APPENDIX ‘A’

GEOTECHNICAL REPORT
Dear Mr. Rowbotham:

This letter summarizes KGS Group's geotechnical investigation for Raleigh Street (North), Raleigh Street (South), Jamison Avenue, Talbot Avenue, Edison Avenue, Sanford Fleming Road, Day Street that was required as part of the City of Winnipeg Streets Package in Winnipeg, Manitoba.

1.0 INTRODUCTION

KGS Group has completed a geotechnical investigation consisting of 50 test holes for the design of the street pavement structures. The 2019 City of Winnipeg Local Streets Package includes the following streets:

- 305 m section of Raleigh Street extending north from Chalmers Avenue to Monroe Avenue;
- 709 m section of Raleigh Street extending north from Springfield Road to Donwood Drive;
- 650 m section of Jamison Avenue extending east from Henderson Highway to Roch Street;
- 220 m section of Talbot Avenue extending east from Grey Street to Foster Street;
- 792 m section of Edison Avenue extending east from Rothesay Street to De Graff Place;
- 723 m section of Sanford Fleming Road extending east from Plessis Road to Devonshire Drive; and
• 521 m section of Day Street extending north from Kildare Avenue West to McMeans Avenue West.

This report details the results of the geotechnical investigation completed by KGS Group in January and February 2019.

2.0 GEOTECHNICAL INVESTIGATION SERVICES

The scope of this assignment included the following:

• **Utility Clearances** – Prior to undertaking any drilling activities KGS Group obtained the necessary underground utility clearances.

• **Traffic Protection** – KGS Group arranged for traffic protection throughout the geotechnical investigation in accordance with City of Winnipeg Manual for Temporary Traffic Control requirements.

• **Geotechnical Investigation** – A geotechnical investigation was completed to investigate the subsurface conditions below the pavement surface in accordance with City of Winnipeg geotechnical requirements for public works projects. The breakdown of the requested number of pavement cores and test holes by street is outlined in the table below. All test holes were advanced to a total depth of 3.1 m.

<table>
<thead>
<tr>
<th>STREET NAME</th>
<th>NUMBER OF CORE / TEST HOLES</th>
<th>PAVEMENT CORE HOLES ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raleigh Street (North)</td>
<td>7</td>
<td>None</td>
</tr>
<tr>
<td>Raleigh Street (South)</td>
<td>9</td>
<td>None</td>
</tr>
<tr>
<td>Jamison Avenue</td>
<td>7</td>
<td>None</td>
</tr>
<tr>
<td>Talbot Avenue</td>
<td>None</td>
<td>5</td>
</tr>
<tr>
<td>Edison Avenue</td>
<td>None</td>
<td>8</td>
</tr>
<tr>
<td>Sanford Fleming Road</td>
<td>None</td>
<td>8</td>
</tr>
<tr>
<td>Day Street</td>
<td>None</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>23</strong></td>
<td><strong>27</strong></td>
</tr>
</tbody>
</table>

• **Laboratory Testing** – Laboratory testing including grain size analyses, Atterberg limits and moisture contents were performed on select soil samples for correlation to relevant engineering properties of the soils.

3.0 GEOTECHNICAL INVESTIGATION

3.1 TEST HOLE DRILLING AND SOIL SAMPLING PROGRAM

A drilling and sampling program consisting of 50 cores through the pavement structure and 23 test holes advanced to depths of 3.1 m were completed from January 24, 2019 to February 14, 2019. Drilling services were provided by Maple Leaf Drilling Ltd. of
Winnipeg, Manitoba with KGS Group supervision. Test holes were completed using a mobile B40 truck mounted drill rig. Test holes were cored through the existing pavement and advanced the remaining depth using 125 mm diameter solid stem continuous flight augers. The locations of the test holes are shown on Figures attached in the Appendices with the approximate UTM coordinates (Zone 14) and ground elevations listed in Table 1 to 7.

The first soil sample in each test hole was obtained no deeper than 0.1 m below the existing pavement structure, with subsequent soil samples recovered at 0.3 m intervals to a total depth of 3.1 m. Soil samples were collected directly off the auger flights and visually classified in the field in accordance with the modified Unified Soil Classification System (USCS). Field Torvane’s were complete on the clay soils to estimate the undrained shear strength.

Upon completion of drilling, the test holes were examined for indications of sloughing and seepage, and then backfilled to grade with bentonite chips, auger cuttings and cold-mix asphalt patch to the pavement surface. Detailed summary soil logs incorporating all field observations details are attached in the Appendices.

### TABLE 2
**RALEIGH STREET (NORTH) – TEST HOLE COORDINATES AND ELEVATIONS**

<table>
<thead>
<tr>
<th>TEST HOLE ID</th>
<th>APPROXIMATE UTM COORDINATES</th>
<th>GROUND ELEV. (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TH19-01</td>
<td>5,533,530 639,164</td>
<td>230.70</td>
</tr>
<tr>
<td>TH19-02</td>
<td>5,533,494 639,131</td>
<td>230.76</td>
</tr>
<tr>
<td>TH19-03</td>
<td>5,533,452 639,098</td>
<td>230.79</td>
</tr>
<tr>
<td>TH19-04</td>
<td>5,533,414 639,074</td>
<td>230.81</td>
</tr>
<tr>
<td>TH19-05</td>
<td>5,533,396 639,055</td>
<td>230.86</td>
</tr>
<tr>
<td>TH19-06</td>
<td>5,533,373 639,042</td>
<td>230.88</td>
</tr>
<tr>
<td>TH19-07</td>
<td>5,533,328 639,002</td>
<td>231.05</td>
</tr>
</tbody>
</table>

### TABLE 3
**RALEIGH STREET (SOUTH) – TEST HOLE COORDINATES AND ELEVATIONS**

<table>
<thead>
<tr>
<th>TEST HOLE ID</th>
<th>APPROXIMATE UTM COORDINATES</th>
<th>GROUND ELEV. (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TH19-11</td>
<td>5,530,888 637,114</td>
<td>230.61</td>
</tr>
<tr>
<td>TH19-12</td>
<td>5,530,837 637,074</td>
<td>230.75</td>
</tr>
<tr>
<td>TH19-13</td>
<td>5,530,769 637,022</td>
<td>230.51</td>
</tr>
<tr>
<td>TH19-14</td>
<td>5,530,684 636,960</td>
<td>231.21</td>
</tr>
<tr>
<td>TH19-15</td>
<td>5,530,611 636,904</td>
<td>230.77</td>
</tr>
<tr>
<td>TH19-16</td>
<td>5,530,535 636,845</td>
<td>230.33</td>
</tr>
<tr>
<td>TH19-17</td>
<td>5,530,478 636,801</td>
<td>230.53</td>
</tr>
<tr>
<td>TH19-18</td>
<td>5,530,392 636,734</td>
<td>230.98</td>
</tr>
<tr>
<td>TH19-19</td>
<td>5,530,337 636,693</td>
<td>231.12</td>
</tr>
</tbody>
</table>
### TABLE 4
JAMISON AVENUE – TEST HOLE COORDINATES AND ELEVATIONS

<table>
<thead>
<tr>
<th>TEST HOLE ID</th>
<th>APPROXIMATE UTM COORDINATES</th>
<th>GROUND ELEV. (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NORTHING (m)</td>
<td>EASTING (m)</td>
</tr>
<tr>
<td>TH19-21</td>
<td>5,531,328</td>
<td>635,566</td>
</tr>
<tr>
<td>TH19-22</td>
<td>5,531,285</td>
<td>635,653</td>
</tr>
<tr>
<td>TH19-23</td>
<td>5,531,240</td>
<td>635,748</td>
</tr>
<tr>
<td>TH19-24</td>
<td>5,531,211</td>
<td>635,809</td>
</tr>
<tr>
<td>TH19-25</td>
<td>5,531,169</td>
<td>635,897</td>
</tr>
<tr>
<td>TH19-26</td>
<td>5,531,125</td>
<td>635,988</td>
</tr>
<tr>
<td>TH19-27</td>
<td>5,531,072</td>
<td>636,098</td>
</tr>
</tbody>
</table>

### TABLE 5
TALBOT AVENUE – TEST HOLE COORDINATES AND ELEVATIONS

<table>
<thead>
<tr>
<th>TEST HOLE ID</th>
<th>APPROXIMATE UTM COORDINATES</th>
<th>GROUND ELEV. (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NORTHING (m)</td>
<td>EASTING (m)</td>
</tr>
<tr>
<td>TH19-31</td>
<td>5,529,800</td>
<td>636,853</td>
</tr>
<tr>
<td>TH19-32</td>
<td>5,529,777</td>
<td>636,946</td>
</tr>
<tr>
<td>TH19-33</td>
<td>5,529,764</td>
<td>636,996</td>
</tr>
<tr>
<td>TH19-34</td>
<td>5,529,787</td>
<td>636,906</td>
</tr>
<tr>
<td>TH19-35</td>
<td>5,529,805</td>
<td>636,831</td>
</tr>
</tbody>
</table>

### TABLE 6
EDISON AVENUE – TEST HOLE COORDINATES AND ELEVATIONS

<table>
<thead>
<tr>
<th>TEST HOLE ID</th>
<th>APPROXIMATE UTM COORDINATES</th>
<th>GROUND ELEV. (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NORTHING (m)</td>
<td>EASTING (m)</td>
</tr>
<tr>
<td>TH19-41</td>
<td>5,533,492</td>
<td>637,857</td>
</tr>
<tr>
<td>TH19-42</td>
<td>5,533,448</td>
<td>637,948</td>
</tr>
<tr>
<td>TH19-43</td>
<td>5,533,397</td>
<td>638,052</td>
</tr>
<tr>
<td>TH19-44</td>
<td>5,533,346</td>
<td>638,158</td>
</tr>
<tr>
<td>TH19-45</td>
<td>5,533,301</td>
<td>638,252</td>
</tr>
<tr>
<td>TH19-46</td>
<td>5,533,261</td>
<td>638,336</td>
</tr>
<tr>
<td>TH19-47</td>
<td>5,533,214</td>
<td>638,429</td>
</tr>
<tr>
<td>TH19-48</td>
<td>5,533,159</td>
<td>638,503</td>
</tr>
</tbody>
</table>
Table 7
SANFORD FLEMING ROAD – TEST HOLE COORDINATES AND ELEVATIONS

<table>
<thead>
<tr>
<th>TEST HOLE ID</th>
<th>APPROXIMATE UTM COORDINATES</th>
<th>GROUND ELEV. (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NORTHING (m)</td>
<td>EASTING (m)</td>
</tr>
<tr>
<td>TH19-51</td>
<td>5,530,021</td>
<td>641,834</td>
</tr>
<tr>
<td>TH19-52</td>
<td>5,530,044</td>
<td>641,928</td>
</tr>
<tr>
<td>TH19-53</td>
<td>5,530,077</td>
<td>642,011</td>
</tr>
<tr>
<td>TH19-54</td>
<td>5,530,120</td>
<td>642,102</td>
</tr>
<tr>
<td>TH19-55</td>
<td>5,530,192</td>
<td>642,145</td>
</tr>
<tr>
<td>TH19-56</td>
<td>5,530,276</td>
<td>642,105</td>
</tr>
<tr>
<td>TH19-57</td>
<td>5,530,347</td>
<td>642,071</td>
</tr>
<tr>
<td>TH19-58</td>
<td>5,530,420</td>
<td>642,044</td>
</tr>
</tbody>
</table>

Table 8
DAY STREET – TEST HOLE COORDINATES AND ELEVATIONS

<table>
<thead>
<tr>
<th>TEST HOLE ID</th>
<th>APPROXIMATE UTM COORDINATES</th>
<th>GROUND ELEV. (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NORTHING (m)</td>
<td>EASTING (m)</td>
</tr>
<tr>
<td>TH19-61</td>
<td>5,529,965</td>
<td>643,432</td>
</tr>
<tr>
<td>TH19-62</td>
<td>5,529,908</td>
<td>643,433</td>
</tr>
<tr>
<td>TH19-63</td>
<td>5,529,809</td>
<td>643,435</td>
</tr>
<tr>
<td>TH19-64</td>
<td>5,529,720</td>
<td>643,436</td>
</tr>
<tr>
<td>TH19-65</td>
<td>5,529,648</td>
<td>643,437</td>
</tr>
<tr>
<td>TH19-66</td>
<td>5,529,530</td>
<td>643,439</td>
</tr>
</tbody>
</table>

Test hole UTM coordinates were surveyed using a hand held unit (±5 m) with ground elevations selected based on KGS Group’s topographic survey.

3.2 LABORATORY TESTING

Laboratory testing was completed on select representative soil samples for correlation to relevant engineering properties of the subsurface soils. Laboratory testing included six (6) particle size analyses, six (6) Atterberg limits and one hundred fifty five (155) moisture contents. Laboratory testing was completed at a Canadian Council of Independent Laboratories (CCIL) certified soil testing laboratory in Winnipeg, Manitoba in general accordance with ASTM Standards.

4.0 INVESTIGATION RESULTS

4.1 STRATIGRAPHY – RALEIGH STREET (NORTH)

Seven (7) test holes were drilled on Raleigh Street extending north from Springfield Road to Donwood Drive. In general, the stratigraphy at the site was interpreted by KGS Group to consist of a concrete pavement structure and granular base, overlying fat clay and silt.
The location of the test holes are provided on Figure A1 in Appendix A. Atterberg limits and grain size analysis results are presented on the attached Figures A2 and A3 in Appendix A.

**Concrete Pavement Structure with Partial Asphalt Overlay**

The existing pavement structure at the test hole locations with exception to TH19-01 consisted of 140 to 175 mm of concrete. The existing pavement structure at TH19-01 consisted of 50 mm of asphalt. Granular base was encountered below the pavement in all of the test holes and ranged in thickness from 50 to 560 mm. The granular base was brown in colour, frozen, well-graded, and contained fine to coarse grained sand and fine grained gravel. The granular base encountered in TH19-04 contained some clay. The moisture content of the granular base ranged from 3 to 19% as measured from six (6) samples. The granular base sample obtained from TH19-04 had a measured moisture content of 26%.

**Fat Clay (CH)**

Fat clay was encountered below the granular base in all test holes. In all test holes, the fat clay extended to the end of each test hole at 3.1 m, with the exception of TH19-07 where silt was encountered at 2.1 m extending to the bottom of the test hole. The fat clay was black to brown in colour, damp to moist, stiff in consistency, of high plasticity and contained trace sand. At the time of the investigation the fat clay was frozen to a depth of 0.9 to 1.5 m.

The moisture content of the fat clay ranged from 12 to 45 %, as measured from 28 samples. Atterberg limits on two (2) fat clay samples at depths of 0.9 m measured a liquid limit of 74 to 75, a plastic limit of 20 to 21 and a plasticity index of 54, classifying the material as fat clay (CH). Grain size analyses completed on the same samples measured 71 to 75 % clay sized particles, 22 to 24 % silt sized particles, 3 to 5% sand sized particles and 0 % gravel sized particles.

**Silt (ML)**

A 0.3 to 1.3 m thick layer of silt was encountered within the fat clay at a depth ranging from 1.4 to 2.1 m below the top of pavement in TH19-02, TH19-03, TH19-04, TH19-05, TH19-06, and TH19-07. The silt was light brown in colour, moist, soft in consistency, with no to low plasticity. The moisture content of the silt was 22 to 31% as measured from seven (7) samples.

### 4.2 STRATIGRAPHY – RALEIGH STREET (SOUTH)

Nine (9) test holes were drilled on Raleigh Street extending north Chalmers Avenue to Monroe Avenue. In general, the stratigraphy at the site was interpreted by KGS Group to consist of a concrete pavement structure and granular base, overlying fat clay and silt.

The location of the test holes are provided on Figure B1 in Appendix B. Atterberg limits and grain size analysis results are presented on the attached Figures B2 and B3 in Appendix B.

**Concrete Pavement Structure with Partial Asphalt Overlay**

The existing pavement structure at the test hole locations with the exception of TH19-19 consisted of 125 to 255 mm of concrete. A 40 mm asphalt overlay was observed in TH19-19 overlaying 200 mm of concrete and clay fill. Granular base was encountered below the pavement in all of the test holes with exception of TH19-19 and ranged in thickness from 125 to 585 mm. The granular base was brown in colour, frozen, well-graded, and contained medium to coarse grained sand and fine grained gravel. The moisture content of the granular base ranged from 6 to 11% as measured from eight (8) samples.
Fat Clay (CH)
Fat clay was encountered below the granular base in all test holes, with exception of TH19-14, TH19-17 and TH19-19. In all test holes, the fat clay extended to the end of each test hole at 3.1 m, with the exception of TH19-11, TH19-13, TH19-14, and TH19-15 where silt was encountered that extending to the bottom of the test hole. The fat clay was brown in colour, moist, stiff in consistency, of high plasticity. At the time of the investigation the fat clay was frozen to a depth of 1.3 to 1.5 m. In TH19-18, the fat clay contained with fine to coarse grained sand.

The moisture content of the fat clay ranged from 26 to 46 %, as measured from 35 samples. Atterberg limits on two (2) fat clay samples at depths of 0.6 and 0.8 m measured a liquid limit of 65 to 82, a plastic limit of 20 to 25 and a plasticity index of 45 to 57, classifying the material as fat clay (CH). Grain size analyses completed on the same samples measured 57 to 80 % clay sized particles, 18 to 20 % silt sized particles 3 to 20 % sand sized particles and 0 % gravel sized particles. One of the samples tested was from the fat clay with sand layer.

Silt (ML)
A 0.6 to 1.3 m thick layer of silt was encountered within the fat clay at a depth ranging from 1.5 to 2.1 m below the top of pavement in TH19-11, TH19-12, TH19-13, TH19-18, and TH19-19. The silt was light brown in colour, moist, soft in consistency, with no to low plasticity. The moisture content of the silt was 22 to 28% as measured from 19 samples.

Clay Fill (CH)
Clay fill was encountered below the granular base in TH19-14, TH19-17 and TH19-19 at depths ranging from 0.3 to 0.8. The clay fill ranged in thickness from 0.4 to 1.1 m. The clay fill was dark brown to black in colour, of high plasticity and contained trace medium to coarse grained sand and trace fine grained gravel. At the time of the investigation the clay fill was frozen. The moisture content of the clay fill ranged from 27 to 34 %, as measured from seven (7) samples.

4.3 STRATIGRAPHY – JAMISON AVENUE
Seven (7) test holes were drilled on Jamison Avenue extending east from Henderson Highway to Roch Street. In general, the stratigraphy at the site was interpreted by KGS Group to consist of a concrete pavement structure, overlying fat clay and silt.

The location of the test holes are provided on Figure C1 in Appendix C. Atterberg limits and grain size analysis results are presented on the attached Figures C2 and C3 in Appendix C.

Concrete Pavement Structure with Partial Asphalt Overlay
The existing pavement structure at the test hole locations consisted of 40 to 85 mm of asphalt overlaying 100 to 185 mm of concrete. Granular base was encountered below the pavement in TH19-25, TH19-26 and TH19-27, ranging in thickness from 100 to 175 mm. The granular base was brown in colour, frozen, well-graded, and contained medium to coarse grained sand and fine grained gravel. The moisture content of the granular base was 10% as measured from one (1) samples.

Fat Clay (CH)
Fat clay was encountered below the pavement structure in all test holes. In all test holes, the fat clay extended to the end of each test hole at 3.1 m. The fat clay was black to brown in colour, moist, stiff in consistency, of high plasticity and contained trace fine to coarse grained sand. At the time of the investigation the fat clay was frozen to a depth of 1.2 to 1.4 m.
The moisture content of the fat clay ranged from 26 to 49 %, as measured from 34 samples. Atterberg limits on two (2) fat clay samples at depths of 0.6 m measured a liquid limit of 75 to 76, a plastic limit of 23 to 24 and a plasticity index of 52, classifying the material as fat clay (CH). Grain size analyses completed on the same samples measured 77 to 81 % clay sized particles, 18 to 23 % silt sized particles 1 to 2 % sand sized particles and 0 % gravel sized particles.

*Silt (ML)*
A 0.6 to 1.1 m thick layer of silt was encountered within the fat clay at a depth ranging from 0.9 to 1.3 m below the top of pavement in TH19-23, TH19-24, TH19-25 and TH19-27. The silt was light brown in colour, moist, soft in consistency, with no to low plasticity. The moisture content of the silt was 19 to 28% as measured from 10 samples.

*Lean Clay (CL)*
A 0.7 m layer of lean clay was encountered within the fat clay deposit in TH19-22 at a depth of 1.2 m below the top of the pavement structure. The lean clay was light brown in colour, moist, firm, and of low to intermediate plasticity. The moisture content of the lean clay ranged from 24 to 33 %, as measured from two (2) samples

4.4 STRATIGRAPHY – TALBOT AVENUE

The existing pavement structure measured at five (5) test hole locations consisted of 35 to 90 mm of asphalt over approximately 175 to 230 mm of concrete, as listed in Table D1 in Appendix D. Only pavement coring was completed on Talbot Avenue.

4.5 STRATIGRAPHY – EDISON AVENUE

The existing pavement structure measured at eight (8) locations consisted of 50 to 120 mm of asphalt over 140 to 210 mm of concrete, as listed in Table E1 in Appendix E. Only pavement coring was completed on Edison Avenue.

4.6 STRATIGRAPHY – SANFORD FLEMING ROAD

The existing pavement structure measured at eight (8) locations consisted of 20 to 45 mm of asphalt over 155 to 220 mm of concrete, as listed in Table F11 in Appendix F. Only pavement coring was completed on Sanford Fleming Road.

4.7 STRATIGRAPHY – DAY STREET

The existing pavement structure measured at six (6) locations consisted of 40 to 90 mm of asphalt over 185 to 210 mm of concrete, as listed in Table G1 in Appendix G. Only pavement coring was completed on Day Street.

4.8 GROUNDWATER CONDITIONS

Upon completion of drilling the test holes were left open to observe potential groundwater inflow for five (5) minutes. All test holes were open and remained dry five (5) minutes after the completion of drilling within the exploration depths of 3.1 m.
Groundwater levels should be expected to fluctuate seasonally and following precipitation events; hence, the actual water level at the time of construction could differ from those reported in this report.

5.0 STATEMENT OF LIMITATIONS AND CONDITIONS

5.1 THIRD PARTY USE OF REPORT

This report has been prepared for KGS Group and any use a third party makes of this report or any reliance on or decisions made based on it, are the responsibility of such third parties. KGS Group accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions undertaken based on this report.

5.2 GEOTECHNICAL INVESTIGATION STATEMENT OF LIMITATIONS

The geotechnical investigation findings and recommendations of this report were prepared in accordance with generally accepted professional engineering principles and practice. The findings and recommendations are based on the results of field and laboratory investigations, combined with an interpolation of soil and groundwater conditions found at and within the depth of the test holes drilled by KGS Group at this site. If conditions encountered during construction appear to be different from those shown by the test holes drilled by KGS Group or if the assumptions stated herein are not in keeping with the design, this office should be notified in order that the recommendations can be reviewed and modified if necessary.

If you have any questions regarding the enclosed information or require additional information, please contact the undersigned.

Prepared By:

[Signature]

Jacqueline MacLennan, P.Eng.
Geotechnical Engineer

Approved By:

[Signature]

Taunya Ernst, P.Eng., P.E., P.G.
Senior Geotechnical Engineer

JRM/jr
Enclosure
APPENDIX A

Raleigh Street (North)
Figure A1 – Test hole Locations
  Figure A2 – A-Line Plot
  Figure A3 – Grain Size Analyses
  Test Hole Logs
FIGURE A1
RALEIGH STREET (NORTH) – TEST HOLE LOCATIONS
A-LINE PLOT U:FM9S-19-0535-001\2019 COW STREETS.GPJ

Notes:
ML - Low Plasticity Silt
MH - High Plasticity Silt
CL-ML - Silty Clay
CL - Low Plasticity Clay
CI - Intermediate Plasticity Clay
CH - High Plasticity Clay
LL - Liquid Limit
PL - Plastic Limit
PI - Plasticity Index
MC - Moisture Content
NP - Non-Plastic
SIEVE ANALYSIS

HYDROMETER ANALYSIS

PERCENT PASSING

PARTICLE SIZE IN MILLIMETERS

GRAVEL  SAND  SILT  CLAY

SYMBOL  HOLE  DEPTH (m)  SAMPLE #  % GRAVEL  % SAND  % SILT  % CLAY  % SILT & CLAY  Cu  Cc  CLASSIFICATION

7H19-01  0.9  S4  0.0  2.4  22.6  75.0  97.6  CH
7H19-02  0.9  S4  0.0  5.0  23.9  71.1  95.0  CH

KGS GROUP

2019 City of Winnipeg Local Streets Renewal Program

GRAIN SIZE ANALYSES

March 2019  Figure A3  Page 1 of 1
**DESCRIPTION AND CLASSIFICATION**

- **ASPHALT** - 50 mm thickness.
- **GRANULAR BASE** - 560 mm thickness, brown, frozen, well-graded, fine to coarse grained sand, 10 mm max particle size.
- **FAT CLAY (CH)** - Brown, frozen to 1.5 m, high plasticity.
  - Grain Size Distribution: Gravel (0.0%), Sand (2.7%), Silt (22.3%) and Clay (75.0%) at 0.9 m.
  - Atterberg Limits: Liquid Limit (75), Plastic Limit (21), Plasticity Index (54) at 0.9 m.
  - Moist, stiff, trace silt inclusions below 1.5 m.

**END OF TEST HOLE AT 3.05 m**

Notes:
1. Open to 3.05 m upon completion of drilling.
2. No water observed during drilling within the depth explored.
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.
4. Test hole location is approximate.
**CONCRETE** - 140 mm thickness.

**GRANULAR BASE** - 470 mm thickness, brown, frozen, well-graded, fine to coarse grained sand, 10 mm max particle size.

**FAT CLAY (CH)** - Brown, frozen to 1.5 m, high plasticity.

**SILT** - Light brown, moist, soft, no to low plasticity.

**FAT CLAY (CH)** - Brown, damp, stiff, high plasticity.

- Mottled brown to grey below 2.3 m.

**END OF TEST HOLE AT 3.05 m**

Notes:
1. Open to 3.05 m upon completion of drilling.
2. No water observed during drilling within the depth explored.
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.
4. Test hole location approximate.
CONCRETE - 140 mm thickness.

GRANULAR BASE - 580 mm thickness, brown, frozen, well-graded, fine to coarse grained sand, fine grained gravel, 10 mm max particle size.

FAT CLAY (CH) - Dark brown, frozen, high plasticity.
- Damp, stiff below 1.5 m.

SILT (ML) - Light brown, moist, soft, no to low plasticity.

FAT CLAY (CH) - Brown, moist, stiff, high plasticity.

END OF TEST HOLE AT 3.05 m

Notes:
1. Open to 3.05 m upon completion of drilling.
2. No water observed during drilling within the depth explored.
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.
4. Test hole location approximate
CONCRETE - 165 mm thickness.

GRANULAR BASE - 300 mm thickness, brown, frozen, well-graded, fine to coarse grained sand, 5 mm max particle size, some clay.

FAT CLAY (CH) - Black, frozen, high plasticity, trace organics, trace fine to coarse grained sand.

- Brown, no organics, no fine to coarse grained sand below 0.8 m.

- Damp, stiff below 1.5 m.

SILT (ML) - Light brown, moist, soft, no to low plasticity.

FAT CLAY (CH) - Brown, moist, stiff, high plasticity.

END OF TEST HOLE AT 3.05 m

Notes:
1. Open to 3.05 m upon completion of drilling.
2. No water observed during drilling within the depth explored.
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.
4. Test hole location approximate.
### Summary Log

**Client:** KGS GROUP  
**Project:** 2019 City of Winnipeg Local Streets Renewal Program  
**Site:** Raleigh Street Extending North from Springfield Road to Donwood Drive  
**Location:** Southbound Lane, 128 m North of Springfield Road  
**Drilling Method:** 150 mm Ø Core Barrel, 125 mm Ø Solid Stem Auger, GeoProbe Drill Rig  

<table>
<thead>
<tr>
<th>Elevation (m)</th>
<th>Depth (ft)</th>
<th>Graphics</th>
</tr>
</thead>
<tbody>
<tr>
<td>230.7</td>
<td>79.5</td>
<td></td>
</tr>
<tr>
<td>230.3</td>
<td>79.3</td>
<td></td>
</tr>
<tr>
<td>230</td>
<td>79.0</td>
<td></td>
</tr>
<tr>
<td>229.0</td>
<td>76.2</td>
<td></td>
</tr>
<tr>
<td>228.1</td>
<td>75.5</td>
<td></td>
</tr>
<tr>
<td>227.8</td>
<td>75.5</td>
<td></td>
</tr>
<tr>
<td>227</td>
<td>74.0</td>
<td></td>
</tr>
</tbody>
</table>

**Description and Classification**

- **Concrete** - 150 mm thickness.
- **Granular Base** - 450 mm thickness, brown, frozen, well-graded, fine to coarse grained sand, 5 mm max particle size.
- **Fat Clay (CH)** - Black to brown, frozen, high plasticity, trace organics.
  - Grain Size Distribution: Gravel (0.0%), Sand (5.0%), Silt (23.9%) and Clay (71.1%) at 0.9 m.
  - Atterberg Limits: Liquid Limit (74), Plastic Limit (20), Plasticity Index (54) at 0.9 m.
  - Damp, stiff below 1.5 m.
- **Silt (ML)** - Light brown, moist, soft, no to low plasticity.
- **Fat Clay (CH)** - Mottled brown to grey, moist, stiff, high plasticity.

**Notes:**
1. Open to 3.05 m upon completion of drilling.
2. No water observed during drilling within the depth explored.
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.
4. Test hole location approximate.

---

**Sample Type** Core Barrel  
**Contractor** Maple Leaf Drilling  
**INSPECTOR** J. MACLENNAN  
**APPROVED** KWH  
**DATE** 3/8/19
### Site Description

#### Concrete
- 140 mm thickness.

#### Granular Base
- 50 mm thickness, brown, frozen, well-graded, fine to coarse-grained sand, 5 mm max particle size.

#### Fat Clay (CH)
- Black, frozen, high plasticity, some organics, trace fine to coarse-grained sand.
- Trace fine to coarse grained sand from 0.2 to 0.8 m.

#### Silty Clay (CH)
- Brown, moist, stiff, high plasticity, trace silt inclusions.

#### End of Test Hole at 3.05 m

**Notes:**
1. Open to 3.05 m upon completion of drilling.
2. No water observed during drilling within the depth explored.
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.
4. Test hole location approximate.
CONCRETE - 150 mm thickness.

GRANULAR BASE - 150 mm thickness, brown, frozen, well-graded, fine to coarse grained sand, trace fine grained gravel, 20 mm max particle size.

FAT CLAY (CH) - Black, frozen, high plasticity, trace organics.
- Mottled black to brown below 0.9 m.
- Brown below 1.0 m.
- Damp, stiff below 1.5 m.

SILT (ML) - Light brown, moist, soft, no to low plasticity.

END OF TEST HOLE AT 3.05 m

Notes:
1. Open to 3.05 m upon completion of drilling.
2. No water observed during drilling within the depth explored.
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.
4. Test hole location approximate.
APPENDIX B

Raleigh Street (South)
Figure B1 – Test hole Locations
Figure B2 – A-Line Plot
Figure B3 – Grain Size Analyses
Test Hole Logs
FIGURE B1
RALEIGH STREET (SOUTH) – TEST HOLE LOCATIONS

Munroe Avenue
TH19-11 (SBL)

Washington Avenue
TH19-14 (SBL)

Raleigh Street
TH19-17 (SBL)
TH19-18 (SBL)
TH19-19 (SBL)

Chalmers Avenue

300 m

N

Munroe Avenue
TH19-11 (SBL)

Washington Avenue
TH19-14 (SBL)

Raleigh Street
TH19-17 (SBL)
TH19-18 (SBL)
TH19-19 (SBL)

Chalmers Avenue

300 m

N
A-LINE PLOT

U:\FMS\19-0535-001\2019 COW STREETS.GPJ

Notes:
ML - Low Plasticity Silt
MH - High Plasticity Silt
CL-ML - Silty Clay
CL - Low Plasticity Clay
CI - Intermediate Plasticity Clay
CH - High Plasticity Clay
LL - Liquid Limit
PL - Plastic Limit
PI - Plasticity Index
MC - Moisture Content
NP - Non-Plastic

SYMBOL HOLE DEPTH (m) SAMPLE # LL PL PI % SAND % SILT % CLAY % MC CLASSIFICATION
⊙ TH19-13 0.8 S3 82 25 57 2.7 17.5 79.8 36.3 CH
□ TH19-18 0.6 S3 65 20 45 19.8 22.9 57.1 26.5 CH
### Description and Classification

<table>
<thead>
<tr>
<th>Elevation (m)</th>
<th>Depth (ft)</th>
<th>Sample Type</th>
<th>Number</th>
<th>Recovery %</th>
<th>SPT (N) blows/0.15 m</th>
<th>Dynamic Cone (N) blows/ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>230.4</td>
<td>1</td>
<td>S1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>230.3</td>
<td>1</td>
<td>S2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>230.0</td>
<td>1</td>
<td>S3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>229.0</td>
<td>5</td>
<td>S4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>228.2</td>
<td>3</td>
<td>S5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>228.0</td>
<td>2</td>
<td>S6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>227.6</td>
<td>3</td>
<td>S7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>S8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>S9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
1. Open to 3.05 m upon completion of drilling.
2. No water observed during drilling within the depth explored.
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.
4. Test hole location is approximate.
CONCRETE - 175 mm thickness.

GRANULAR BASE - 280 mm thickness, brown, frozen, well-graded, medium to coarse grained sand, fine grained gravel, 20 mm max particle size.

FAT CLAY (CH) - Dark brown, frozen, high plasticity.

SILT (ML) - Light brown, moist, soft, no to low plasticity.

FAT CLAY (CH) - Brown, moist, stiff, high plasticity.

END OF TEST HOLE AT 3.05 m

Notes:
1. Open to 3.05 m upon completion of drilling.
2. No water observed during drilling within the depth explored.
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.
4. Test hole location is approximate.
CONCRETE - 175 mm thickness.

GRANULAR BASE - 585 mm thickness, brown, frozen, well-graded, medium to coarse grained sand, fine grained gravel, 20 mm max particle size.

FAT CLAY (CH) - Dark brown, frozen to 1.4 m, high plasticity, trace fine grained sand.
- Grain Size Distribution: Gravel (0.0%), Sand (2.7%), Silt (17.5%) and Clay (79.8%) at 0.8 m.
- Atterberg Limits: Liquid Limit (82), Plastic Limit (25), Plasticity Index (57) at 0.8 m.
- Moist, stiff below 1.4 m.

SILT (ML) - Light brown, moist, soft, no to low plasticity, trace clay pockets.

END OF TEST HOLE AT 3.05 m

Notes:
1. Open to 3.05 m upon completion of drilling.
2. No water observed during drilling within the depth explored.
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.
4. Test hole location is approximate.
CONCRETE - 200 mm thickness.

GRANULAR BASE - 560 mm thickness, brown, frozen, well-graded, medium to coarse grained sand, fine grained gravel, 20 mm max particle size.

CLAY FILL (CH) - Black, frozen, high plasticity, trace coarse grained sand, trace fine to coarse grained gravel.

FAT CLAY (CH) - Dark brown, frozen to 1.4 m, high plasticity.
- Moist, stiff below 1.4 m.

SILT (ML) - Light brown, moist, soft, no to low plasticity.
- Clay pocket from 2.7 m to 2.8 m.

END OF TEST HOLE AT 3.05 m

Notes:
1. Open to 3.05 m upon completion of drilling.
2. No water observed during drilling within the depth explored.
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.
4. Test hole location is approximate.
**CONCRETE** - 190 mm thickness.

**GRANULAR BASE** - 420 mm thickness, brown, frozen, well-graded, medium to coarse grained sand, fine grained gravel, 20 mm max particle size.

**FAT CLAY (CH)** - Brown, frozen to 1.4 m, high plasticity.
- Moist, stiff below 1.4 m.

**SILT (ML)** - Light brown, moist, soft, no to low plasticity.
- Trace clay from 2.1 to 2.3 m.
- Increased moisture content between 2.4 to 2.6 m.

**END OF TEST HOLE AT 3.05 m**

Notes:
1. Open to 3.05 m upon completion of drilling.
2. No water observed during drilling within the depth explored.
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.
4. Test hole location is approximate.
CONCRETE - 180 mm thickness.

GRANULAR BASE - 430 mm thickness, brown, frozen, well-graded, medium to coarse grained sand, fine grained gravel, 20 mm max particle size.

FAT CLAY (CH) - Brown, moist, stiff, high plasticity.

FAT CLAY (CH) - Brown, moist, stiff, high plasticity, trace silt nodules.

SILT (ML) - Light brown, moist, soft, no to low plasticity.

- Moist, stiff below 1.3 m.

END OF TEST HOLE AT 3.05 m

Notes:
1. Open to 3.05 m upon completion of drilling.
2. No water observed during drilling within the depth explored.
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.
4. Test hole location is approximate.
CONCRETE - 255 mm thickness. Top 180 mm intact. Bottom 75 mm very poor quality, broken.

GRANULAR BASE - 430 mm thickness, brown, frozen, well-graded, medium to coarse grained sand, fine grained gravel, 20 mm max particle size.

CLAY FILL (CH) - Dark brown, frozen, high plasticity, trace coarse grained sand, trace fine grained gravel.

FAT CLAY (CH) - Brown, frozen to 1.4 m, high plasticity.
- Moist, stiff below 1.4 m.

SILT (ML) - Light brown, moist, soft, no to low plasticity.

FAT CLAY (CH) - Brown, moist, stiff, high plasticity, trace silt nodules.

END OF TEST HOLE AT 3.05 m

Notes:
1. Open to 3.05 m upon completion of drilling.
2. No water observed during drilling within the depth explored.
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.
4. Test hole location is approximate.
CONCRETE - 200 mm thickness.

GRANULAR BASE - 410 mm thickness, brown, frozen, well-graded, medium to coarse grained sand, fine grained gravel, 20 mm max particle size.

FAT CLAY WITH SAND (CH) - Grey, frozen, high plasticity, some medium to coarse grained sand, trace fine grained gravel.
- Grain Size Distribution: Gravel (0.2%), Sand (19.8%), Silt (22.9%) and Clay (57.1%) at 0.6 m.
- Atterberg Limits: Liquid Limit (65), Plastic Limit (20), Plasticity Index (45) at 0.6 m.

FAT CLAY (CH) - Brown, frozen, high plasticity.

SILT (ML) - Light brown, moist, soft, no to low plasticity.

FAT CLAY (CH) - Brown, moist, stiff, high plasticity, trace silt nodules.

END OF TEST HOLE AT 3.05 m

Notes:
1. Open to 3.05 m upon completion of drilling.
2. No water observed during drilling within the depth explored.
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.
4. Test hole location is approximate.
**ASPHALT** - 40 mm thickness.

**CONCRETE** - 200 mm thickness.

**CLAY FILL (CH)** - Black, frozen, high plasticity, trace medium to coarse grained sand, trace fine grained gravel.

**FAT CLAY (CH)** - Brown, frozen, high plasticity.

**SILT (ML)** - Light brown, moist, soft, no to low plasticity.

**FAT CLAY (CH)** - Brown, moist, stiff, high plasticity, trace silt nodules.

---

Notes:
1. Open to 3.05 m upon completion of drilling.
2. No water observed during drilling within the depth explored.
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.
4. Test hole location is approximate.
APPENDIX C

Jamison Avenue

Figure C1 – Test hole Locations
Figure C2 – A-Line Plot
Figure C3 – Grain Size Analyses
Test Hole Logs
FIGURE C1
JAMISON AVENUE – TEST HOLE LOCATIONS

Henderson Highway

TH19-21 (WBL)

Jamison Avenue

TH19-22 (WBL)

TH19-23 (EBL)

Brazier Street

TH19-24 (WBL)

TH19-25 (WBL)

Roch Street

TH19-26 (WBL)

TH19-27 (EBL)
Notes:
ML - Low Plasticity Silt
MH - High Plasticity Silt
CL-ML - Silty Clay
CL - Low Plasticity Clay
CI - Intermediate Plasticity Clay
CH - High Plasticity Clay
LL - Liquid Limit
PL - Plastic Limit
PI - Plasticity Index
MC - Moisture Content
NP - Non-Plastic

SYMBOL  HOLE  DEPTH (m)  SAMPLE #  LL  PL  PI  % SAND  % SILT  % CLAY  % MC  CLASSIFICATION
•  TH19-23  0.6  S3  75  23  52  0.5  22.5  77.0  31.3  CH
□  TH19-25  0.6  S3  76  24  52  1.1  18.2  80.6  31.6  CH
### SIEVE ANALYSIS

<table>
<thead>
<tr>
<th>PARTICLE SIZE IN MILLIMETERS</th>
<th>GRAVEL</th>
<th>SAND</th>
<th>SILT</th>
<th>CLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>coarse</td>
<td>fine</td>
<td>coarse</td>
<td>medium</td>
<td>fine</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>HOLE</th>
<th>DEPTH (m)</th>
<th>SAMPLE #</th>
<th>% GRAVEL</th>
<th>% SAND</th>
<th>% SILT</th>
<th>% CLAY</th>
<th>% SILT &amp; CLAY</th>
<th>Cu</th>
<th>Cc</th>
<th>CLASSIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>□</td>
<td>TH18-23</td>
<td>0.6</td>
<td>S3</td>
<td>0.0</td>
<td>0.5</td>
<td>22.5</td>
<td>77.0</td>
<td>99.5</td>
<td></td>
<td></td>
<td>CH</td>
</tr>
<tr>
<td></td>
<td>TH19-25</td>
<td>0.6</td>
<td>S3</td>
<td>0.1</td>
<td>1.1</td>
<td>18.2</td>
<td>80.6</td>
<td>98.8</td>
<td></td>
<td></td>
<td>CH</td>
</tr>
</tbody>
</table>

### HYDROMETER ANALYSIS

### GRAIN SIZE ANALYSES

March 2019 | Figure C3 | Page 1 of 1
**ASPHALT** - 50 mm thickness.

**CONCRETE** - 140 mm thickness.

**FAT CLAY (CH)** - Black, frozen, high plasticity. 
- Trace fine to coarse grained gravel at 0.3 m.

- Brown, stiff, moist below 1.2 m.

**END OF TEST HOLE AT 3.05 m**

Notes:
1. Open to 3.05 m upon completion of drilling.
2. No water observed during drilling within the depth explored.
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.
4. Test hole location is approximate.
1. Open to 3.05 m upon completion of drilling.
2. No water observed during drilling within the depth explored.
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.
4. Test hole location is approximate.
ASPHALT - 50 mm thickness.

CONCRETE - 160 mm thickness, very poor quality, broken, unable to remove core.

FAT CLAY (CH) - Brown, frozen, high plasticity.
- Grain Size Distribution: Gravel (0.0%), Sand (0.5%), Silt (22.5%) and Clay (77.0%) at 0.6 m.
- Atterberg Limits: Liquid Limit (75), Plastic Limit (23), Plasticity Index (52) at 0.6 m.
- Moist, stiff below 1.2 m.

SILT (ML) - Light brown, moist, soft, no to low plasticity.

FAT CLAY (CH) - Brown, moist, stiff, high plasticity.
- Trace silt nodules below 2.4 m.

END OF TEST HOLE AT 3.05 m

Notes:
1. Open to 3.05 m upon completion of drilling.
2. No water observed during drilling within the depth explored.
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.
4. Test hole location is approximate.
ASPHALT - 50 mm thickness.

CONCRETE - 160 mm thickness, very poor quality, broken, unable to remove core.

FAT CLAY (CH) - Brown, frozen, high plasticity, trace coarse grained sand.

SILT (ML) - Light brown, moist, soft, no to low plasticity.

FAT CLAY (CH) - Brown, moist, stiff, high plasticity.

- Trace silt nodules below 2.1 m.

END OF TEST HOLE AT 3.05 m

Notes:
1. Open to 3.05 m upon completion of drilling.
2. No water observed during drilling within the depth explored.
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.
4. Test hole location is approximate.
**SUMMARY LOG**

**CLIENT**  KGS GROUP  
**PROJECT**  2019 City of Winnipeg Local Streets Renewal Program  
**SITE**  Jamison Avenue Extending East from Henderson Highway to Roch Street  
**LOCATION**  Westbound Lane, 401 m East of Henderson Highway  
**DRILLING METHOD**  150 mm ø Core Barrel, 125 mm ø Solid Stem Auger, B40 Truck Mounted Drill Rig

**DESCRIPTION AND CLASSIFICATION**

- **ASPHALT** - 40 mm thickness.
- **CONCRETE** - 140 mm thickness, very poor quality, broken, unable to remove core.
- **GRANULAR BASE** - 420 mm thickness, brown, frozen, well-graded, medium to coarse grained sand, fine grained gravel, 20 mm max particle size.
- **FAT CLAY (CH)** - Brown, frozen, high plasticity, trace fine to coarse grained sand.
  - Grain Size Distribution: Gravel (0.1%), Sand (1.1%), Silt (18.2%) and Clay (80.6%) at 0.6 m.
  - Atterberg Limits: Liquid Limit (76), Plastic Limit (24), Plasticity Index (52) at 0.6 m.
- **SILT (ML)** - Light brown, moist, soft, no to low plasticity.
- **FAT CLAY (CH)** - Brown, moist, stiff, high plasticity, trace silt nodules.

**END OF TEST HOLE AT 3.05 m**

Notes:
1. Open to 3.05 m upon completion of drilling.
2. No water observed during drilling within the depth explored.
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.
4. Test hole location is approximate.
### Geotechnical Soil Log

**Client**: KGS GROUP  
**Project**: 2019 City of Winnipeg Local Streets Renewal Program  
**Site**: Jamison Avenue Extending East from Henderson Highway to Roch Street  
**Location**: Westbound Lane, 506 m East of Henderson Highway  
**Drilling Method**: 150 mm ø Core Barrel, 125 mm ø Solid Stem Auger, B40 Truck Mounted Drill Rig

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Description and Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>230.2</td>
<td>ASPHALT - 50 mm thickness.</td>
</tr>
<tr>
<td>230.1</td>
<td>CONCRETE - 100 mm thickness.</td>
</tr>
<tr>
<td>230.0</td>
<td>GRANULAR BASE - 420 mm thickness, brown, frozen, well-graded, medium to coarse grained sand, fine grained gravel, 20 mm max particle size.</td>
</tr>
<tr>
<td>227.2</td>
<td>FAT CLAY (CH) - Brown, frozen to 1.4 m, high plasticity, trace coarse grained sand.</td>
</tr>
</tbody>
</table>

Notes:
1. Open to 3.05 m upon completion of drilling.  
2. No water observed during drilling within the depth explored.  
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.  
4. Test hole location is approximate.
ASPHALT - 85 mm thickness.

CONCRETE - 185 mm thickness.

GRANULAR BASE - 420 mm thickness, brown, frozen, well-graded, medium to coarse grained sand, fine grained gravel, 20 mm max particle size.

FAT CLAY (CH) - Dark grey, frozen, high plasticity.

SILT (ML) - Light brown, moist, soft, no to low plasticity.

FAT CLAY (CH) - Brown, moist, stiff, high plasticity, trace silt nodules.

END OF TEST HOLE AT 3.05 m

Notes:
1. Open to 3.05 m upon completion of drilling.
2. No water observed during drilling within the depth explored.
3. Backfilled with bentonite chips, auger cuttings and cold patch to grade.
4. Test hole location is approximate.
APPENDIX D

Talbot Avenue

Figure D1 – Test hole Locations
Table D1 – Pavement Section Thicknesses
FIGURE D1
TALBOT AVENUE – PAVEMENT CORING LOCATIONS

Grey Street
TH19-31 (EBL)
TH19-35 (WBL)
Railway Tracks
TH19-34 (WBL)
TH19-32 (EBL)
Talbot Avenue
TH19-33 (WBL)
100 m
Foster Street
## TABLE D1
### PAVEMENT SECTION THICKNESSES

<table>
<thead>
<tr>
<th>Test hole ID</th>
<th>Location</th>
<th>Asphalt Thickness (mm)</th>
<th>Concrete Thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TH19-31</td>
<td>EBL, 54 m E of Grey Street</td>
<td>40 to 70</td>
<td>200 to 230</td>
</tr>
<tr>
<td>TH19-32</td>
<td>EBL, 148 m E of Grey Street</td>
<td>35</td>
<td>190</td>
</tr>
<tr>
<td>TH19-33</td>
<td>WBL, 198 m E of Grey Street</td>
<td>45</td>
<td>175</td>
</tr>
<tr>
<td>TH19-34</td>
<td>WBL, 106 m E of Grey Street</td>
<td>90</td>
<td>180</td>
</tr>
<tr>
<td>TH19-35</td>
<td>WBL, 29 m E of Grey Street</td>
<td>80</td>
<td>200</td>
</tr>
</tbody>
</table>
APPENDIX E

Adison Avenue
Figure E1 – Test hole Locations
Table E1 – Pavement Section Thicknesses
FIGURE E1
EDISON AVENUE – PAVEMENT CORING LOCATIONS
### TABLE E1

**PAVEMENT SECTION THICKNESSES**

<table>
<thead>
<tr>
<th>Test hole ID</th>
<th>Location</th>
<th>Asphalt Thickness (mm)</th>
<th>Concrete Thickness (mm)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>TH19-41</td>
<td>WBL (Parking Area), 54 m E of Rothesay Street</td>
<td>75</td>
<td>190</td>
<td></td>
</tr>
<tr>
<td>TH19-42</td>
<td>Eastbound Lane, 152 m E of Rothesay Street</td>
<td>50</td>
<td>200</td>
<td>Horizontal crack at 175 mm</td>
</tr>
<tr>
<td>TH19-43</td>
<td>WBL (Parking Area), 268 m E of Rothesay Street</td>
<td>50</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>TH19-44</td>
<td>EBL, 385 m E of Rothesay Street</td>
<td>90 to 100</td>
<td>200 to 210</td>
<td></td>
</tr>
<tr>
<td>TH19-45</td>
<td>WBL (Parking Area), 491 m E of Rothesay Street</td>
<td>55</td>
<td>140</td>
<td></td>
</tr>
<tr>
<td>TH19-46</td>
<td>EBL, 583 m E of Rothesay Street</td>
<td>50 to 55</td>
<td>165 to 170</td>
<td></td>
</tr>
<tr>
<td>TH19-47</td>
<td>WBL (Parking Area), 688 m E of Rothesay Street</td>
<td>75</td>
<td>180</td>
<td></td>
</tr>
<tr>
<td>TH19-48</td>
<td>WBL, 778 m E of Rothesay Street</td>
<td>100 to 120</td>
<td>145 to 165</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX F

Sandford Fleming Road
Figure F1 – Test hole Locations
Table F1 – Pavement Section Thicknesses
FIGURE F1
SANFORD FLEMING ROAD – PAVEMENT CORING LOCATIONS
### TABLE F1

**PAVEMENT SECTION THICKNESSES**

<table>
<thead>
<tr>
<th>Test hole ID</th>
<th>Location</th>
<th>Asphalt Thickness (mm)</th>
<th>Concrete Thickness (mm)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>TH19-51</td>
<td>WBL, 46 m E of Sandford Fleming Road</td>
<td>40</td>
<td>180</td>
<td>Upper 80 mm broken and very poor quality unable to remove lower piece of concrete, lower portion of concrete appeared to be intact</td>
</tr>
<tr>
<td>TH19-52</td>
<td>EBL, 142 m E of Sandford Fleming Road</td>
<td>20 to 35</td>
<td>205 to 220</td>
<td>Unable to remove bottom 25 to 50 mm of concrete</td>
</tr>
<tr>
<td>TH19-53</td>
<td>WBL, 233 m E of Sandford Fleming Road</td>
<td>35</td>
<td>195</td>
<td>Top 75 mm broken and very poor</td>
</tr>
<tr>
<td>TH19-54</td>
<td>EBL, 331 m E of Sandford Fleming Road</td>
<td>25</td>
<td>185</td>
<td>Top 30 mm broken and very poor quality</td>
</tr>
<tr>
<td>TH19-55</td>
<td>SBL, 279 m S of Devonshire Drive</td>
<td>25</td>
<td>175</td>
<td>Broken, very poor quality</td>
</tr>
<tr>
<td>TH19-56</td>
<td>Northbound Lane, 188 m S of Devonshire Drive</td>
<td>40</td>
<td>170</td>
<td>Top 20 to 60 mm poor quality, core remained intact</td>
</tr>
<tr>
<td>TH19-57</td>
<td>SBL, 108 m S of Devonshire Drive</td>
<td>45</td>
<td>155</td>
<td>Very poor quality, broken</td>
</tr>
<tr>
<td>TH19-58</td>
<td>Northbound Lane, 31 m S of Devonshire Drive</td>
<td>30</td>
<td>200</td>
<td>Very poor quality, broken, unable to remove core</td>
</tr>
</tbody>
</table>
APPENDIX G

Day Street
Figure G1 – Test hole Locations
Table G1 – Pavement Section Thicknesses
FIGURE H1
DAY STREET – PAVEMENT CORING LOCATIONS

TH19-61 (SBL)
TH19-62 (NBL)
TH19-63 (SBL)
TH19-64 (NBL)
TH19-65 (SBL)
TH19-66 (NBL)

McMeans Avenue
Edward Avenue
Newman Avenue
Horton Avenue
Ralph Avenue
Kildare Avenue

200 m

Day Street
McMeans Avenue
Edward Avenue
Newman Avenue
Horton Avenue
Ralph Avenue
Kildare Avenue

North

North

North

North

North
<table>
<thead>
<tr>
<th>Test hole ID</th>
<th>Location</th>
<th>Asphalt Thickness (mm)</th>
<th>Concrete Thickness (mm)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>TH19-61</td>
<td>SBL, 459 m N of Kildare Avenue</td>
<td>40 to 60</td>
<td>190 to 210</td>
<td>Horizontal joint ay 130, unable to remove core below joint</td>
</tr>
<tr>
<td>TH19-62</td>
<td>NBL, 402 m N of Kildare Avenue</td>
<td>75</td>
<td>190</td>
<td>Top 20 mm slightly broken at asphalt-concrete interface</td>
</tr>
<tr>
<td>TH19-63</td>
<td>SBL, 303 m N of Kildare Avenue</td>
<td>75</td>
<td>205</td>
<td></td>
</tr>
<tr>
<td>TH19-64</td>
<td>NBL, 214 m N of Kildare Avenue</td>
<td>60</td>
<td>185</td>
<td>20 to 30 mm of granular frozen to bottom of core</td>
</tr>
<tr>
<td>TH19-65</td>
<td>SBL, 142 m N of Kildare Avenue</td>
<td>90</td>
<td>180</td>
<td>Horizontal joint at 210 mm</td>
</tr>
<tr>
<td>TH19-66</td>
<td>NBL, 25 m N of Kildare Avenue</td>
<td>80</td>
<td>190</td>
<td></td>
</tr>
</tbody>
</table>