EPC Engineering & Testing
Geotechnical • Environmental • Materials Engineering
539 Garfield Avenue (218) 727-1239
Duluth, Minnesota 55802 (218) 727-1248 fax

December 16, 2014
EPC # 14G0946

Duluth Airport Authority
Attn: Mr. Mr. Blaine Peterson
4701 Grinden Drive
Duluth, MN 55811

Re: Preliminary Geotechnical Exploration Report
   Proposed Cirrus Building Site
   Airport Road / Lackland Street and Vanderberg Drive
   Duluth, MN

Dear Mr. Peterson,

This letter report is in regard to the five (5) soil borings performed by EPC on November 25 and 26,
2014. All work was performed at the direction of yourself, according to EPC proposal dated
November 19, 2014. All borings were staked and numbered in the field by EPC. Boring surface
elevations were also determined by EPC, with the base of the fire hydrant near the north end of
Vanderberg Drive being assumed elevation 100.0 feet. Borings were performed with EPC’s CME
850 track mounted drill rig. Standard penetration tests were performed with an automatic hammer.

Soil Boring Findings:
Generally speaking, soils consisted of 6.0 to 11-feet of silty clayey sand FILL/Could Be Fill soils
and ORGANIC soils (Boring 2 only), over native silty clayey sand soils. In Borings 1, 2 and 3 the
fill soils were also mainly silty clayey sand. In Borings 4 and 5 the soils encountered from about 4.0
to 11-feet below existing grade (BBG) were more of a sandy silt, that could be fill. These sandy silt
soils are generally quite sensitive if disturbed, and often present stability challenges during
construction.

Boring 5 reached substantial sampler refusal at a depth of 20.2-feet below existing grade (BBG). The
other four borings were voluntarily terminated at 21-feet BBG. Water was observed in all five
borings from 6.0 to 18-feet BBG (elevation range 95.0 to 80.0-feet), during the relatively short
drilling process. Please refer to the table below and the boring logs in the appendix for details.

<table>
<thead>
<tr>
<th>Boring Number</th>
<th>Surface Elevation (ft)</th>
<th>Depth/Elevation to Bottom of Fill (ft)</th>
<th>Depth/Elevation to Bottom of Organic (ft)</th>
<th>Depth/Elevation to Bottom of Sandy Silt / Could Be Fill (ft)</th>
<th>Depth/Elevation to Bottom of Native Silty Clayey Sand / Boring Depth (ft)</th>
<th>Required Minimum Excavation Depth/Elevation (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>96.1</td>
<td>*6.5 / 89.6</td>
<td>None Observed</td>
<td>None Observed</td>
<td>21 / 75.1</td>
<td>6.5 / 89.6</td>
</tr>
<tr>
<td>2</td>
<td>98.0</td>
<td>6.5 / 91.5</td>
<td>**10 / 88.0</td>
<td>None Observed</td>
<td>21 / 77.0</td>
<td>10 / 88.0</td>
</tr>
<tr>
<td>3</td>
<td>102.4</td>
<td>6.5 / 95.9</td>
<td>None Observed</td>
<td>9.0 / 93.4</td>
<td>21 / 81.4</td>
<td>9.0 / 93.4</td>
</tr>
<tr>
<td>4</td>
<td>104.0</td>
<td>4.0 / 100.0</td>
<td>None Observed</td>
<td>*11.5 / 92.5</td>
<td>21 / 83.0</td>
<td>4.0 / 100.0</td>
</tr>
<tr>
<td>5</td>
<td>102.7</td>
<td>4.0 / 98.7</td>
<td>None Observed</td>
<td>10.5 / 92.2</td>
<td>20.2 / 82.5</td>
<td>4.0 / 98.7</td>
</tr>
</tbody>
</table>

*Indicates gravel layer observed below fill / could be fill soils.
**Indicates silt layer observed below bottom of organic layer.
Laboratory Observation and Testing:
Laboratory testing was limited to moisture content and visual classification of all samples and organic content of three samples. Significantly organic soils were only observed in Boring 2, in the sample from 7.0 to 8.5-feet. Water bearing soils were observed in the gravelly samples of Borings 1 and 4, at about 7.0 and 12-feet, respectively. Water bearing soils were also observed in the sand and silty sand soils of Borings 3 and 5, at about 7 and 15-feet, respectively.

Allowable Bearing Capacity:
Preliminary allowable bearing capacity after performing the soils correction and pending the proposed foundation type/depth and location of construction on this relatively long site, is 3000 psf at/near Borings 1 and 2, and 1500 psf at/near Borings 3, 4 and 5. Additional soils information is necessary to better define this site.

Recommendation:
Perform building specific soil borings and a final geotechnical engineering report, prior to design and construction on this site.

This report completes EPC’s work on this project to date. We must caution you that this report, prepared for preliminary design information only, is not a complete geotechnical engineering report. EPC cannot be responsible for possible misinterpretation of the contents of the boring logs, or the strengths of the soils described in them. Soil samples from this project will be saved for two months from the date of this report unless EPC is directed in writing to do otherwise.

We would like to thank you for allowing EPC to be of service to you on this project. If you have any questions or comments, please call us at (218) 727-1239 (w) or (218) 341-4536 (c).

Sincerely,
EPC Engineering & Testing,

Gary E. Hage, P.E.
Principal Engineer

Reviewed by:

Brian E. McVeagh, P.E.
Principal Engineer

CC: Reynolds Smith & Hills - Mr. Darren Christopher
    DSGW – Mr. John Guissler

Enclosures: Location Map, Boring Plan/Elevation Drawing and Boring Logs
Elevation (ft)

0
5
10
65
80
85
15
20

Silty Clayey Sand (SC-SM) (Fill) Brown, wet, with trace organics, little gravel, loose relative density.

Sandy Silty Clay (CL-ML) to Silty Clayey Sand (SC-SM) (Fill) Light brown to brown, wet, trace gravel, soft consistency / loose relative density.

1-inch layer of gray silt in sample from 4 to 6-feet.

Sandy Silty Gravel (OP-QM) Brown, water bearing, fine grained, medium dense relative density.

Silt Clayey Sand (SC-SM) Dark brown, moist to wet, little gravel, very dense to dense to medium dense to dense relative density.

Cave-in level = 10-feet.

Boulder at 12-feet.

Bottom of hole at 21.0 feet.
### BORING NUMBER SB-14-2

**Geotechnical • Environmental • Materials Engineering**

**Client:** Duluth Airport Authority

**Date Started:** 11/26/14  **Completed:** 11/25/14

**Ground Elevation:** 98 ft  **Hole Size:** 7-inch

**Drilling Contractor:** EPC Engineering & Testing

**Drilling Method:** CME 850 Tract with HSA & Auto-SPT-Hammer

**Logged By:** NEW  **Checked By:** GH

**Logged by:** NEW  **Checked by:** GH

**Notes:** Central portion of west-most one-quarter of parcel.

<table>
<thead>
<tr>
<th>Elevation (ft)</th>
<th>Depth (ft)</th>
<th>Graphic Log</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td>SILTY CLAYEY SAND (SC-SCM) (FILL) Brown, wet, trace gravel, organics and concrete, loose relative density.</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>SPT 1</td>
<td>48 1-2-3-4 (6)</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>SPT 2</td>
<td>50 5-10-8-9 (18)</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>SPT 3</td>
<td>33 2-6-8-5 (14)</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td>PEAT (PT) to ORGANIC SILT (OL) (SWAMP / ORGANIC) Dark greenish brown to dark brown, moist, soft consistency.</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td>SPT 4</td>
<td>72 1-2-2 (4)</td>
</tr>
<tr>
<td>30</td>
<td></td>
<td>SPT 5</td>
<td>61 0-8-13 (21)</td>
</tr>
<tr>
<td>50</td>
<td></td>
<td>SPT 6</td>
<td>44 4-6-8 (14)</td>
</tr>
<tr>
<td>75</td>
<td></td>
<td>SPT 7</td>
<td>28 4-6-4 (10)</td>
</tr>
<tr>
<td>100</td>
<td></td>
<td>SPT 8</td>
<td>56 8-8-12 (20)</td>
</tr>
</tbody>
</table>

**Cave-In Level:** 15-feet.

**Bottom of hole at:** 21.0 feet.

**Ground Water Levels:**

- At the time of drilling: 13.0 ft / Elev 80.0 ft
- At the end of drilling: None

**Drill Cuttings:**

- 13.9
- 10.9
- 11.2
- 11.4
- 11.0
- 7.64
- 23.3
- 15.9
- 11.4

**Fines Content (%):**

<table>
<thead>
<tr>
<th></th>
<th>PL</th>
<th>MC</th>
<th>LL</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>40</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>20</td>
<td>40</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>20</td>
<td>40</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>20</td>
<td>40</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>ELEVATION (ft)</td>
<td>MATERIAL DESCRIPTION</td>
<td>SAMPLE TYPE NUMBER</td>
<td>RECOVERY % (RCD)</td>
</tr>
<tr>
<td>---------------</td>
<td>----------------------</td>
<td>--------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>0</td>
<td>SILTY CLAYEY SAND (SC-SM) (FILL) Brown, trace black, moist, medium dense relative density.</td>
<td>SPT 1</td>
<td>67</td>
</tr>
<tr>
<td>100</td>
<td>SILTY SAND (SM) to SAND with Silt (SP-SM) (FILL) Brown, moist to wet, trace gravel, medium dense to loose relative density. Boulder at 3-feet.</td>
<td>SPT 2</td>
<td>29</td>
</tr>
<tr>
<td>6</td>
<td>SILTY CLAYEY SAND (SC-SM) Brown to dark brown, wet to water bearing to wet, trace to little gravel, medium dense to dense to medium dense relative density.</td>
<td>SPT 3</td>
<td>25</td>
</tr>
<tr>
<td>95</td>
<td>SAND with Silt (SP-SM) Black, water bearing, fine to medium grain; with gravel, very loose relative density. Organic content of sample from 7.0 to 8.5-foot = 0.5%. Cave-in level = 7-foot.</td>
<td>SPT 4</td>
<td>33</td>
</tr>
<tr>
<td>10</td>
<td>SILTY CLAYEY SAND (SC-SM)</td>
<td>SPT 5</td>
<td>72</td>
</tr>
<tr>
<td>50</td>
<td></td>
<td>SPT 6</td>
<td>58</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>SPT 7</td>
<td>72</td>
</tr>
<tr>
<td>65</td>
<td></td>
<td>SPT 8</td>
<td>83</td>
</tr>
</tbody>
</table>

Bottom of hole at 21.0 feet.
BORING NUMBER SB-14-4

EPC Engineering & Testing
Geotechnical • Environmental • Materials Engineering
539 Garfield Avenue
Duluth, Minnesota 55802

CLIENT Duluth Airport Authority
PROJECT NUMBER 14G0946

DATE STARTED 11/20/14  COMPLETED 11/29/14
GROUND ELEVATION 104 ft  HOLE SIZE 7-inch

DRILLING CONTRACTOR EPC Engineering & Testing
GROUND WATER LEVELS:

DRILLING METHOD CME 650 Track with HSA & Auto-SPT-Hammer

LOGGED BY NEW CHECKED BY GH

NOTES Southeast portion of east-most one-quarter of parcel.

 Cannell, Nicholas

<table>
<thead>
<tr>
<th>ELEVATION (ft)</th>
<th>DEPTH (ft)</th>
<th>GRAPHIC LOG</th>
<th>MATERIAL DESCRIPTION</th>
<th>SAMPLE TYPE NUMBER</th>
<th>RECOVERY % (ROD)</th>
<th>SLOCMOUNTS (N VALUE)</th>
<th>DRY UNIT WGT. (GSD)</th>
<th>SPT N VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td>SILTY CLAYEY SAND (SC-SM) (FILL) Dark brown, wet, with to trace organics.</td>
<td>SPT 1</td>
<td>25</td>
<td>8-7-6-5 (13)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
<td>SANDY SILTY CLAY (CL-ML) (Topsoil-like) (FILL) Black and dark brown, moist, with organics.</td>
<td>SPT 2</td>
<td>33</td>
<td>2-3-5-3 (8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
<td>SANDY SILTY CLAY (CL-ML) to SANDY SILT (ML) (Could Be Fill) Brown, wet, trace gravel, medium to stiff to medium consistency. Organic content of sample from 4.0 to 6.0-feet = 1.0%.</td>
<td>SPT 3</td>
<td>50</td>
<td>1-2-3-4 (6)</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>95</td>
<td></td>
<td></td>
<td>SANDY SILTY GRAVEL (GP-GM) Brown, water bearing, fine to medium grained, trace cobbles and boulders, very dense relative density.</td>
<td>SPT 4</td>
<td>78</td>
<td>4-4-5 (9)</td>
<td>2.2</td>
<td></td>
</tr>
<tr>
<td>90</td>
<td></td>
<td></td>
<td>SANDY SILTY CLAY (CL-ML) Dark brown, wet, little gravel, very stiff consistency. Cave-In level = 15-feet.</td>
<td>SPT 5</td>
<td>72</td>
<td>1-3-4 (7)</td>
<td>2.1</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td></td>
<td></td>
<td>SILTY SAND (SM) Dark brown, wet to water bearing, dense to medium dense relative density.</td>
<td>SPT 6</td>
<td>89</td>
<td>12-35-35 (70)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td></td>
<td></td>
<td></td>
<td>SPT 7</td>
<td>100</td>
<td>7-8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>67</td>
<td></td>
<td></td>
<td></td>
<td>SPT 8</td>
<td>67</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>67</td>
<td></td>
<td></td>
<td></td>
<td>SPT 9</td>
<td>67</td>
<td>5-15-13 (28)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bottom of hole at 21.0 feet.</td>
<td></td>
</tr>
</tbody>
</table>
EPC Engineering & Testing
Geotechnical • Environmental • Materials Engineering
539 Garfield Avenue
Duluth, Minnesota 55802

CLIENT: Duluth Airport Authority
PROJECT NUMBER: 1403040
DATE STARTED: 11/26/14 COMPLETED: 11/26/14
DRILLING CONTRACTOR: EPC Engineering & Testing
DRILLING METHOD: CME 850 Track with HSA & Auto-SPT-Hammer
LOGGED BY: GH CHECKED BY: GH
NOTES: Northeast corner of east-central one-quarter of parcel.

PROJECT NAME: Proposed Development
PROJECT LOCATION: Duluth International Airport
GROUND ELEVATION: 102.7 ft HOLE SIZE: 7-inch
GROUND WATER LEVELS:
- AT TIME OF DRILLING: 12.0 ft / Elev 90.7 ft
- AT END OF DRILLING: 18.0 ft / Elev 84.7 ft
- 0hr AFTER DRILLING: 10.0 ft / Elev 92.7 ft

ELEVATION (ft) | DEPTH (ft) | GRAPHIC LOG |
<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>MATERIAL DESCRIPTION</td>
</tr>
<tr>
<td>100</td>
<td>5</td>
<td>SILTY CLAYEY SAND (SC-SM) (FILL) Brown, moist, little gravel.</td>
</tr>
<tr>
<td>95</td>
<td>10</td>
<td>SILTY CLAYEY SAND (SC-SM) (FILL) Black and brown, wet.</td>
</tr>
<tr>
<td>90</td>
<td>15</td>
<td>SANDY SILTY CLAY (CL-ML) to SANDY SILT (ML) (Could Be Fill) Brown, wet, stiff consistency.</td>
</tr>
<tr>
<td>85</td>
<td>20</td>
<td>SILTY CLAYEY SAND (SC-SM) Dark brown, wet to moist, little gravel, dense relative density.</td>
</tr>
<tr>
<td>80</td>
<td>25</td>
<td>SILTY SAND (SM) Dark brown to brown, water bearing, little gravel, trace cobbles and boulders, very dense relative density. Cave-In level = 15-feet.</td>
</tr>
<tr>
<td>75</td>
<td>30</td>
<td>SILTY CLAYEY SAND (SC-SM) to SANDY SILTY CLAY (CL-ML) Dark grayish brown, wet, little gravel, trace cobbles and boulders, very dense relative density.</td>
</tr>
</tbody>
</table>

SAMPLE TYPE NUMBER: SPT
RECOVERY (ROD %): 63
BLOW COUNTS (N-VALUE): 1-8-11-10 (19)
DRY UNIT WT. (lb/ft³): 110.0

SPT N VALUE
PL MC LL
20 40 60 80
20 40 60 80

FINES CONTENT (%): 80

Substantial sampler refusal at 20.2-feet. Bottom of hole at 20.2 feet.