# GEOTECHNICAL STUDY

# JORDAN CREDIT UNION

# RIVERTON, UTAH

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Job No. 97E-248

Prepared for:

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July 25, 1997

**Geotechnical Study**
**Jordan Credit Union**
**Riverton, Utah**
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## 1.0 INTRODUCTION

We understand that a commercial building is planned for a 0.9 acre parcel of land located north of 12600 South Street at approximately 2522 West in Riverton, Utah as shown on the Vicinity Map, Figure 1, and the Site Plan and Locations of Test Holes, Figure 2.

This study was made to assist in evaluating the subsurface conditions and engineering characteristics of the foundation soils and in developing our opinions and recommendations concerning appropriate foundation types, floor slabs and pavements for the planned facility. This report presents the results of our geotechnical investigations including field exploration, laboratory testing, engineering analysis, pavement design and our opinions and recommendations. Data from the study is summarized in Figures 3 through 8, and on Table I.

## 2.0 CONCLUSIONS

(1) Our test holes drilled at this site revealed that the soil profile generally consists of 6 inches of topsoil underlain by a medium stiff layer of clay followed by a loose, elastic silt followed by clay and gravel layers which extended to the maximum depth of investigation of 16.5 feet below surface. Groundwater was not encountered in the test holes during our investigation.

(2) The native silt encountered at 4.5 feet are weak and should not directly support the structural loads of the proposed structure. Therefore, we recommend that spread footings be found on a minimum 24 inches of properly placed structural fill over native soils for an allowable bearing capacity of 1500 psf. Detailed footing recommendations are found in the report.

(4) Pavements should consist of 2.5 inches of asphalt over 6 inches of road base and 6 inches of subbase.

(5) Proper drainage control is important to the performance of the structure at this site.

## 3.0 PROPOSED CONSTRUCTION

We understand that the proposed structure will be a one story block wall building with concrete slab on grade floors. We anticipate the floors to be at or above the existing ground elevation. Structural loads are anticipated to be on the order of 3 to 5 kips per lineal foot of wall or no more than 75 kips per column. Exterior concrete flatwork and parking lots are also planned. For the pavement design, we estimated approximately 250 cars and 2 heavy trucks per day. If building or traffic loads are different than those assumed, then we should be notified to reevaluate our recommendations.

## 4.0 SITE CONDITIONS

The property is located on the north side of 12600 South Street at approximately 2522 West in Riverton, Utah. The topography appears to be level with a slight downward slope to the north at less than 1 percent. The surface of the site was vegetated with native weeds and grasses. The property is bordered on the south by 12600 South Street, on the west and east by residences, and on the north by open fields. Existing foundations in the area appear to be performing well from a soils standpoint.

## 5.0 FIELD INVESTIGATION

The field investigation consisted of the drilling of 3 test holes to a maximum depth of 16.5 feet in the building and pavement areas. TH-3 was drilled in the pavement area to a depth of 6.5 feet below surface. The locations of the test holes are shown schematically in Figure 2. The soils encountered at the site were continuously logged by an engineer from our office. Both disturbed and undisturbed samples were obtained and returned to our laboratory for testing. Graphical representations of the soils encountered are shown on Figures 3 through 5, Drill Hole Logs. A key to the symbols on the logs is shown on Figure 6.

## 6.0 LABORATORY TESTING

Samples obtained from the test holes were sealed and returned to our laboratory where each one was inspected to confirm field classifications in accordance with the Unified Soil Classification System and to select representative samples for laboratory testing.

Laboratory tests included natural moisture, natural density, Atterberg limits, consolidation/swell tests, and mechanical sieve analysis. Results of these tests are shown on Figures 3 through 8 and on Table I, attached.

Samples will be retained in our laboratory for 30 days following the date of this report at which time they will be disposed of unless a written request for additional holding time is received prior to the disposal date.

## 7.0 SUBSURFACE CONDITIONS

Our test holes drilled at this site revealed a soil profile of 6 inches of topsoil underlain by a medium stiff layer of clay followed by a loose, elastic layer of silt followed by alternating layers of clay and gravel which extended beyond the maximum depth of investigation of 16.5 feet below surface. Ground water was not encountered in the test holes during our investigation.

## 8.0 SITE GRADING

Topsoil, man-made fill, or soils loosened by construction activities should be completely removed from the building pad areas prior to foundation excavations. Following foundation excavations, the subgrade should be proof rolled to a firm, non-yielding surface. Soft spots identified during proof rolling should be excavated and replaced with structural fill.

Structural fill should consist of imported sands and gravel with a maximum particle size of 2 inches and less than 20 to 30 percent fines (materials passing the No. 200 sieve). The liquid limit of the fines should not exceed 35 and the plasticity index should be below 15. Structural fill should be placed in maximum 10-inch loose lifts at a moisture content within 2 percent of optimum and

compacted to at least 95 percent of maximum density (ASTM D 1557) under the building and 90 percent under exterior concrete flatwork.

Utility trenches may be backfilled with the native soils if placed in lift thicknesses appropriate for the compaction equipment used (122 inches maximum) and compacted to at least 90 percent of modified proctor (ASTM D1557).

## 9.0 SEISMIC CONSIDERATIONS

Based on published data, no active faults are known to traverse the site and no faulting was indicated by our test holes drilled for this project. The nearest known fault trace is associated with the Wasatch which is located several miles to the east.of the subject property.

Liquefaction is a phenomenon where soils lose their intergranular strength due to the increase of pore pressures during a dynamic event such as an earthquake. For liquefaction to cause significant damage, three factors must be present: (1) The soils must be uniformly graded sands or silts; (2) the sands or silts must be in a relatively loose condition; and (3) the soils must be saturated. Based on our subsurface investigation, the subsurface soils encountered in the area are not susceptible to liquefaction. However, the limited depth of our investigation does not allow a thorough analysis of the liquefaction potential at this site.

No special seismic considerations are recommended other than the proposed structure should be designed in accordance with the "Zone 3" requirements of the Uniform Building Code. We recommend a seismic zone factor of 0.3 and a site coefficient of 1.5.

## 10.0 FOUNDATIONS

If the footings for the proposed structure are located at a depth sufficient for frost protection, the zone of signficant stress will include the weak silt layer found at 4.5 feet. It is our opinion that the silt should be removed from beneath the footings and replaced with structural fill. It is apparent that this will require excavations of up to 8 feet. Because of the depth of the recommended excavation, we suggest that consideration be given to a basement for the building. For the purposes of this report and particularly the foundation recommendations, we have assumed that a basement is not to be constructed since it is not presently contemplated. The following recommendations should be followed during design and construction of this project:

(1) Spread footings founded on properly compacted structural fill completely replacing the silt layer should be designed for a maximum soil pressure of 1500 psf. A one-third increase is allowed for short term transient loads such as wind and seismic events. Footings should be uniformly loaded.

(2) Structural fill should extend ½ the footing width beyond the edge of the footing.

(3) Continuous footings and spot footings should have minimum widths of 24 and 30 inches, respectively.

(4) Exterior footings should be placed below frost depth which is about 30 inches in this area.

(5) The bottom of interior footings should extend at least 18 inches below the lowest adjacent final grade.

(6) Foundation walls on continuous footings should be well reinforced both top and bottom. We suggest a minimum amount of steel equivalent to that required for a simply supported span of 12 feet.

If footings are designed and constructed in accordance with the recommendations presented above the risk of total movement exceeding 1 inch and differential movement exceeding 0.5 inch for a 25-foot span will be low.

## 11.0 FLOOR SLABS

A 4-inch layer of free-draining gravel should be placed immediately below the floor slabs to help distribute floor loads and aid in the concrete curing process. To help control normal shrinkage and stress cracking the floor slabs should have the following features:

(1) Adequate reinforcement for the anticipated floor loads with the reinforcement continuous through interior floor joints;

(2) Frequent crack control joints; and

(3) Non-rigid attachment of the slabs to foundation and bearing walls

## 12.0 SURFACE DRAINAGE

Wetting of the foundation soils will cause some degree of volume change within the soil and should be prevented both during and after construction. We recommend that the following precautions be taken at this site:

(1) The ground surface should be graded to drain away from the structure in all directions. We recommend a minimum fall of 8 inches in the first 10 feet. Entrances to the building should have a minimum slope of 4 percent. Pavements should also be well drained and carefully monitored during construction to avoid low spots where ponding may occur.

(2) Roof runoff should be collected in the rain gutters with downspouts designed to discharge well outside the backfill limits.

(3) Sprinkler heads, if planned, should be aimed away and kept at least 12 inches from foundation walls.

(4) Other precautions which may become evident during design and construction should be taken.

## 13.0 PAVEMENT DESIGN

We understand that a flexible pavement is desired for the parking lot for this project. We have prepared a pavement design section based on the traffic loads previously discussed. We recommend a pavement section consisting of 2.5 inches of asphaltic concrete over 6 inches of aggregate base over 6 inches of granular fill. The design recommendations were based on AASHTO design methods and the following assumptions: Following stripping, the subgrade should be compacted to a firm, unyielding surface. This design assumes that the asphalt is compacted to 95 percent of ASTM D1559 and the road base to 95 percent of ASTM D1557.

## 14.0 GENERAL CONDITIONS

The exploratory data presented in this report were collected to provide geotechnical design recommendations for this project. Variations from the conditions portrayed in the test holes often occur which are sometimes sufficient to require modifications in the design. Thus it is important that we observe subsurface materials exposed after stripping and in the excavations to take advantage of the opportunity to identify unusual soil conditions which could influence the performance of the facilities being planned. An experienced geotechnical engineer or technician from our office should observe site preparation activities and conduct testing as required to confirm the use of proper procedures. Further, we recommend that plans and specifications be reviewed by our office to determine if the recommendations presented in this report were understood and properly implemented.

The geotechnical study as presented in this report was conducted within the limits prescribed by our client, with the usual thoroughness and competence of the engineering profession in the area. No other warranty or representation, either expressed or implied, is intended in our proposals, contracts or reports.

We appreciate the opportunity of providing our services on this project. If we can answer questions or be of further service, please call.

Respectfully;
EARTHTEC ENGINEERING, P.C.

Jason D. Crosby
Staff Engineer

Reviewed by:

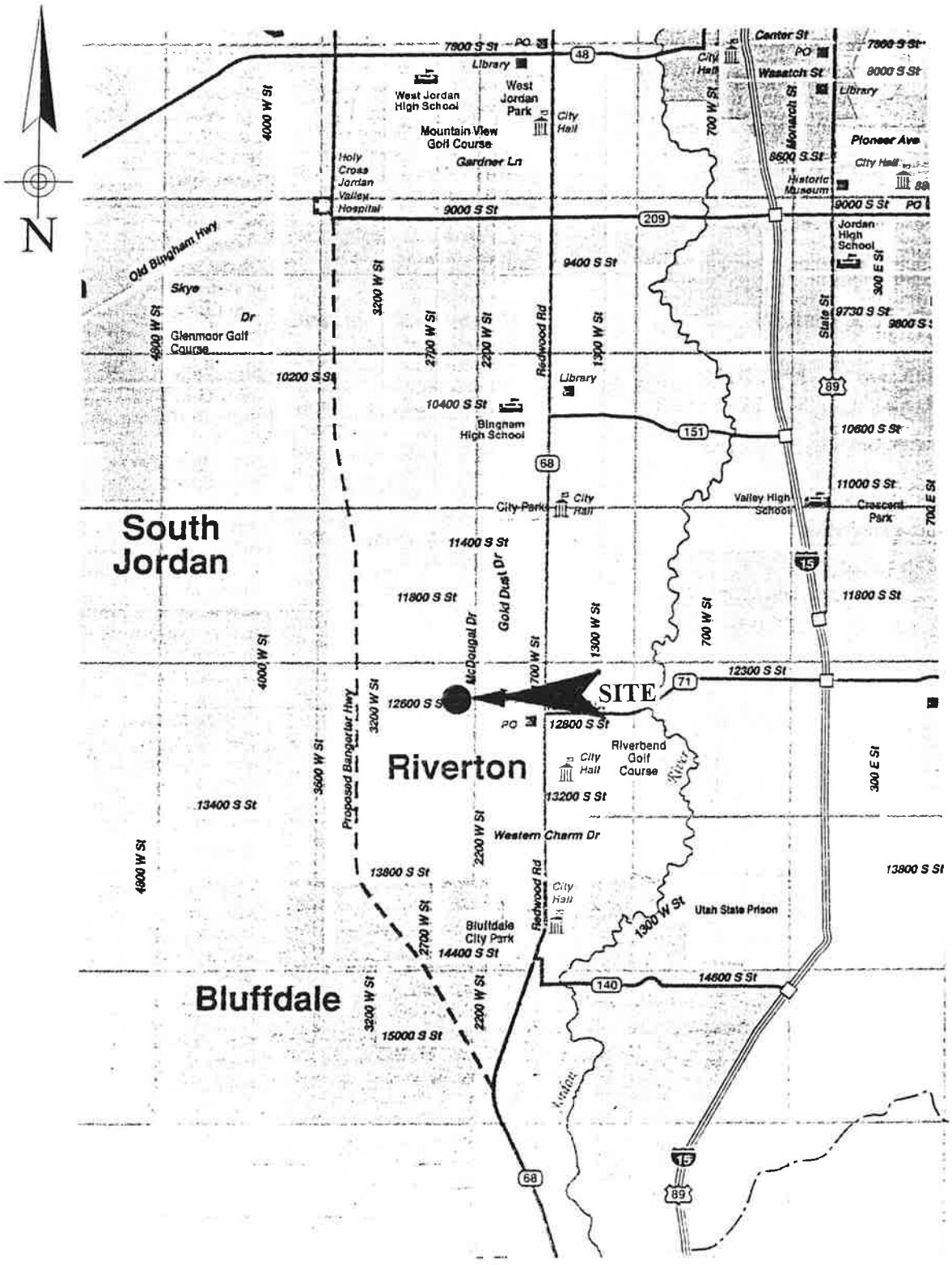
Steven L. Smith, P.E.
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
No. 171322
STEVEN L SMITH
STATE OF UTAH

JDC/jdc

3 Copies Sent

**VICINITY MAP** *EARTHTEC ENGINEERING, P.C.*




Job No. 97E-248

Figure No. 1

## SITE PLAN AND LOCATIONS OF TEST HOLES

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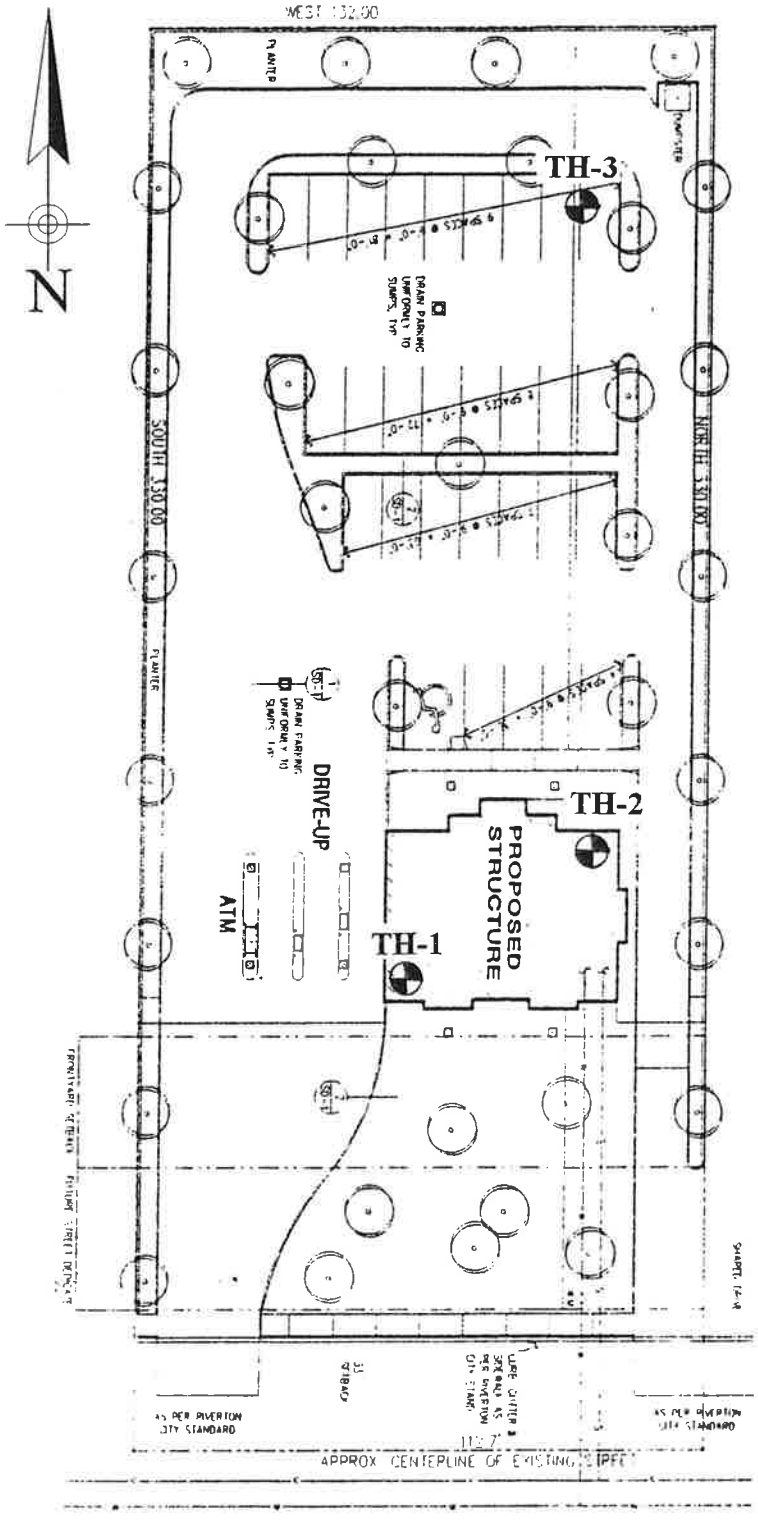



Job No. 97E-248

Figure No. 2

# DRILL HOLE LOG

BORING NO.: TH-1

**PROJECT:** Jordan Credit Union, Riverton, Ut.
**PROJECT NO.:** 97E-248
**CLIENT:** Scholz and Associates
**DATE:** 7-15-97
**LOCATION:** 85'N. 65'W. of SE Corner of Prop.
**ELEVATION:**
**DRILLER:** Bedke Drilling
**LOGGED BY:** DJ
**DRILL RIG:** CME 75
**DEPTH TO WATER > INITIAL** ▽ : **AT COMPLETION** ▽ :

| Depth (Ft.) | Graphic Log | USCS | Description | Samples | Blows/ Foot | TEST RESULTS: Plastic Limit ⊢ Liquid Limit; Water Content - ●; Penetration - ▨ (10 20 30 40 50) | Dry Dens. pcf | Water Cont. % | Other Tests |
|---|---|---|---|---|---|---|---|---|---|
| | | OL | TOPSOIL: Organic, silty, brown. | | | | | | |
| | | CL | CLAY: Little silt, medium stiff, moist, brown. | | | | | | |
| 3 | | | | | | | | | |
| | | MH | SILT: Elastic, soft, moist, greyish-light brown. | | 3 | | | | |
| 6 | | | | | | | | | |
| | | GP-GM | GRAVEL: Sandy, silty, medium dense, moist, brown. | | 14 | | | | |
| 9 | | | | | | | | | |
| | | CL | CLAY: Little silt, medium stiff, moist, brown. | | 21 | | | | |
| 12 | | GP-GM | GRAVEL: Sandy, little silt, moist, medium dense to dense, rust-brown. | | | | | | |
| 15 | | | | | 46 | | | | |
| 18 | | | | | | | | | |

Notes: Test hole ends at 16.5 feet below surface.
No groundwater found.

**Tests Key:**
A = Atterberg Limits
C = Consolidation
G = Gradation
DS = Direct Shear
SO = Solubility
UC = Unconf. Compress. Strength

PROJECT NO. 97E-248 | EARTHTEC ENGINEERING, P.C. | FIGURE NO.: 3

# DRILL HOLE LOG

BORING NO.: TH-2

**PROJECT:** Jordan Credit Union, Riverton, Ut.
**CLIENT:** Scholz and Associates
**LOCATION:** 115' N. 25' W. of SE Prop. Corner
**DRILLER:** Bedke Drilling
**DRILL RIG:** CME 75
**DEPTH TO WATER > INITIAL** ▽ : **AT COMPLETION** ▼ :

**PROJECT NO.:** 97E-248
**DATE:** 7-15-97
**ELEVATION:**
**LOGGED BY:** DJ

| Depth (Ft.) | Graphic Log | USCS | Description | Samples | Blows/ Foot | TEST RESULTS: Plastic Limit — Liquid Limit; Water Content -; Penetration - (10 20 30 40 50) | Dry Dens. pcf | Water Cont. % | Other Tests |
|---|---|---|---|---|---|---|---|---|---|
| | | OL | TOPSOIL: Organic, silty, brown. | | | | | | |
| | | CL | CLAY: Little silt, medium stiff, moist, brown. | | | | | | |
| 3 | | | | | | | 103.4 | 21 | C |
| | | MH | SILT: Elastic, soft, moist, greyish-light brown. | | | | 65.8 | 52.2 | C |
| 6 | | | | | | | | | |
| 9 | | GP-GM | GRAVEL: Sandy, silty, medium dense, moist, brown. | | 11 | | | | Gravel = 0% Sand = 8% Fines = 92% |
| 12 | | CL | CLAY: Little silt, medium stiff, moist, brown. | | 4 | | | | |
| 15 | | GP-GM | GRAVEL: Sandy, little silt, moist, medium dense to dense, rust-brown. | | 45 | | | | |
| 18 | | | | | | | | | |

**Notes:** Test hole ends at 16.5 feet below surface.
No groundwater found.

**Tests Key:**
A = Atterberg Limits
C = Consolidation
G = Gradation
DS = Direct Shear
SO = Solubility
UC = Unconf. Compress. Strength

PROJECT NO. 97E-248 | EARTHTEC ENGINEERING, P.C. | FIGURE NO.: 4

# DRILL HOLE LOG

BORING NO.: TH-3

**PROJECT:** Jordan Credit Union, Riverton, Ut.
**CLIENT:** Scholz and Associates
**LOCATION:** 50'S. 40' W. of NE Corner of Property
**DRILLER:** Bedke Drilling
**DRILL RIG:** CME 75
**DEPTH TO WATER > INITIAL** ▽ : **AT COMPLETION** ▼ :

**PROJECT NO.:** 97E-248
**DATE:** 7-15-97
**ELEVATION:**
**LOGGED BY:** DJ

| Depth (Ft.) | Graphic Log | USCS | Description | Samples | Blows/ Foot | TEST RESULTS: Plastic Limit ⊢ Liquid Limit; Water Content - ●; Penetration - ▨; 10 20 30 40 50 | Dry Dens. pcf | Water Cont. % | Other Tests |
|---|---|---|---|---|---|---|---|---|---|
| | | OL | TOPSOIL: Organic, silty, brown. | | | | | | |
| | | CL-ML | CLAY-SILT: Medium dense, moist, brown to dark brown. | | 10 | | | | |
| 3 | | CL | CLAY: Little silt, medium stiff to soft, moist, brown. | | 6 | | | | |
| 6 | | MH | SILT: Elastic, soft, moist, greyish-light brown. | | 2 | | | | |
| 9 | | | | | | | | | |
| 12 | | | | | | | | | |
| 15 | | | | | | | | | |
| 18 | | | | | | | | | |

**Notes:** Test hole ends at 6.5 feet below surface.
No groundwater found.

**Tests Key:**
A = Atterberg Limits
C = Consolidation
G = Gradation
DS = Direct Shear
SO = Solubility
UC = Unconf. Compress. Strength

| PROJECT NO. 97E-248 | EARTHTEC ENGINEERING, P.C. | FIGURE NO.: 5 |
|---|---|---|

# KEY TO SYMBOLS

Symbol Description

Strata symbols

 Topsoil

 Low plasticity clay

 Elastic silt

 Poorly graded gravel with silt

 Silty low plasticity clay

Misc. Symbols

 Water table during drilling

 Water table at boring completion

Soil Samplers

 Undisturbed thin wall Shelby tube

 Standard penetration test

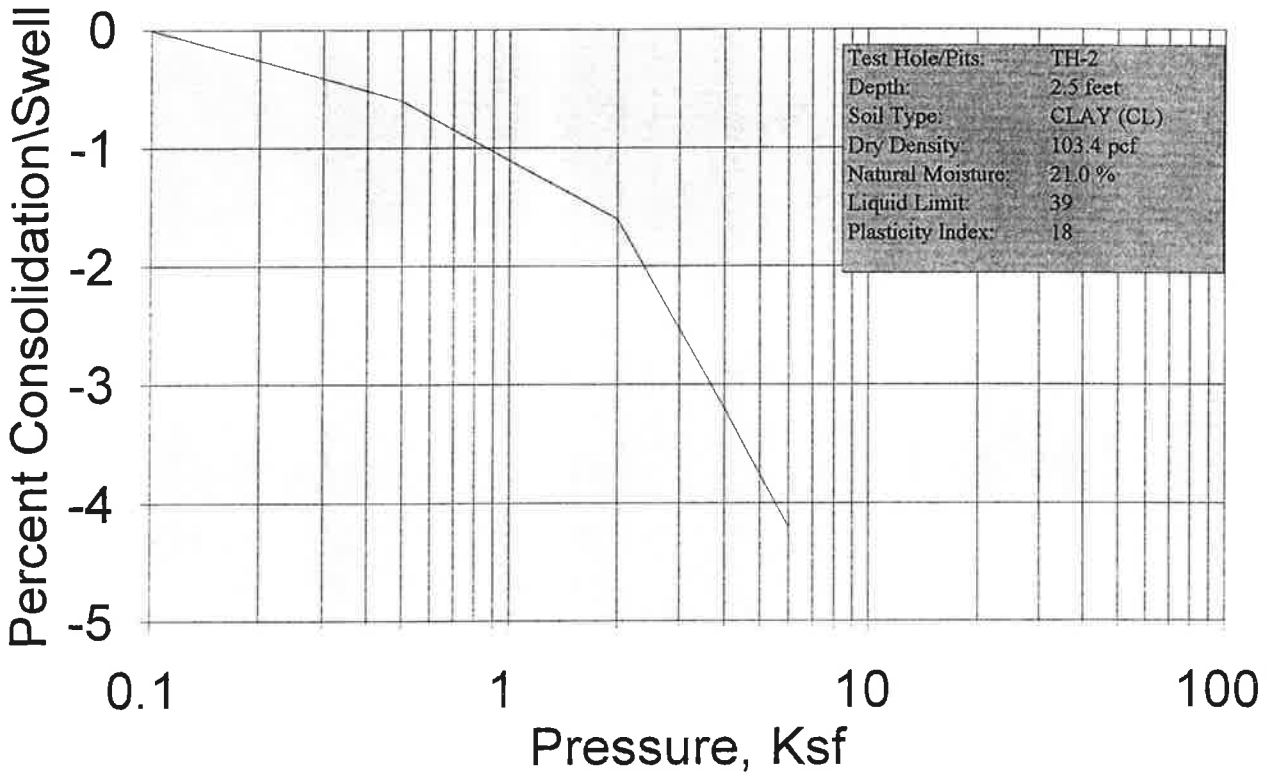
Notes:

1. These logs are subject to the limitations, conclusions, and recommendations in this report.

2. Results of tests conducted on samples recovered are reported on the logs.

**FIGURE NO.: 6**

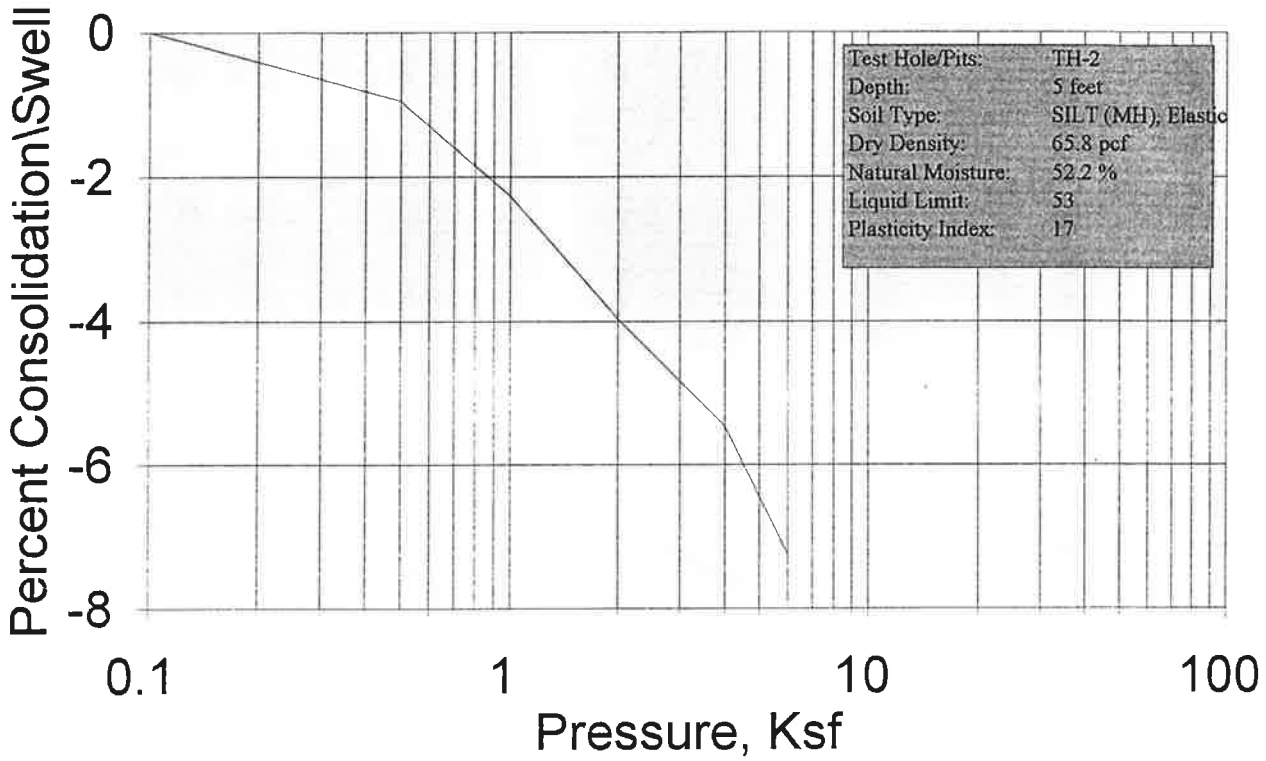
# Swell - Consolidation Test




Job No. 97E-248

Figure No. 7

# Swell - Consolidation Test




Job No. 97E-248

Figure No. 8

## TABLE 1

## Summary of Laboratory Test Data

| TEST HOLE NO. | DEPTH (ft.) | NATURAL MOISTURE (%) | NATURAL DRY DENSITY (PCF) | GRAIN SIZE DISTRIBUTION (%) | | | ATTERBERG LIMITS | | SOIL TYPE |
|---|---|---|---|---|---|---|---|---|---|
| | | | | GRAVEL #4 | SAND | SILT/CLAY #200 | LIQUID LIMIT | PLASTIC INDEX | |
| TH-2 | 2.5 | 21.0 | 103.4 | | | | 39 | 18 | CL |
| TH-2 | 5.0 | 52.2 | 65.8 | | | | 53 | 17 | MH |
| TH-2 | 7.5 | | | 0 | 8 | 92 | 32 | 16 | CL |
| TH-2 | 10.0 | | | | | | 25 | 8 | CL |
| TH-3 | 2.5 | | | | | | 28 | 13 | CL |