PRELIMINARY GEOTECHNICAL SUMMARY
FOR
PROPOSED PARKING FACILITY
ORCHARD STREET LOT
DOVER, NH
CITY OF DOVER
OFFICE OF THE FINANCE DIRECTOR
288 CENTRAL AVENUE
DOVER, NH 03820-4169
ATTN: DANIEL BARUFALDI

JTC Project # 11-GEO-005
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Site Photos
MEMORANDUM

TO: City of Dover
Office of the Finance Director
288 Central Avenue
Dover, NH 03820-4169

FROM: Kyle Urso  Kevin Martin, P.E.
Field Engineer  Geotechnical Engineer

DATE: February 24, 2011

RE: PRELIMINARY GEOTECHNICAL SUMMARY
PROPOSED PARKING FACILITY
ORCHARD STREET LOT
DOVER, NEW HAMPSHIRE

This memorandum report presents the findings of a subsurface exploration program and a preliminary evaluation of the conditions encountered as they relate to the feasibility of a proposed parking facility. The contents of this report are subject to the attached Limitations.

BACKGROUND

The purpose of this preliminary geotechnical study is to review the subgrade conditions and feasibility for potential re-use of city owned lots. Future development is uncertain but may include a parking lot or parking garage. A parking garage may be up to 4-7 stories with considerable load. Based on a recent meeting, it is expected that the Orchard Street Lot may be the preferred candidate for a parking garage given the large footprint. It was further discussed that a basement level is being considered which would require a =10-12 ft deep lower garage level. It is expected that the basement level of the garage will be accessed from Central Avenue Street to the east with first floor access along Chestnut Street to the west.
SITE & PROJECT DESCRIPTION

The project site is presently utilized as a parking lot. The Cocheco River is located to the immediate north of the site. The site is relatively level based on visual estimate. Recent survey of the test bores indicates grades to vary from elevation =53-61 ft with an average grade near =57 ft. In general, the grades are shown to gradually slope downward to the east. A Site Plan is in the process of being complied for the project. An Environmental Site Assessment (ESA) is also being completed for the project. This ESA report was not completed at the time of this study. It is noted that the site was prior used as a tannery. Prior Sanborn Fire Maps show several dwellings throughout the property.

SUBSURFACE EXPLORATIONS & LABORATORY TESTING

Test Borings

The subgrade conditions were reviewed with the completion of six (6) test borings throughout the lot. The test borings (identified as B13 to B18) were advanced to refusal depths of about =38-47 ft utilizing either continuous flight solid stem augers, hollow stem augers and/or NW casing. Soil samples were typically retrieved at no greater than 5 ft intervals with a 2-inch diameter split-spoon sampler. Standard Penetration Tests (SPTs) were performed at the sampling intervals in general accordance with ASTM-D1586 (Standard Method for Penetration Test and Split-Barrel Sampling of Soils). Field descriptions and penetration resistance of the soils encountered, observed depth to groundwater, depth to apparent bedrock refusal and other pertinent data are contained on the attached Test Boring Logs. The test borings were located by survey as shown on the Test Boring Location Plan.

Laboratory Testing

Three (3) selected split-spoon samples obtained from the test borings were submitted to our laboratory for sieve analyses or Atterberg Limits per ASTM Standards. The purpose of the testing was to assess engineering characteristics for design and to assess the suitability of the site soils for re-use as structural fill on the project. The test results are attached for review.

SUBGRADE CONDITIONS

The subgrade conditions were consistent across the site. The subgrade conditions, in general, consist of (1) shallow granular Fill underlain by (2) a clayey Silt, (3) very soft silty Clay then (4) Refusal. The clayey Silt and deeper silty Clay are unconsolidated alluvium deposits associated with the adjacent river. A Subsurface Profile depicting the subgrade conditions is attached for review.
A shallow, granular Fill was encountered throughout the site to depths of ≈3-5 ft. Other fill should be expected being associated with intersecting utilities and past construction. A relatively stable clayey Silt was identified to a depth of about ≈13-14 ft below grade. This deposit consists of a sandy Silt at shallow depths being more plastic (clayey) with depth. The clayey Silt is expected to be encountered throughout most of the basement level construction. The clayey Silt is moisture sensitive, poor-draining and frost susceptible. The predominate overburden consists of a grey, very soft, silty Clay. This deposit is very weak and unstable. The silty Clay will govern the foundation design for the parking garage.

Test boring refusal, presumably bedrock, was met in all the test borings at depths of ≈38-43 ft below grade. The relatively consistent depth to refusal further suggests bedrock. The USGS Bedrock Geologic Map of New Hampshire (1996) depicts bedrock in the area to include biotite granofels, mica schist, quartzite and/or phyllite. Such rock types are characteristically hard and of sound quality. The bedrock is expected to possess a gradual contour.

Groundwater was encountered in the test borings about ≈9 ft below grade. It should be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors differing from the time of the measurements. The study was completed at a time of seasonally low groundwater. The groundwater is expected to be directly impacted by the Cochecho River to the north. Monitoring wells should be considered for better survey of the groundwater table especially for a basement level foundation.

**PRELIMINARY GEOTECHNICAL EVALUATION**

The soft Silt & Clay will govern the foundation for the parking garage. The Silt & Clay is weak, compressible and unstable. Given the high foundation loads associated with a parking garage, the foundation will likely require deep pile support. More specifically, end-bearing piles driven to bedrock will likely be the most feasible means of foundation support. Driven piles may include steel (concrete filled pipe or H-sections) or precast concrete. Pile loads upwards of ≈50-150 tons should be feasible given the bedrock. Pile loads greater than ≈100 tons will likely be necessary for a multilevel parking garage. It is possible to support the ground level floor on a conventional slab-on-grade. The lighter floor loads and basement level excavation should be feasible for this approach.

The subsurface conditions were reviewed with respect to seismic criteria set forth in the International Building Code (2009). Based on the fine-grained composition of the site soils (clay), the site is not susceptible to liquefaction (complete loss of shear resistance) in the event of an earthquake. Based on interpretation of the Building Code together with the project and site conditions, the Site Classification (Table 1613.5.2) is “E” (Soft Soil). This Classification will likely impact the structural design of the garage due to increased shear (lateral) loads.
The groundwater table should also be considered with the final foundation design. A basement level foundation will require some means of groundwater control. The deeper the groundwater encroachment, the more difficulty with both short and long term water management. The flood elevation of the adjacent Cocheco River should also be considered in the final design.

We trust the contents of this memorandum report are responsive to your needs at this time. Should you have any questions or require additional assistance, please do not hesitate to contact our office.
LIMITATIONS

Explorations

1. The analyses, recommendations and designs submitted in this report are based in part upon the data obtained from preliminary subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.

2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretation of widely spaced explorations and samples; actual soil transitions are probably more gradual. For specific information, refer to the individual test pit and/or boring logs.

3. Water level readings have been made in the test pits and/or test borings under conditions stated on the logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors differing from the time the measurements were made.

Review

4. It is recommended that this firm be given the opportunity to review final design drawings and specifications to evaluate the appropriate implementation of the recommendations provided herein.

5. In the event that any changes in the nature, design, or location of the proposed areas are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of the report modified or verified in writing by John Turner Consulting, Inc.

Construction

6. It is recommended that this firm be retained to provide geotechnical engineering services during the earthwork phases of the work. This is to observe compliance with the design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

Use of Report

7. This report has been prepared for the exclusive use of the City of Dover in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

8. This report has been prepared for this project by John Turner Consulting, Inc. This report was completed for preliminary design purposes and may be limited in its scope to complete an accurate bid. Contractors wishing a copy of the report may secure it with the understanding that its scope is limited to geotechnical design considerations.
ORCHARD ST LOT
DOVER, NH

ELEVATION (FT)

60
50
40
30
20
10
0

B14

B15

B16

SANDY FILL

GREY-BRN SILT, LITTLE FINE SAND, CLAY

GREY, VERY SOFT SILT/CLAY

ELEV. ~ 57'

LOWER LEVEL ~ 45'

PILE FOUNDATION SUPPORT

REFUSAL
## Boring Log

**JOHN TURNER CONSULTING, INC.**  
**PHONE:** 603-749-1841  
**FAX:** 603-516-6851  
**19 DOVER STREET**  
**DOVER, NH 03820**

**CLIENT:** City of Dover  
**PROJECT:** Geo-Analysis: 4 City Parking Lots  
**PROJECT NO:** 11-GEO-005  
**BORING #:** B13  
**LOCATION:** See Plan  
**SURFACE ELEVATION:** 56.5  
**DATE:** 04-Feb-11

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| JTC REP | |
|---------| |
| Kyle Urs | |

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**REMARKS:**  
- Acker Drill Rig, 2.25" Internal Diameter Hollow Stem Auger

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Standard Penetration Tests (SPT) = 140# hammer falling 30" (ASTM D-1586)  
Blows are per 6 inches with a 24" long by 2" O.D. by 1 3/8" I.D. split spoon sampler unless otherwise noted  
S = split-spoon sampler; C = rock core sample; U = undisturbed

**REMARKS:**  
The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water  
level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations  
in the level of the groundwater may occur due to other factors than those present at the time measurements were made.  
Proprietary used: trace (0-10%), little (10-20%), some (20-35%), and (35-50%)
**BORE LOG**

**JOHN TURNER CONSULTING, INC.**

**PHONE:** 603-749-1841

**19 DOVER STREET**

**FAX:** 603-516-6851

**DOVER, NH 03820**

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<td>JTC REP.:</td>
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<th>FT</th>
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<td>Probe Refusal @ 38.0' on Probable Intact Bedrock</td>
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**REMARKS:** Acker Drill Rig, 2.25" Internal Diameter Hollow Stem Auger

Standard Penetration Tests (SPT) = 140# hammer falling 30" (ASTM D1586)
Blows are per 6 inches with a 24" long by 2" O.D. by 1 3/8" I.D. split spoon sampler unless otherwise noted
S = split spoon sample; C = rock core sample; U = undisturbed

**REMARKS:** The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.
Proportions used: trace (0-10%), little (10-20%), some (20-35%), and (35-50%)
## Boring Log

**Client:** City of Dover  
**Project:** Geo-Analysis: 4 City Parking Lots  
**Project No.:** 11-GEO-005  
**Location:** See Plan  
**Surface Elevation:** 57.3  
**Date:** 08-Feb-11  
**Boring No.:** B14  
**Drilling Co.:** Great Works Test Boring  
**Driller:** Jeff Lee  
**JTC Rep.:** Kyle Urso

### Soil & Rock Classification-Description

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### Blows per 6 inches (N)

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**Remarks:** Steel Track Drill Rig, 2.25" Internal Diameter Hollow Stem Auger, Automatic Hammer

**Standard Penetration Tests (SPT) = 140# hammer falling 30" (ASTM D1586)**

Blows are per 6 inches with a 24" long by 2" O.D. by 1 3/8" I.D. split spoon sampler unless otherwise noted.

S = split-spoon sample; C = rock core sample; U = undisturbed

**Remarks:** The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made. Proportions used: trace (0-10%), little (10-20%), some (20-35%), and (35-50%).
### BORING LOG

**John Turner Consulting, Inc.**

**Phone:** 603-749-1841  
**Fax:** 603-516-6851

**19 Dover Street**  
**Dover, NH 03820**

**Client:** City of Dover  
**Project:** Geo-Analyze: 4 City Parking Lots  
**Project No:** 11-GEO-005

<table>
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<tr>
<th><strong>Type of Boring:</strong></th>
<th>2.25' H.S.A./Casing @ 5.0'</th>
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**Groundwater Observations**

**Drilling Co.:** Great Works Test Boring  
**Driller:** Jeff Lee  
**JTC Rep.:** Kyle Uso

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**Stratum Change (FT.):**

**Borehole Observations:**

**Tri-Cone Drill Bit Refusal @ 44.0' on Probable Intact**

**Bedrock**

**Remarks:**

- Steel Track Drill Rig, 2.25" Internal Diameter Hollow Stem Auger, Automatic Hammer

- Standard Penetration Tests (SPT) = 140# hammer falling 30" (ASTM D1586)
- Blows are per 6 inches with a 24" long by 2" O.D. by 1 3/8" I.D. split spoon sampler unless otherwise noted
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**Remarks:** The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made. Proportions used: Trace (0-16%), little (16-26%), some (26-35%), and (35-59%).
**BORING LOG**

**JOHN TURNER CONSULTING, INC.**

**19 DOVER STREET**

**DOVER, NH 03820**

**PHONE:** 603-749-1841  
**FAX:** 603-516-6851

---

**CLIENT:** City of Dover  
**PROJECT:** Geo-Analysis: 4 City Parking Lots  
**PROJECT NO.:** 11-GEO-005  
**LOCATION:** See Plan  
**SURFACE ELEVATION:** 57.4  
**DATE:** 08-Feb-11  

---

**TYPE OF BORING:** 2.25" H.S.A./Casing @ 5.0'  
**GROUNDWATER OBSERVATIONS**  
**DRILLING CO:** Great Works Test Boring  
**DRILLER:** Jeff Loo  
**JTC REP.:** Kyle Uso

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<td>24</td>
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<td></td>
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<td>4-6-8-10</td>
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<tr>
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<td>S-3</td>
<td>10-12</td>
<td>24</td>
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<td>15-17</td>
<td>24</td>
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<td></td>
<td></td>
<td></td>
<td>WOH/24</td>
<td>0</td>
</tr>
</tbody>
</table>

**REMARKS:** Steel Track Drill Rig, 2.25" Internal Diameter Hollow Stem Auger, Automatic Hammer  

Standard Penetration Tests (SPT) = 140# hammer falling 30" (ASTM D1586)  
Blows are per 6 inches with a 24" long by 2" O.D. by 1 3/8" I.D. split spoon sampler unless otherwise noted  
S = split-spoon sample; C = rock core sample; U = undisturbed

**REMARKS:** The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made. Proportions noted: trace (0-10%), little (10-20%), some (20-35%), and (35-50%)
### Boring Log

**Client:** City of Dover  
**Project:** Geo-Analysis: 4 City Parking Lots  
**Project No.:** 11-GEO-005

**Type of Boring:** 2.25" H.S.A./Casing @ 5.0'  
**Groundwater Observations**

<table>
<thead>
<tr>
<th>FT</th>
<th>NO.</th>
<th>Sample Depth (FT.)</th>
<th>REC. (IN.)</th>
<th>Soil &amp; Rock Classification-Description</th>
<th>Burmeister System (Soil)</th>
<th>U.S. Corps of Engineers System (Rock)</th>
<th>Stratum Change (FT.)</th>
<th>Bows Per 6 Inches</th>
<th>Pen (N)</th>
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<td>S-8</td>
<td>35-37</td>
<td>24</td>
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<td>WOR/24</td>
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<td>S-9</td>
<td>40-42</td>
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<td>WOR/24</td>
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<td>0</td>
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**Remarks:**
- Tri-Cone Drill Bit Refusal @ 47.0' on Probable intact  
  Bedrock
- Steel Track Drill Rig, 2.25" Internal Diameter Hollow Stem Auger, Automatic Hammer

**Standard Penetration Tests (SPT) = 140# hammer falling 30" (ASTM D1586)**

- Blows are per 6 inches with a 24" long by 2" O.D. by 1 3/8" I.D. split spoon sampler unless otherwise noted
- S = split-spoon sample; C = rock core sample; U = undisturbed

**Remarks:** The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.

- Proportions used: trace (0-10%), little (10-20%), some (20-35%), and (35-50%)
# Boring Log

**Client:** City of Dover  
**Project:** Geo-Analysis: 4 City Parking Lots  
**Location:** See Plan  
**Surface Elevation:** 53.2  
**Date:** 18-Feb-11  
**Type of Boring:** 2.25" H.S.A./Casing @ 5.0'  
**Drilling Co.:** Great Works Test Boring  
**Driller:** Jeff Lee  
**JTC Rep.:** Kyle Usko  

<table>
<thead>
<tr>
<th>FT</th>
<th>NO.</th>
<th>Sample Depth (FT.)</th>
<th>Rec. (IN.)</th>
<th>Soil &amp; Rock Classification-Description</th>
<th>Burmeister System (Soil)</th>
<th>U.S. Corps of Engineers System (Rock)</th>
<th>Stratum Change (FT.)</th>
<th>Blows per 6 Inches</th>
<th>Pen (N)</th>
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<tbody>
<tr>
<td>0</td>
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<td>Asphalt</td>
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<td>S-2</td>
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<td>Moist, Grayish Brown, Silt, little fine Sand</td>
<td>WOH/24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>S-3</td>
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</table>

**Remarks:** Steel Track Drill Rig, 2.25" Internal Diameter Hollow Stem Auger, Automatic Hammer

*Standard Penetration Tests (SPT) = 140ft hammer falling 30" (ASTM D1586)*

Blows are per 6 inches with a 24" long by 2" O.D. by 1 3/8" I.D. split spoon sampler unless otherwise noted

S = split-spoon sample; C = rock core sample; U = undisturbed

**Remarks:** The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.

Proportions noted: trace (0-1%), little (10-20%), some (20-33%), and (33-50%)
<table>
<thead>
<tr>
<th>FT</th>
<th>NO.</th>
<th>SAMPLE DEPTH (FT.)</th>
<th>REC. (IN.)</th>
<th>SOIL &amp; ROCK CLASSIFICATION-DESCRIPTION</th>
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<tbody>
<tr>
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<td>S-6</td>
<td>35-37</td>
<td>24</td>
<td>Wet, Gray, Silty Clay</td>
</tr>
</tbody>
</table>

Tri-Cone Drill Bit Refusal @ 39.0' on Probable Intact BEDROCK

**REMARKS:** Steel Track Drill Rig, 2.25" Internal Diameter Hollow Stem Auger, Automatic Hammer

---

**GROUNDWATER OBSERVATIONS**

- DATE: 18-Feb-11
- LOCATION: See Plan
- SURFACE ELEVATION: 53.2
- TYPE OF BORING: 2.25" H.S.A./Casing @ 5.0'

---

**REMARKS:**

- Standard Penetration Tests (SPT) = 140# hammer falling 30" (ASTM D1586)
- Blows are per 6 inches with a 24" long by 2" O.D. by 1 3/8" I.D. split spoon sampler unless otherwise noted
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**REMARKS:** The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made. Proportions used: trace (0-10%), little (10-20%), some (20-35%), and (35-50%)
# BORING LOG

**JOHN TURNER CONSULTING, INC.**  
**PHONE:** 603-749-1841  
**19 DOVER STREET**  
**FAX:** 603-516-6851  
**DOVER, NH 03820**  

**CLIENT:** City of Dover  
**PROJECT:** Geo-Analysis: 4 City Parking Lots  
**PROJECT NO.:** 11-GEO-005  
**LOCATION:** Sec Plan  
**SURFACE ELEVATION:** 60.7  
**DATE:** 18-Feb-11  

**TYPE OF BORING:** S.S.A  
**GROUNDWATER OBSERVATIONS**  
**DATE:** 18-Feb-11  
**DEPTH:** 14.5'  
**TIME:** Upon Completion  
**DRILLER:** Jeff Lee  
**JTC REP.:** Kyle Uso  

<table>
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<tr>
<th>FT</th>
<th>NO.</th>
<th>SAMPLE DEPTH (FT.)</th>
<th>REC. (IN.)</th>
<th>SOIL &amp; ROCK CLASSIFICATION-DESCRIPTION</th>
<th>BURMEISTER SYSTEM (SOIL)</th>
<th>U.S. CORPS OF ENGINEERS SYSTEM (ROCK)</th>
<th>STRATUM CHANGE (FT.)</th>
<th>BLOWS PER 6 INCHES</th>
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<tr>
<td>5</td>
<td>S-2</td>
<td>0-5</td>
<td>24</td>
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<td>4-4-7-9</td>
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<td>10</td>
<td>S-3</td>
<td>0-10</td>
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<tr>
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<td>WOH/6-2-2-2</td>
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</table>

**REMARKS:** Steel Track Drill Rig, Solid Stem Auger, Automatic Hammer

---

Standard Penetration Tests (SPT) = 140# hammer falling 30" (ASTM D1586)  
Blows are per 6 inches with a 24" long by 2" O.D. by 1 3/8" I.D. split spoon sampler unless otherwise noted  
S = split-spoon sample; C = rock core sample; U = undisturbed

**REMARKS:** The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made. Proportions used: trace (0-10%), little (10-20%), some (20-35%), and (35-50%)
# Boring Log

**Client:** City of Dover  
**Project:** Geo-Analysis: 4 City Parking Lots  
**Project No.:** 11-GEO-005  
**Drilling Co.:** Great Works Test Boring  
**Driller:** Jeff Lee  
**JTC Rep.:** Kyle Uso  
**Date:** 18-Feb-11  
**Location:** See Plan  
**Surface Elevation:** 60.7  
**Place:** B17  
**Date:** 18-Feb-11  
**Depth:** 14.5'  
**Time:** Upon Completion  

## Soil & Rock Classification

<table>
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<tr>
<th>FT</th>
<th>NO.</th>
<th>Depth (ft.)</th>
<th>Rec. (In.)</th>
<th>Soil &amp; Rock Classification/Description</th>
<th>Burmeister System (Soil)</th>
<th>U.S. Corps of Engineers System (Rock)</th>
<th>Stratum Change (ft.)</th>
<th>Bows per 6 Inches</th>
<th>Pen (N)</th>
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<tbody>
<tr>
<td>35</td>
<td>S-6</td>
<td>35-37</td>
<td>24</td>
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<td>WOR/24</td>
<td>0</td>
<td></td>
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<tr>
<td>40</td>
<td>S-7</td>
<td>41-43</td>
<td>0</td>
<td>Weathered Rock</td>
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<td>41</td>
<td>46-50/6&quot;</td>
<td>50+</td>
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**Probe Refusal @ 43.5" on Probable Intact**  
**Bedrock**

## Remarks

- Steel Track Drill Rig, Soil Stem Auger, Automatic Hammer
- Standard Penetration Tests (SPT) = 140# hammer falling 30" (ASTM D1586)
- Blows are per 6 inches with a 24" long by 2" O.D. by 1 3/8" I.D. split spoon sampler unless otherwise noted
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**Remarks:** The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.

Proportions used: trace (0-10%), little (10-20%), some (20-35%), and (35-50%)
# Boring Log

### General Information
- **Client:** City of Dover
- **Location:** See Plan
- **Surface Elevation:** 54.2
- **Date:** 18-Feb-11
- **Type of Boring:** S.S.A
- **Groundwater Observations:**
  - **Time:** During Drilling

### Drilling Details
- **Driller:** Jeff Lee
- **JTC Rep.:** Kyle Urso

### Boring Data

<table>
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<tr>
<th>FT</th>
<th>No.</th>
<th>Sample Depth (FT.)</th>
<th>REC. (IN.)</th>
<th>Soil &amp; Rock Classification-Description</th>
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<td>U.S. Corps of Engineers System (Rock)</td>
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<td></td>
<td>Stratum Change (FT.)</td>
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<td></td>
<td></td>
<td></td>
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<td>S-2</td>
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<td>5</td>
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<tr>
<td></td>
<td>S-3</td>
<td>7-9</td>
<td>24</td>
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<td>S-3</td>
<td>10-12</td>
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</table>

### Remarks
- **Remarks:** Steel Track Drill Rig, Solid Stem Auger, Automatic Hammer

**Standard Penetration Tests (SPT) = 140# hammer falling 30" (ASTM D1586)**

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Preponderant used: trace (0-10%), little (10-20%), some (20-35%), and (35-50%)
### BORING LOG

**JOHN TURNER CONSULTING, INC.**  
19 DOVER STREET  
DOVER, NH 03820  
PHONE: 603-749-1841  
FAX: 603-516-6851

**CLIENT:** City of Dover  
**PROJECT:** Geo-Analysis: 4 City Parking Lots
Orchard Street Parking Lot
**PROJECT NO:** 11-GEO-005  
**BORING #:** B18  
**LOCATION:** See Plan  
**SURFACE ELEVATION:** 54.2  
**DATE:** 18-Feb-11

**TYPE OF BORING:** S.S.A  
**DRILLING CO:** Great Works Test Boring  
**DATE:** 18-Feb-11  
**DEPTH:** 7.5  
**DRILLER:** Jeff Lee  
**JTC REP:** Kyle Uso

<table>
<thead>
<tr>
<th>FT</th>
<th>NO.</th>
<th>SAMPLE DEPTH (FT.)</th>
<th>REC. (IN.)</th>
<th>SOIL &amp; ROCK CLASSIFICATION-DESCRIPTION</th>
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<tbody>
<tr>
<td>35</td>
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</table>

Probe Refusal @ 43.8" on Probable Intact Bedrock

**REMARKS:** Steel Track Drill Rig, Sodi Stem Auger, Automatic Hammer

Standard Penetration Tests (SPT) = 140# hammer falling 30" (ASTM D1586)  
Blows are per 6 inches with a 24" long by 2" O.D. by 1 3/8" I.D. split spoon sampler unless otherwise noted  
S = split-spoon sample; C = rock core sample; U = undisturbed

**REMARKS:** The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.  
Proportions used: trace (0-10%), little (10-20%), some (20-35%), and (35-50%)
REPORT OF ATTERBERG LIMITS TEST RESULTS

CLIENT:  City of Dover
          Dover, NH 03820

PROJECT: Orchard Street Parking Lot

DATE: February 21, 2010

REPORT #: 11-GEO-005-006

Sampled Source: B14-S6 (25.0-27.0 ft)

Soil ID#: 11-588-008

Soil Type: Clay (Lean)

Intended Use: GEO

Date Received: 02/11/11

Sampled By: Kyle Urso

Tested By: Kyle Urso

ATTERBERG LIMITS TEST RESULTS

Plastic Limit: 24

Liquid Limit: 45

Plasticity Index: 21

Remarks: In-Situ Moisture: 44.0%
          USCS-Lean Clay
REPORT OF ATTERBERG LIMITS TEST RESULTS

CLIENT: City of Dover
Dover, NH 03820

PROJECT: Orchard Street Parking Lot

DATE: February 21, 2010

REPORT #: 11-GEO-005-007

Sampled Source: B13-S14 (15.0-17.0 ft)
Soil Type: Clay (Heavy)

Soil ID#: 11-588-003
Intended Use: GEO

Date Received: 02/11/11
Sampled By: Kyle Urso

Tested By: Kyle Urso

ATTERBERG LIMITS TEST RESULTS

Plastic Limit: 26
Liquid Limit: 52
Plasticity Index: 26
Remarks: In-Situ Moisture: 36.3%
USCS-Fat Clay
REPORT OF ATTERBERG LIMITS TEST RESULTS

CLIENT: City of Dover
          Dover, NH 03820

PROJECT: Orchard Street Parking Lot

DATE: February 21, 2010

REPORT #: 11-GEO-005-008

Sampled Source: B6-S16 (90.0-92.0 ft)  Soil Type: Clay (Lean)

Soil ID#: 11-588-005  Intended Use: GEO

Date Received: 02/11/11  Sampled By: Kyle Urso

Tested By: Kyle Urso

ATTERBERG LIMITS TEST RESULTS

Plastic Limit: 22
Liquid Limit: 36
Plasticity Index: 14
Remarks: In-Situ Moisture: 32.2%
          USCS-Lean Clay
Particle Size Distribution Report

Test Results (ASTM D 422 & ASTM D 1140)

<table>
<thead>
<tr>
<th>Opening Size</th>
<th>Percent Finer</th>
<th>Spec. (Percent)</th>
<th>Pass? (X=Fail)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#10</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#20</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#40</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#80</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#100</td>
<td>100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#200</td>
<td>99.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0248 mm.</td>
<td>98.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0161 mm.</td>
<td>95.0</td>
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</tr>
<tr>
<td>0.0097 mm.</td>
<td>87.2</td>
<td></td>
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<tr>
<td>0.0071 mm.</td>
<td>81.4</td>
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<td></td>
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<tr>
<td>0.0052 mm.</td>
<td>75.6</td>
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</tr>
<tr>
<td>0.0027 mm.</td>
<td>63.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.0012 mm.</td>
<td>46.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Material Description

CLAY, some silt

Atterberg Limits (ASTM D 4318)

PL =
LL =
PI =

USCS (D 2487) =
Classification =
AASHTO (M 145) =

Coefficients

D_{50} = 0.0114
D_{50} = 0.0086
D_{60} = 0.0022

D_{10} =
C_{u} =
C_{c} =

Remarks

Date Received: 02-11-11
Date Tested: 02-18-11
Tested By: Nate Cutter
Checked By: Kyle Urso
Title: Staff Engineer

Location: B13 S2 (Orchard Street)
Sample Number: 11-588-002
Depth: 10.0 - 12.0 ft

JOHN TURNER
Dover, NH

Client: City of Dover
Project: City Parking Lots
Project No: 11-GEO-005
Date Sampled: 02-04-11
City of Dover
Orchard Street
Dover, NH 03820

South End of Property Looking North to Apartment Complex

South End of Property Looking Southwest to Aubuchon Hardware (~15 elevation change)

South End of Property looking South to Washington Street

South End of Property Looking at 1 of 4 Transformers located on Property

Southeast End of Property Looking East down Orchard St

Southeast End of Property Looking North
North End of Property Looking North to Cocheco River

North End of Property Looking SouthEast

East End of Property

Center of Property Looking North toward Apartment Complex

West End of Parking Lot Looking East

West end of Parking Lot Looking North toward Apartment Complex