SITE EXPLORATIONS

Subsurface conditions underlying the Gold Creek Reclamation Project area and potential borrow sources were explored by drilling 21 borings with rotary-wash drilling equipment mounted on a tracked carrier. The borings at the project area were drilled to depths ranging from approximately 46 to 130 feet below current site elevations. Borings drilled during this investigation at the location of the potential borrow sources were drilled to depths on the order of about 20 feet. The approximate locations of the borings drilled during this investigation, in addition to borings drilled by others during previous subsurface exploration, are shown with respect to existing features and the project area on Plates 2 and 3.

The site exploration program was coordinated by members of our staff who located the explorations and maintained detailed logs of the conditions encountered. The location of offshore borings completed at the project area was provided by EMPS; other borings were located approximately relative to topographic features. Logs of the explorations are presented on Plate B-1 through B-12. The borings completed at the project area are designated as SB; borings completed at potential borrow source areas are designated BB; bulk samples obtained at potential borrow sources are designated BS. The soils have been classified in accordance with the Unified Soil Classification System, which is presented on Plate B-13.

Relatively undisturbed samples of the soils were obtained at frequent intervals in the borings using a Dames & Moore Type U Sampler, which is illustrated on page B-6. A Sprague and Henwood sampler with dimensions similar to that of the Dames & Moore sampler was used also to obtain disturbed and undisturbed samples. These samplers were driven with a 300-pound hammer falling a distance of approximately 30 inches.
Standard Penetration Tests (SPT) were also accomplished in the site borings at various depths. The SPT is completed by driving a split-spoon sampler with a 140-pound hammer falling a distance of about 30 inches. The number of blows required to drive each sampler a distance of 1 foot into undisturbed soil is shown immediately adjacent to each sample notation. The correlation between the SPT blow counts and those of the Dames & Moore and Sprague and Henwood samplers is about 1:1. Samples were obtained also by pushing the sampler under the weight of the rods and the hammer. Samples obtained in this manner are noted by the letter (P) adjacent to each sample notation. In addition to the undisturbed and disturbed samples obtained using the three samplers, bulk samples were obtained at several of the borrow source locations as noted on Plate 3.

Boring elevations are approximate and have been estimated from the results of the bathymetric survey accomplished by Dames & Moore and a bathymetric survey of portions of the Gastineau Channel accomplished by the Alaska Department of Transportation and Public Facilities.

LABORATORY TESTS

Soils obtained during the site exploration program were examined in our laboratory in order to select representative samples for testing and to verify the classification recorded during the site exploration program. Laboratory tests included direct shear, triaxial, grain size, compaction, consolidation, and moisture-density tests. Turbidity and elutriate tests were performed by AM TEST, Inc. on samples obtained at the potential borrow source sites. The results of these tests are presented below in Tables B-1 and B-2.

Direct shear and triaxial tests were performed at a continuous rate of shearing deflection in the manner presented on page B-7 and B-8, respectively, in order to evaluate the shear strength of the site soils. The results of the direct shear tests are presented on Plates B-14 and B-15; the triaxial test results are shown on Plate B-16.
## TABLE B-1

<table>
<thead>
<tr>
<th>Test</th>
<th>Sample Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bulk 1</td>
</tr>
<tr>
<td><strong>Bulk sediment analysis:</strong></td>
<td></td>
</tr>
<tr>
<td>Total volatile solids (%) (%)</td>
<td>--</td>
</tr>
<tr>
<td>Chemical Oxygen Demand (%) (%)</td>
<td>--</td>
</tr>
<tr>
<td>Oil and Grease (mg/kg)</td>
<td>130.</td>
</tr>
<tr>
<td><strong>Elutriate analysis:</strong></td>
<td></td>
</tr>
<tr>
<td>(4:1) seawater to sediment ratio)</td>
<td></td>
</tr>
<tr>
<td>Lead (mg/l)</td>
<td>--</td>
</tr>
<tr>
<td>Copper (mg/l)</td>
<td>--</td>
</tr>
<tr>
<td>Zinc (mg/l)</td>
<td>--</td>
</tr>
<tr>
<td>Mercury (mg/l)</td>
<td>--</td>
</tr>
<tr>
<td>Arsenic (mg/l)</td>
<td>--</td>
</tr>
<tr>
<td>Cadmium (mg/l)</td>
<td>--</td>
</tr>
<tr>
<td>Oil sheen</td>
<td>Not</td>
</tr>
<tr>
<td>Detected</td>
<td></td>
</tr>
<tr>
<td>Sample Designation/Depth</td>
<td>Weight (g)(a) in 600 mls</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulk 1/ surface</td>
<td>23.5</td>
</tr>
<tr>
<td>Bulk 6/ surface</td>
<td>4.7</td>
</tr>
<tr>
<td>Bulk 7/ surface</td>
<td>6.1</td>
</tr>
<tr>
<td>Bulk 3/ surface</td>
<td>3.6</td>
</tr>
<tr>
<td>Bulk 4/ surface</td>
<td>4.0</td>
</tr>
<tr>
<td>BB2 #3/ 9-1/2 feet</td>
<td>6.0</td>
</tr>
<tr>
<td>BB3 #1/ 1-1/2 feet</td>
<td>4.9</td>
</tr>
<tr>
<td>BB4 #2/ 4 feet</td>
<td>13.6</td>
</tr>
<tr>
<td>BB5 #2/ 4 feet</td>
<td>4.4</td>
</tr>
<tr>
<td>BB6 #1/ 1-1/2 feet</td>
<td>4.0</td>
</tr>
<tr>
<td>BB8 #4/ 14-1/2 feet</td>
<td>6.6</td>
</tr>
<tr>
<td>BB9 #1/ 1 foot</td>
<td>6.4</td>
</tr>
<tr>
<td>BB8 #2/ 4 feet</td>
<td>6.0</td>
</tr>
<tr>
<td>BB10 #4/ 16 feet</td>
<td>5.0</td>
</tr>
<tr>
<td>Bulk 2/</td>
<td>16.0</td>
</tr>
<tr>
<td>BB3 #2/ 6 feet</td>
<td>5.5</td>
</tr>
</tbody>
</table>

(a) Seawater.
(b) Background turbidity: seawater = 0.44 NTU.
Grain size determinations were completed on samples of the soils encountered at the project area and also at the borrow sites. The results of the tests are presented graphically on Plates B-17 through B-36.

Compaction tests of borrow source soils were completed on several borrow source samples. The results of those tests are presented on Plates B-37 through B-40.

Consolidation tests were completed in order to evaluate the consolidation characteristics of the silt soils which underlie the project area. The results of those tests are presented on Plate B-41.

Moisture-density tests were completed in conjunction with each of the above tests and on other selected soil samples if the sample was undisturbed. The results of these tests are presented on the test summary sheets and on the logs of the borings adjacent to the appropriate sample notation.

The following plates are attached and complete this appendix:

Plates B-1 through B-12, Logs of Borings
Plate B-13, Unified Soil Classification System
Plates B-14 and 15, Summary of Direct Shear Test Data
Plate B-16, Summary of Triaxial Test Data
Plates B-17 through B-36, Gradation Curves
Plates B-37 through B-40, Compaction Test Data
Plate B-41, Consolidation Test Data
SOIL SAMPLER TYPE U
FOR SOILS DIFFICULT TO RETAIN IN SAMPLER

NOTE:
"HEAD EXTENSION" CAN BE INTRODUCED BETWEEN "HEAD" AND "SPLIT BARREL."

ALTERNATE ATTACHMENTS

CORE-RETAINING RINGS
(2-1/2" O.D., BY 1" LONG)

CORE-RETAINING DEVICE
RETAINER PLATES
(INTERCHANGEABLE WITH OTHER TYPES)

THIN-WALLED SAMPLING TUBE
(INTERCHANGEABLE LENGTHS)
Method Of Performing Direct Shear and Friction Tests

Direct shear tests are performed to determine the shearing strengths of soils. Friction tests are performed to determine the frictional resistances between soils and various other materials such as wood, steel, or concrete. The tests are performed in the laboratory to simulate anticipated field conditions.

Each sample is tested in a split sample holder, two and one-half inches in diameter and one inch high. Undisturbed samples of in-place soils are extruded from rings taken from the sampling device in which the samples were obtained. Loose samples of soils to be used in constructing earth fills are compacted in rings to predetermined conditions and tested.

Direct Shear Tests

A one-inch length of the sample is tested in direct single shear. A constant pressure, appropriate to the conditions of the problem for which the test is being performed, is applied normal to the ends of the sample through porous stones. A shearing failure of the sample is caused by moving the upper sample holder in a direction perpendicular to the axis of the sample. Transverse movement of the lower sample holder is prevented.

The shearing failure is accomplished by applying to the upper sample holder a constant rate of deflection. The shearing load and the deflections in both the axial and transverse directions are recorded and plotted. The shearing strength of the soils is determined from the resulting load-deflection curves.

Friction Tests

In order to determine the frictional resistance between soil and the surfaces of various materials, the lower sample holder in the direct shear test is replaced by a disk of the material to be tested. The test is then performed in the same manner as the direct shear test by forcing the soil over the friction material surface.
METHODS OF PERFORMING UNCONFINED COMPRESSION AND TRIAXIAL COMPRESSION TESTS

The shearing strengths of soils are determined from the results of unconfined compression and triaxial compression tests. In triaxial compression tests the test method and the magnitude of the confining pressure are chosen to simulate anticipated field conditions.

Unconfined compression and triaxial compression tests are performed on undisturbed or remolded samples of soil approximately six inches in length and two and one-half inches in diameter. The tests are run either strain-controlled or stress-controlled. In a strain-controlled test the sample is subjected to a constant rate of deflection and the resulting stresses are recorded. In a stress-controlled test the sample is subjected to equal increments of load with each increment being maintained until an equilibrium condition with respect to strain is achieved.

Yield, peak, or ultimate stresses are determined from the stress-strain plot for each sample and the principal stresses are evaluated. The principal stresses are plotted on a Mohr’s circle diagram to determine the shearing strength of the soil type being tested.

Unconfined compression tests can be performed only on samples with sufficient cohesion so that the soil will stand as an unsupported cylinder. These tests may be run at natural moisture content or on artificially saturated soils.

In a triaxial compression test the sample is encased in a rubber membrane, placed in a test chamber, and subjected to a confining pressure throughout the duration of the test. Normally, this confining pressure is maintained at a constant level, although for special tests it may be varied in relation to the measured stresses. Triaxial compression tests may be run on soils at field moisture content or on artificially saturated samples. The tests are performed in one of the following ways:

Unconsolidated-undrained: the confining pressure is imposed on the sample at the start of the test. No drainage is permitted and the stresses which are measured represent the sum of the intergranular stresses and pore water pressures.

Consolidated-undrained: the sample is allowed to consolidate fully under the applied confining pressure prior to the start of the test. The volume change is determined by measuring the water and/or air expelled during consolidation. No drainage is permitted during the test and the stresses which are measured are the same as for the unconsolidated-undrained test.

Drained: the intergranular stresses in a sample may be measured by performing a drained, or slow, test. In this test the sample is fully saturated and consolidated prior to the start of the test. During the test, drainage is permitted and the test is performed at a slow enough rate to prevent the buildup of pore water pressures. The resulting stresses which are measured represent only the intergranular stresses. These tests are usually performed on samples of generally non-cohesive soils, although the test procedure is applicable to cohesive soils if a sufficiently slow test rate is used.

An alternate means of obtaining the data resulting from the drained test is to perform an undrained test in which special equipment is used to measure the pore water pressures. The differences between the total stresses and the pore water pressures measured are the intergranular stresses.
Boring BB-6-81

Depth in Feet

Elevation +4'

ML Dark brown silt with occasional gravel and shell fragments (very soft)
Dark gray to black sandy silt with shell fragments and trace of gravel (very soft)
Dark gray silty fine to medium sand with trace of gravel (loose)
Dark gray silty fine sand with some gravel (loose)
Dark gray sandy silt with trace of gravel (medium stiff)

Boring completed 12-6-81

Boring BB-7-81

Depth in Feet

Elevation +4'

ML Brown silt (very soft)
Dark gray silty fine sand with occasional shell fragments (very loose to loose)
Grades with trace of gravel
Dark gray to black silt very fine sand with occasional shell fragments (very loose)
Dark gray to black sandy silt (soft)

Boring completed 12-6-81

Boring BB-8-81

Depth in Feet

Elevation +4'

ML Brown organic silt with organic matter and abundant shell fragments (very soft)
Brown and gray silty sandy fine to medium gravel with organic matter and abundant shell fragments (loose)
Grades with decreasing shell fragments

Boring completed 12-5-81

Boring BB-9-81

Depth in Feet

Elevation +10'

ML Dark gray to black silty fine sand with some shell fragments (very loose)
Grades to loose

Boring completed 11-21-81

LOG OF BORINGS

Job No. 6842-003-20

Dames & Moore

Plate B-1
Boring SB-2-81

DEPTf IN FEET

ELAVATION - SHA

0
25.4
4
7.5
10
12.5
15
20
25.6
30
37.1
40
50
60
70
80

Gray silt with shell fragments (very soft)
Gray silt fine to medium sand with some gravel and shell fragments (very loose)
Grades to loose to medium dense with decreasing shell fragments and increasing gravel
Dark gray to black silty very fine sand and sandy silt (loose and medium stiff)
Gray slightly silty to silty fine to coarse sand with occasional gravel (loose to medium dense)
Grades with increasing gravel
Dark gray to black silty very fine to fine sand with abundant shell fragments and a trace of gravel (loose)

DEPTf IN FEET

11
42.2
80
90
100
110

Dark gray to black silty fine to medium sand with shell fragments (loose)
Dark gray to black silty very fine sand and sandy silt with occasional shell fragments (loose and medium stiff)
Gray slightly silty to silty fine sand with shell fragments and a trace of gravel (medium dense)
Grades to loose with decreasing shell fragments and gravel
Gray silty very fine sand with occasional shell fragments (loose)

Boring completed 11-17-81

LOG OF BORINGS

Job No. 6842-003-20

Dames & Moore

Plate B-2
Boring SB-3-81

Depth in Feet

Elevation: 0

Gray silty fine to medium sand with occasional gravel and shell fragments (very loose)

Dark gray to black silty fine to coarse sand with occasional fine gravel (very loose)

Gray very fine sandy silt and silty very fine sand (soft and loose)

Gray slightly silty to silty fine to coarse sand with occasional gravel (loose)

Dark gray to black silty fine to medium sand with gravel (loose)

Gray silty fine to coarse sand with occasional gravel (medium dense)

Gray slightly silty to silty fine to medium sand with occasional gravel (medium dense)

Dark gray to black silty fine to medium sand with occasional shell fragments and trace of gravel (loose)

Grades with decreasing medium sand

Dark gray silty very fine to fine sand and sandy silt with trace of shell fragments (loose to medium stiff)

Gray silty fine to coarse sand with gravel (medium dense)

Gray sandy silt with occasional shell fragments (medium stiff)

Gray sandy silt with trace of shell fragments (medium stiff)

Boring completed 11-17-81

LOG OF BORINGS

Job No. 6842-003-20

Plate B-3
Boring SB-4-81

**Gray sandy silt with shell fragments (very soft)**

**Dark gray to black silty very fine to medium sand with some coarse sand and trace of gravel (loose to medium dense)**

**Gray silty fine to coarse sand with occasional gravel (loose to medium dense)**

**Dark gray to black silty fine sand with some coarse sand and gravel (medium dense)**

**Dark gray slightly silty to silty fine to medium sand with occasional gravel and trace of shell fragments (medium dense)**

**Dark gray to black silty fine to medium sand with some coarse sand, gravel, and shell fragments (medium dense)**

**Grades with increasing gravel content**

**Dark gray silty very fine to fine sand with occasional shell fragments and organic matter (loose)**

**Grades with occasional gravel**

**Boring completed 11-19-81**

---

Log of Borings

Dames & Moore

Job No. 6842-003-20

Plate B-4
Boring SB-5-81

Log of Borings

Job No. 6842-003-20

Dames & Moore

Plate B-5
**Boring SB-6-81**

**DEPTCH IN FEET**

**ELEVATION -51.1**

- **Gray sandy silt with shell fragments (very soft)**

- **Gray and brown silty fine to medium sand with occasional coarse sand and gravel (very loose)**
  - Grades to loose
  - Grades to medium dense

- **Grades with increasing gravel and trace of shell fragments**

- **Dark gray silty fine to medium sand with occasional coarse sand, gravel, and shell fragments (medium dense)**

- **Gray silty very fine to fine sand with shell fragments and lenses of sandy silt (medium dense)**

- **Gray silt with trace of gravel (stiff)**

- **Boring completed 11-21-01**

*Boring measured at Elevation -38 ft during site exploration; Elevation -55 based on surveyed location and results of bathymetric survey.*

**LOG OF BORINGS**

Job No. 6842-003-20
Boring SB-7-81

Brown and gray tine to coarse gravel with cobbles and boulders in a silty tine to coarse sand matrix (loose)

Grades with increasing cobbles and boulders from 15' to 27' depths

Gray silty fine to coarse sand and gravel with occasional cobbles (medium dense)

Boring completed 12-4-81
Boring SB-8-81

DEPTH IN FEET

ELEVATION +2 ft

0 10 20 30 40 50 60

0 10 20 30 40 50 60

Dark gray fine to coarse gravel in a silty fine to coarse sand matrix (medium dense)
Grades with lenses of silty fine to medium sand

Brown and gray silty fine to coarse sand with gravel (medium dense)
Grades with decreasing coarse sand

Boring completed 11-12-81

Boring SB-9-81

DEPTH IN FEET

ELEVATION +6 ft

0 10 20 30 40 50 60

0 10 20 30 40 50 60

Brown and gray silty fine to coarse sand with gravel (medium dense)
Grades with increasing gravel

Dark gray silty very fine to fine sand with some shell fragments (medium dense)
Dark gray to black slightly silty to silty fine to medium sand with some coarse sand and gravel (loose)

Boring completed 11-10-81

LOG OF BORINGS

Job No. 6842-003-20

Plate B-8
Boring SB-10-81

ELEVATION +4/1

- Brown slightly silty to silty fine to coarse sand with gravel and trace of shell fragments (medium dense)
- Grades with increasing gravel
- Dark gray to black silty very fine to fine sand (loose to medium dense)
- Brown and gray fine to coarse gravel in a silty fine to coarse sand matrix (medium dense)
- Brown and gray slightly silty to silty fine to medium sand with some coarse sand and trace of gravel (medium dense)
- Brown and gray slightly silty to silty fine to coarse sand with trace of gravel (medium dense)

Boring completed 11-9-81

Boring SB-11-81

Depth in Feet

- Brown and gray fine to coarse gravel in a silty fine to coarse sand matrix (loose)
- Gray slightly silty fine to coarse sand with some gravel (loose)
- Dark gray to black silty fine sand with some medium sand and gravel (medium dense)

Boring completed 11-8-81

LOG OF BORINGS

Job No. 6842-003-20

Plate B-9
**Boring BB-2-81**

ELEVATION +5 ft

Dark gray to black slightly silty fine to coarse sand with some gravel and shell fragments (loose)

Grades to medium dense with increasing silt and gravel content

Boring completed 11-17-81

---

**Boring BB-3-81**

ELEVATION +6 ft

Brown and gray slightly silty fine to coarse sand and gravel with organic matter and abundant shell fragments (very loose to loose)

Grades with decreasing shell fragments

Grades to medium dense

Boring completed 12-21-81

---

**Boring BB-4-81**

ELEVATION +5 ft

Black silt with organic matter, shell fragments, and occasional gravel (very soft)

Brown silty fine to coarse sand and gravel with occasional organic matter and shell fragments (loose)

Boring completed 12-20-81

---

**Boring BB-5-81**

ELEVATION +5 ft

Black sandy silt with shell fragments (very soft)

Brown silty fine to coarse sand and gravel with occasional shell fragments (loose)

Grades to medium dense with occasional cobbles

Grades with increasing sand content

Boring completed 12-20-81

---

**LOG OF BORINGS**

Job No. 6842-003-20

Dames & Moore

Plate B-10
Boring BB-6-81

DEPTH IN FEET
0
10
20
2 4 SM
8 ML
13 SM

ELEVATION +4
ML Dark brown silt with occasional gravel and shell fragments (very soft)

ELEVATION +4
Dark gray to black sandy silt with shell fragments and trace of gravel (very soft)

Dark gray silty fine to medium sand with trace of gravel (loose)

Dark gray silty fine sand with some gravel (loose)

Dark gray sandy silt with trace of gravel (medium stiff)

Boring completed 12-6-81

Boring BB-7-81

DEPTH IN FEET
0
10
20
2 SM
4 SM
5 SM
2 SM
4 ML

ELEVATION +4
ML Brown silt (very soft)

Dark gray silty fine sand with occasional shell fragments (very loose to loose)

Grades with trace of gravel

Dark gray to black silty very fine sand with occasional shell fragments (very loose)

Dark gray to black sandy silt (soft)

Boring completed 12-6-81

Boring BB-8-81

DEPTH IN FEET
0
10
20
2 GM
6 GM
3 GM
10 GM
9 GM

ELEVATION +4
ML Brown organic silt with organic matter and abundant shell fragments (very soft)

Brown and gray silty sandy fine to medium gravel with organic matter and abundant shell fragments (loose)

Grades with decreasing shell fragments

Boring completed 12-5-81

Boring BB-9-81

DEPTH IN FEET
0
10
20
2 SM
4 SM
5 SM
6 SM

ELEVATION +10

Dark gray to black silty fine sand with some shell fragments (very loose)

Grades to loose

Boring completed 11-21-81

LOG OF BORINGS

Dames & Moore

Job No. 6842-003-20

Plate B-11
**Boring BB-10-81**

- ELEVATION - (ft)
  - 0
  - 2
  - 4
  - 6
  - 8
  - 10
  - 12
  - 14
  - 16
  - 18
  - 20

- Depth in feet
  - 2
  - 4
  - 6
  - 8
  - 10
  - 12
  - 14
  - 16
  - 18
  - 20

**Description:**
- ML Dark gray to black organic silt (very soft)
- Dark gray silty fine sand with occasional shell fragments (very loose)
- Grades to loose with decreasing silt content and some medium sand

**Boring completed 11-22-81**

**Boring BB-11-81**

- ELEVATION - (ft)
  - 0
  - 2
  - 4
  - 6
  - 8
  - 10
  - 12
  - 14
  - 16
  - 18
  - 20

- Depth in feet
  - 2
  - 4
  - 6
  - 8
  - 10
  - 12
  - 14
  - 16
  - 18
  - 20

**Description:**
- ML Dark gray to black sandy silt with occasional organic matter (very soft)
- Dark gray to black silty fine sand with occasional shell fragments and organic matter (very loose)
- Dark gray silty fine to medium sand with occasional shell fragments and organic matter (very loose)
- Grades to loose

**Boring completed 11-22-81**

---

**LOG OF BORINGS**

---

**Dames & Moore**

Job No. 6842-003-20
## Unified Soil Classification System

<table>
<thead>
<tr>
<th>Major Divisions</th>
<th>Graph Symbol</th>
<th>Letter Symbol</th>
<th>Typical Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravel and Gravelly Soils</td>
<td>Clean Gravels (Little or no fines)</td>
<td>GW</td>
<td>Well-graded gravels, gravel-sand mixtures, little or no fines.</td>
</tr>
<tr>
<td>Coarse Grained Soils</td>
<td>Gravels with Fines (Appreciable amount of fines)</td>
<td>GP</td>
<td>Poorly-graded gravels, gravel-sand mixtures, little or no fines.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GM</td>
<td>Silty gravels, gravel-sand-silt mixtures.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GC</td>
<td>Clayey gravels, gravel-sand-clay mixtures.</td>
</tr>
<tr>
<td></td>
<td>Clean Sand (Little or no fines)</td>
<td>SW</td>
<td>Well-graded sands, gravelly sands, little or no fines.</td>
</tr>
<tr>
<td>Sand and Sandy Soils</td>
<td>Sands with Fines (Appreciable amount of fines)</td>
<td>SP</td>
<td>Poorly-graded sands, gravelly sands, little or no fines.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SM</td>
<td>Silty sands, sand-silt mixtures.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SC</td>
<td>Clayey sands, sand-clay mixtures.</td>
</tr>
<tr>
<td>Silts and Clays</td>
<td>Liquid Limit LESS than 50</td>
<td>ML</td>
<td>Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.</td>
</tr>
<tr>
<td>Fine Grained Soils</td>
<td></td>
<td>CL</td>
<td>Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.</td>
</tr>
<tr>
<td></td>
<td>Liquid Limit GREATER than 50</td>
<td>OL</td>
<td>Organic silt and organic silty clays of low plasticity.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MH</td>
<td>Inorganic silts, micaceous or diatomaceous fine sand or silty soils.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CH</td>
<td>Inorganic clays of high plasticity, fat clays.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OH</td>
<td>Organic clays of medium to high plasticity, organic silts.</td>
</tr>
<tr>
<td>Highly Organic Soils</td>
<td></td>
<td>PT</td>
<td>Peat, humus, swamp soils with high organic contents.</td>
</tr>
</tbody>
</table>

Note: Dual symbols are used to indicate borderline soil classifications.
<table>
<thead>
<tr>
<th>BORING</th>
<th>DEPTH</th>
<th>SOIL TYPE</th>
<th>MOISTURE CONTENT % OF DRY WEIGHT</th>
<th>DRY DENSITY LBS./CU.FT.</th>
<th>NORMAL PRESSURE LBS./SQ.FT.</th>
<th>PEAK SHEAR STRENGTH LBS./SQ.FT.</th>
<th>ULTIMATE SHEAR STRENGTH LBS./SQ.FT.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB1</td>
<td>75'</td>
<td>Silty fine to coarse sand with gravel</td>
<td>20.7</td>
<td>105</td>
<td>1500</td>
<td>1400</td>
<td>1000</td>
</tr>
<tr>
<td>SB1</td>
<td>93'</td>
<td>Slightly silty fine to coarse sand</td>
<td>11.9</td>
<td>122</td>
<td>1500</td>
<td>1340</td>
<td>940</td>
</tr>
<tr>
<td>SB1</td>
<td>108'</td>
<td>Silty fine to medium sand</td>
<td>30.3</td>
<td>93</td>
<td>3000</td>
<td>2640</td>
<td>1850</td>
</tr>
<tr>
<td>SB2</td>
<td>4'</td>
<td>Silty fine to medium sand</td>
<td>25.4</td>
<td>91</td>
<td>300</td>
<td>470</td>
<td>330</td>
</tr>
<tr>
<td>SB2</td>
<td>28'</td>
<td>Silty very fine sand and sandy silt</td>
<td>28.1</td>
<td>95</td>
<td>400</td>
<td>360</td>
<td>250</td>
</tr>
<tr>
<td>SB2</td>
<td>74'</td>
<td>Silty very fine to fine sand</td>
<td>32.1</td>
<td>88</td>
<td>2500</td>
<td>2100</td>
<td>1470</td>
</tr>
<tr>
<td>SB2</td>
<td>104'</td>
<td>Silty very fine sand</td>
<td>37.1</td>
<td>83</td>
<td>3000</td>
<td>2460</td>
<td>1720</td>
</tr>
<tr>
<td>SB3</td>
<td>34'</td>
<td>Slightly silty to silty fine to coarse sand</td>
<td>17.8</td>
<td>111</td>
<td>1500</td>
<td>1900</td>
<td>1330</td>
</tr>
</tbody>
</table>

**SUMMARY OF DIRECT SHEAR TEST DATA**
<table>
<thead>
<tr>
<th>BORING</th>
<th>DEPTH</th>
<th>SOIL TYPE</th>
<th>MOISTURE CONTENT % OF DRY WEIGHT</th>
<th>DRY DENSITY LBS./CU.FT</th>
<th>NORMAL PRESSURE LBS./SQ.FT</th>
<th>PEAK SHEAR STRENGTH LBS./SQ.FT</th>
<th>ULTIMATE SHEAR STRENGTH LBS./SQ.FT</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB3</td>
<td>76'</td>
<td>Silty fine to medium sand</td>
<td>29.9</td>
<td>92</td>
<td>3500</td>
<td>2940</td>
<td>2050</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4500</td>
<td>3900</td>
<td>2730</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5500</td>
<td>4380</td>
<td>3060</td>
</tr>
<tr>
<td>SB3</td>
<td>94'</td>
<td>Silty very fine to fine sand</td>
<td>27.5</td>
<td>97</td>
<td>4000</td>
<td>3300</td>
<td>2310</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and sandy silt</td>
<td></td>
<td></td>
<td>5000</td>
<td>3960</td>
<td>2770</td>
</tr>
<tr>
<td>SB5</td>
<td>68'</td>
<td>Silty fine to coarse sand</td>
<td>19.5</td>
<td>107</td>
<td>3000</td>
<td>2400</td>
<td>1680</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3500</td>
<td>3120</td>
<td>2180</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4000</td>
<td>3660</td>
<td>2560</td>
</tr>
<tr>
<td>SB6</td>
<td>64'</td>
<td>Silty fine to medium sand</td>
<td>17.3</td>
<td>114</td>
<td>2000</td>
<td>1740</td>
<td>1220</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3000</td>
<td>2460</td>
<td>1720</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4000</td>
<td>2820</td>
<td>1970</td>
</tr>
</tbody>
</table>

**SUMMARY OF DIRECT SHEAR TEST DATA**
<table>
<thead>
<tr>
<th>BORING</th>
<th>DEPTH</th>
<th>SOIL TYPE</th>
<th>MOISTURE CONTENT % OF DRY WEIGHT</th>
<th>DRY DENSITY LBS./CU.FT</th>
<th>CELL PRESSURE LBS./SQ.FT</th>
<th>DEVIATOR STRESS* LBS./SQ.FT</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB-1-81</td>
<td>25½'</td>
<td>SILTY FINE TO COARSE SAND</td>
<td>16.5</td>
<td>-</td>
<td>1000</td>
<td>1630**</td>
</tr>
<tr>
<td>SB-6-81</td>
<td>50½'</td>
<td>SILTY FINE TO COARSE SAND</td>
<td>12.4</td>
<td>-</td>
<td>2000</td>
<td>1400**</td>
</tr>
<tr>
<td>SB-6-81</td>
<td>58'</td>
<td>SILTY FINE TO COARSE SAND</td>
<td>18.1</td>
<td>-</td>
<td>3000</td>
<td>10900**</td>
</tr>
</tbody>
</table>

**NOTE:**
Dry density not evaluated due to method of testing.

*STRESS AT YIELD POINT
**SAMPLE REMOLDED

**SUMMARY OF TRIAXIAL TEST DATA**
Job No. 6842-003-20

U.S. STANDARD SIEVE SIZE

PERCENT FINER BY WEIGHT

GRAIN SIZE IN MILLIMETERS

COBBLES | GRAVEL | SAND | SILT OR CLAY
|        |        |      |              |
| COARSE | FINE   | COARSE | MEDIUM | FINE |

BORING | DEPTH | DESCRIPTION
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SB-2-81</td>
<td>21'</td>
<td>Silty fine to medium sand with occasional gravel</td>
</tr>
<tr>
<td>SB-2-81</td>
<td>79'</td>
<td>Silty very fine to fine sand with a trace of coarse sand and gravel</td>
</tr>
</tbody>
</table>

GRADATION CURVE
US. STANDARD SIEVE SIZE

SB-3-81 at 67'

SB-3-81 at 53'

PERCENT FINER BY WEIGHT

GRAIN SIZE IN MILLIMETERS

COBBLES | GRAVEL | SAND | SILT OR CLAY
| COARSE | FINE | COARSE | MEDIUM | FINE |

BORING | DEPTH | DESCRIPTION
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SB-3-81</td>
<td>53'</td>
<td>Silty fine to coarse sand with occasional gravel</td>
</tr>
<tr>
<td>SB-3-81</td>
<td>67'</td>
<td>Silty fine to coarse sand with occasional gravel</td>
</tr>
</tbody>
</table>

GRADATION CURVE
US. STANDARD SIEVE SIZE

<table>
<thead>
<tr>
<th>BORING</th>
<th>DEPTH</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB-4-81</td>
<td>5'</td>
<td>Silty very fine to medium sand with gravel</td>
</tr>
<tr>
<td>SB-4-81</td>
<td>67'</td>
<td>Silty fine to coarse sand with some gravel</td>
</tr>
<tr>
<td>SB-4-81</td>
<td>115'</td>
<td>Silty very fine to fine sand</td>
</tr>
</tbody>
</table>

GRADATION CURVE
US STANDARD SIEVE SIZE

PERCENT FINER BY WEIGHT

GRAIN SIZE IN MILLIMETERS

<table>
<thead>
<tr>
<th>COBBLES</th>
<th>GRAVEL</th>
<th>SAND</th>
<th>SILT OR CLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>COARSE</td>
<td>FINE</td>
<td>COARSE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BORING</th>
<th>DEPTH</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB-5-81</td>
<td>23'</td>
<td>Slightly silty fine to coarse sand with gravel</td>
</tr>
<tr>
<td>SB-5-81</td>
<td>86'</td>
<td>Silty fine to coarse sand with some gravel</td>
</tr>
<tr>
<td>SB-5-81</td>
<td>98'</td>
<td>Silty sand with a trace of gravel</td>
</tr>
</tbody>
</table>

GRADATION CURVE
### US Standard Sieve Size

#### Gradation Curve

<table>
<thead>
<tr>
<th>Cobble Size</th>
<th>Percent Finer by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 in</td>
<td>100</td>
</tr>
<tr>
<td>1.5 in</td>
<td>80</td>
</tr>
<tr>
<td>3/4 in</td>
<td>60</td>
</tr>
<tr>
<td>3/8 in</td>
<td>40</td>
</tr>
<tr>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>40</td>
<td>5</td>
</tr>
<tr>
<td>60</td>
<td>2</td>
</tr>
<tr>
<td>100</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Gran Size in Millimeters

- **COBBLES**
- **GRAVEL**
  - Coarse
  - Fine
- **SAND**
  - Coarse
  - Medium
  - Fine
- **SILT OR CLAY**

<table>
<thead>
<tr>
<th>Boring</th>
<th>Depth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB-7-81</td>
<td>29'</td>
<td>Silty fine to coarse sand and gravel</td>
</tr>
<tr>
<td>SB-7-81</td>
<td>86'</td>
<td>Slightly silty fine to coarse sand and gravel</td>
</tr>
</tbody>
</table>
US STANDARD SIEVE SIZE

PERCENT FINER BY WEIGHT

GRAIN SIZE IN MILLIMETERS

COBBLES

GRAVEL

SAND

COARSE | FINE | COARSE | MEDIUM | FINE

SILT OR CLAY

BORING | DEPTH | DESCRIPTION
BB-4-81 | 2' | Silty fine to coarse sand and gravel
BB-4-81 | 9' | Slightly silty fine to coarse sand and gravel

GRADATION CURVE
US. STANDARD SIEVE SIZE

**Gradation Curve**

<table>
<thead>
<tr>
<th>BORING</th>
<th>DEPTH</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>BB-5-81</td>
<td>2'</td>
<td>Silty fine to coarse sand and gravel</td>
</tr>
<tr>
<td>BB-5-81</td>
<td>4'</td>
<td>Slightly silty fine to coarse sand and gravel</td>
</tr>
</tbody>
</table>
US STANDARD SIEVE SIZE

PERCENT FINER BY WEIGHT

GRAIN SIZE IN MILLIMETERS

COBBLES | GRAVEL | SAND | SILT OR CLAY
COARSE | FINE | COARSE | MEDIUM | FINE

BORING | DEPTH | DESCRIPTION
BB-7-81 | 5' | Silty fine sand
BB-7-81 | 10' | Silty fine sand

GRADATION CURVE
US. STANDARD SIEVE SIZE

GRAIN SIZE IN MILLIMETERS

PERCENT FINE BY WEIGHT

COBBLES | GRAVEL COARSE | SAND COARSE MEDIUM FINE | SILT OR CLAY

BORING | DEPTH | DESCRIPTION

BB-9-81 | 4' | Silty fine sand
BB-9-81 | 9' | Silty fine sand

GRADATION CURVE
**US. STANDARD SIEVE SIZE**

**GRAIN SIZE IN MILLIMETERS**

<table>
<thead>
<tr>
<th>COBBLES</th>
<th>GRAVEL</th>
<th>SAND</th>
<th>SILT OR CLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>COARSE</td>
<td>FINE</td>
<td>COARSE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BORING</th>
<th>DEPTH</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>BB-10-81</td>
<td>1'</td>
<td>Silty fine sand</td>
</tr>
<tr>
<td>BB-10-81</td>
<td>6'</td>
<td>Slightly silty fine sand with some medium sand</td>
</tr>
<tr>
<td>BB-10-81</td>
<td>11'</td>
<td>Silty fine sand with some medium sand</td>
</tr>
</tbody>
</table>

**GRADATION CURVE**
US. STANDARD SIEVE SIZE

PERCENT FINER BY WEIGHT

GRAN SIZE IN MILLIMETERS

COBBLES | GRAVEL | SAND | SILT OR CLAY
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>COARSE</td>
<td>FINE</td>
<td>COARSE</td>
<td>MEDIUM</td>
</tr>
</tbody>
</table>

BOARING | DEPTH | DESCRIPTION
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BB-11-81</td>
<td>1'</td>
<td>Silty fine sand</td>
</tr>
<tr>
<td>BB-11-81</td>
<td>6'</td>
<td>Silty fine to medium sand</td>
</tr>
<tr>
<td>BB-11-81</td>
<td>11'</td>
<td>Silty fine sand with medium sand</td>
</tr>
</tbody>
</table>

GRADATION CURVE
SAMPLE NO. Bulk 1  DEPTH 0-1'  ELEVATION  
SOIL  Slightly silty fine to medium sand  
LOCATION  
OPTIMUM MOISTURE CONTENT  
MAXIMUM DRY DENSITY  
METHOD OF COMPACTION  

COMPACATION TEST DATA
SAMPLE NO. Bulk 1  DEPTH  1'-2'  ELEVATION
SOIL  Fine to coarse sand and gravel
LOCATION
OPTIMUM MOISTURE CONTENT
MAXIMUM DRY DENSITY
METHOD OF COMPACTION

MOISTURE CONTENT IN % OF DRY WEIGHT

0  5  10  15  20  25

DRY DENSITY IN LBS./CU. FT.

90  100  110  120  130  140  150

ZERO AIR VOIDS CURVE

COMPACtion TEST DATA

Job No. 6642-003-20  Plate B-38
SAMPLE NO. Bulk 3  DEPTH 1-2'  ELEVATION
SOIL  Silty fine to coarse sand and gravel
LOCATION
OPTIMUM MOISTURE CONTENT
MAXIMUM DRY DENSITY
METHOD OF COMPACTION

COMPACATION TEST DATA

Job No. 6842-003-20
Plate B-39
SAMPLE NO. Bulk 4 DEPTH 1' ELEVATION
SOIL Silty fine sand
LOCATION
OPTIMUM MOISTURE CONTENT
MAXIMUM DRY DENSITY
METHOD OF COMPACTION

MOISTURE CONTENT IN % OF DRY WEIGHT

DRY DENSITY IN LBS./CU. FT.

ZERO AIR VOIDS CURVE

COMPACATION TEST DATA
CONSOLIDATION TEST DATA

<table>
<thead>
<tr>
<th>BORING DEPTH</th>
<th>SOIL TYPE</th>
<th>MOISTURE CONTENT BEFORE</th>
<th>AFTER</th>
<th>DRY DENSITY IN LBS./CU. FT.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SB-2-81</td>
<td>Silty very fine sand &amp; sandy silt</td>
<td>42.2%</td>
<td>36.7%</td>
<td>80</td>
</tr>
<tr>
<td>SB-3-81</td>
<td>Sandy silt</td>
<td>57.0%</td>
<td>42.2%</td>
<td>64</td>
</tr>
<tr>
<td>SB-6-81</td>
<td>Sandy silt</td>
<td>43.3%</td>
<td>40.0%</td>
<td>77</td>
</tr>
</tbody>
</table>

Disturbed
SB-3-81
SB-6-81
SB-2-81