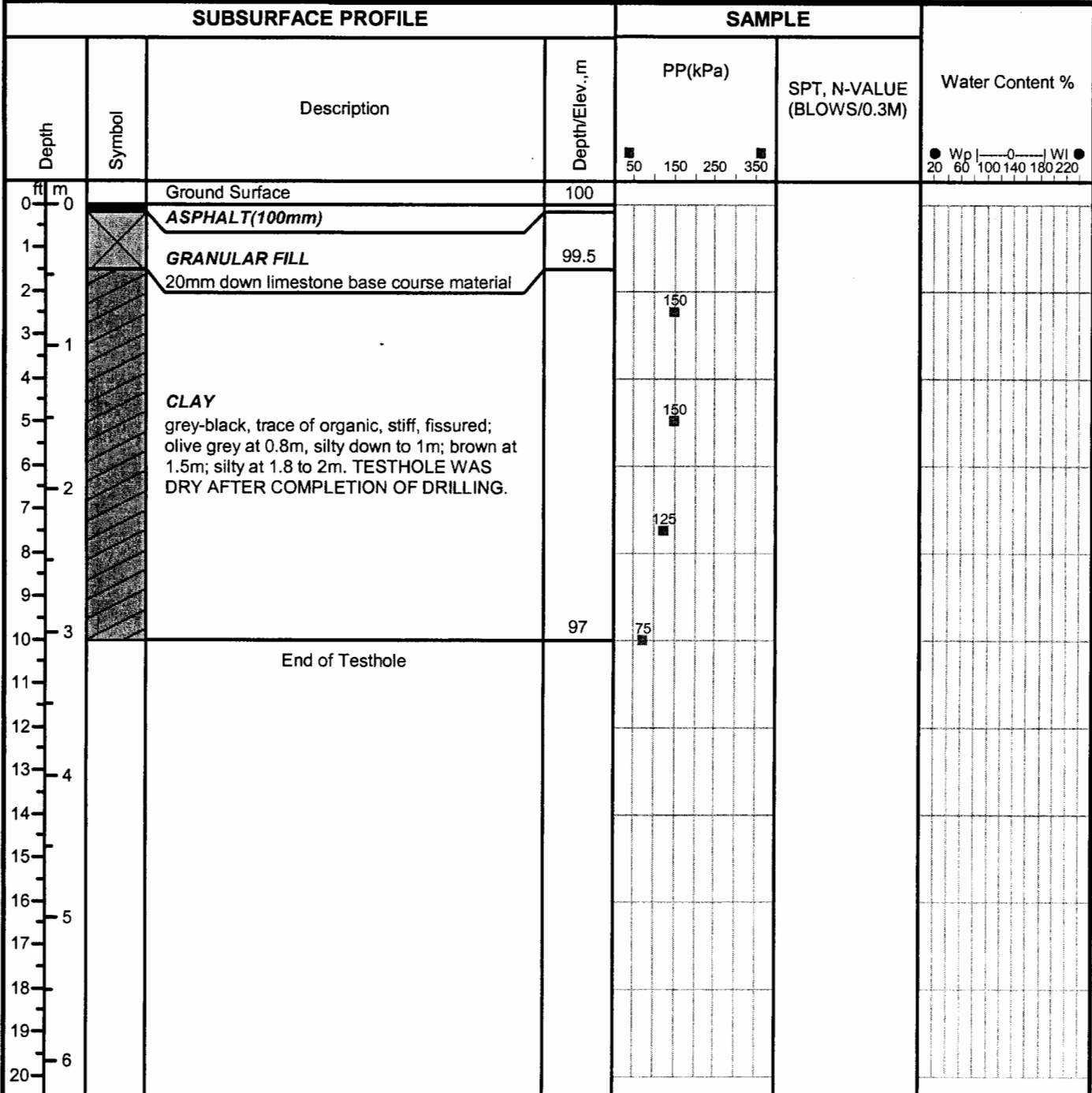
Project: St. James Civic Centre

Client: City of Winnipeg

Enclosure:

Location: 2055 Ness Avenue, Winnipeg

Engineer: SSU



Drill Method: S/S Auger

Cochrane Eng. Ltd.  
 #600-5 Donald Street  
 Winnipeg, MB.  
 R3L 2T4

Elevation: 100.0 (Assumed)

Drill Date: 05/13/05

Checked by: SSU

Hole Size: 125mm

Sheet: 1 of 1

Project No: WE-05-047-00-WE

Testhole No.: TH14

Project: St. James Civic Centre

Client: City of Winnipeg

Enclosure:

Location: 2055 Ness Avenue, Winnipeg

Engineer: SSU

| SUBSURFACE PROFILE |        |   |                | SAMPLE  |                           | Water Content % |
|--------------------|--------|---|----------------|---------|---------------------------|-----------------|
| Depth              | Symbol | Description   | Depth/Elev., m | PP(kPa) | SPT, N-VALUE (BLOWS/0.3M) |                 |
| 0                  |        | Ground Surface  | 100            |         |                           |                 |
| 0                  |        | <b>GRANULAR FILL</b><br>20mm down limestone base course material  | 99.7           |         |                           |                 |
| 1                  |        | <b>CLAY</b><br>grey-black, trace of organic, stiff, fissured;<br>olive grey at 0.8m, silty down to 1m; frost from<br>1.2 to 2.1m; brown at 1.8m; stiff below 2.1m.<br>TESTHOLE WAS DRY AFTER<br>COMPLETION OF DRILLING. |                |         |                           |                 |
| 2                  |        |   |                |         |                           |                 |
| 3                  |        |   |                |         |                           |                 |
| 4                  |        |   |                |         |                           |                 |
| 5                  |        |   |                |         |                           |                 |
| 6                  |        |   |                |         |                           |                 |
| 7                  |        |   |                |         | 150                       |                 |
| 8                  |        |   |                |         |                           |                 |
| 9                  |        |   |                |         |                           |                 |
| 10                 |        |   |                | 97      | 100                       |                 |
| 11                 |        | End of Testhole   |                |         |                           |                 |
| 12                 |        |   |                |         |                           |                 |
| 13                 |        |   |                |         |                           |                 |
| 14                 |        |   |                |         |                           |                 |
| 15                 |        |   |                |         |                           |                 |
| 16                 |        |   |                |         |                           |                 |
| 17                 |        |   |                |         |                           |                 |
| 18                 |        |   |                |         |                           |                 |
| 19                 |        |   |                |         |                           |                 |
| 20                 |        |   |                |         |                           |                 |

Drill Method: S/S Auger

Cochrane Eng. Ltd.  
#600-5 Donald Street  
Winnipeg, MB.  
R3L 2T4

Elevation: 100.0 (Assumed)

Drill Date: 05/13/05

Checked by: SSU

Hole Size: 125mm

Sheet: 1 of 1

**APPENDIX C**

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**Laboratory Test Results**



199 Henlow Bay  
Winnipeg, MB R3Y 1G4  
Phone (204) 488-6999  
Fax (204) 488-6947  
Email info@nationaltestlabs.com  
www.nationaltestlabs.com

Cochrane Engineering Ltd.  
600-5 Donald Street  
Winnipeg, Manitoba  
R3L 2T4

May 30, 2005

Project: St. James Civic Centre  
(COC-506)

Attention: Silvestre Urbano

Soil samples were submitted to our laboratory on May 24, 2005. The following tests were conducted on selected soil samples as requested by the client:

- water content (ASTM D2216)
- particle size analysis (ASTM D422)

The test results are provided in the attached tables.

Please call if you have any questions regarding this report.

Prepared by:

Robert Brown,  
Environmental and Geotechnical  
Engineering Services

Reviewed by:

Rob Hochkovich, C. Tech.,  
Project Manager,  
Environmental and Geotechnical  
Engineering Services



**TABLE 1  
ST. JAMES CIVIC CENTRE  
WATER CONTENT TEST DATA**

| Sample Identification | Water Content, % |
|-----------------------|------------------|
| TH1, 2.5'             | 31.4             |
| TH1, 3'               | 19.0             |
| TH1, 5'               | 31.8             |
| TH1, 10'              | 55.3             |
| TH2, 2.5'             | 23.1             |
| TH3, 2.5'             | 37.1             |
| TH5, 1'-2.5'          | 14.7             |
| TH5, 2.5'-4'          | 28.7             |
| TH5, 10'              | 41.5             |

**Note:**

1. Tests conducted in accordance with ASTM D2216.

**TABLE 2  
ST. JAMES CIVIC CENTRE  
PARTICLE SIZE ANALYSIS TEST DATA**

| Sample Identification | Gravel, %<br>75 to 4.75 mm | Sand, %                   |                            |                            | Silt, %<br><0.075 to 0.005 mm | Clay, %<br>< 0.005 mm | Colloids, %<br>< 0.001 mm |
|-----------------------|----------------------------|---------------------------|----------------------------|----------------------------|-------------------------------|-----------------------|---------------------------|
|                       |                            | Coarse<br><4.75 to 2.0 mm | Medium<br><2.0 to 0.425 mm | Fine<br><0.425 to 0.075 mm |                               |                       |                           |
| TH1, 3'               | 11.2                       | 2.6                       | 3.7                        | 12.4                       | 43.5                          | 26.6                  | 20.0                      |
| TH5, 2.5'-4'          | 0.0                        | 0.5                       | 1.3                        | 3.1                        | 18.2                          | 76.9                  | 68.1                      |

**Notes**

1. Test conducted in accordance with ASTM D422.
2. A high speed stirring device was used for 1 minute to disperse the test sample.
3. The percentage of colloids is also included in the clay size fraction.