Applied Geotechnical Engineering Consultants, Inc.

GEOTECHNICAL INVESTIGATION

PROPOSED SUBDIVISION (Kenadi Cove Phase 1)

12026 SOUTH REDWOOD ROAD

RIVERTON, UTAH

PREPARED FOR:

TOUCAN PROPERTIES
701 SOUTH 900 EAST, SUITE 300
MIDVALE, UTAH 84047

ATTENTION: GARY CANNON

PROJECT NO. 1030266

MAY 5, 2003

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EXECUTIVE SUMMARY

1. Subsurface materials encountered at the site consist of approximately ½ foot of topsoil overlying lean clay with occasional sand and silt layers. The clay extends the full depth investigated, approximately 13 feet below the ground surface.

2. No subsurface water was encountered in the test pits at the time of excavating. No subsurface water was encountered in the pipe installed in Test Pits TP-1 and TP-2 when checked 10 days after excavating.

3. The proposed residences may be supported on spread footings bearing on the undisturbed natural soil or on compacted structural fill extending down to the undisturbed natural soil. Spread footings bearing on the undisturbed natural soil or on compacted structural fill may be designed using an allowable net bearing pressure of 1,500 pounds per square foot. Footings bearing on at least 2 feet of compacted structural fill may be designed for a net allowable bearing pressure of 2,500 pounds per square foot.

4. The upper soil consists of clay. The clay may result in construction difficulties which may become worse when the upper soil is very moist to wet, such as in the winter and spring or at times of prolonged rainfall. Placement of 1 to 2 feet of granular fill above the clay will provide limited access for construction equipment when the subgrade is very moist to wet.

5. Geotechnical information related to foundations, subgrade preparation, pavement design and materials is included in the report.

SCOPE

This report presents the results of a geotechnical investigation for the proposed subdivision to be located at approximately 12026 South Redwood Road in Riverton, Utah. The report presents the subsurface conditions encountered, laboratory test results and recommendations for foundations and pavement. The study was conducted in general accordance with our proposal dated April 17, 2003.

Field exploration was conducted to obtain information on the subsurface conditions. Samples obtained from the field investigation were tested in the laboratory to determine physical and engineering characteristics of the on-site soil. Information obtained from the field and laboratory was used to define conditions at the site for our engineering analysis and to develop recommendations for the proposed foundations and pavement.

This report has been prepared to summarize the data obtained during the study and to present our conclusions and recommendations based on the proposed construction and the subsurface conditions encountered. Design parameters and a discussion of geotechnical engineering considerations related to construction are included in the report.

SITE CONDITIONS

The site is located on the west side of Redwood Road and includes an existing house with an address of 12026 South and the surrounding property and field to the west of the house. The house is a single-story, wood frame structure with a basement and brick exterior. There is a storage shed of wood construction to the west of the house. The majority of the site consists of a vacant field to the west of the house.

The site is relatively flat with a gentle slope down to the east. The field is vegetated with grass and weeds. The area surrounding the house is landscaped with sod and shrubs. There are some large trees in the area around the house.

The surrounding area includes residential development to the north, south and west of the property and commercial development on the east side of Redwood Road. Redwood Road borders the east edge of the site. Residential structures in the area appear to be one to two-story, wood frame structures with basements. The commercial buildings are single-story, slab-on-grade structures.

FIELD STUDY

The field study was conducted on April 22, 2003. Three test pits were excavated at the approximate locations indicated on Figure 1. The test pits were excavated with a rubber-tired backhoe. The test pits were logged and soil samples obtained by an engineer from AGEC. Logs of the subsurface conditions encountered in the test pits are graphically shown on Figure 2.

The test pits were backfilled without significant compaction. The backfill in the test pits should be properly compacted where it will support buildings, floor slabs or pavement.

SUBSURFACE CONDITIONS

Subsurface materials encountered at the site consist of approximately 6 inches of topsoil overlying lean clay with occasional sand and silt layers. The clay extends the full depth investigated, approximately 13 feet below the ground surface.

A description of the various soils encountered in the test pits follows:

Topsoil - The topsoil consists of lean clay which is slightly moist, brown in color and contains roots and organics.

Lean Clay - The clay contains occasional silty sand layers increasing with depth. The clay is stiff to very stiff, very moist and brown to grayish brown with iron oxide staining.

Laboratory tests conducted on samples of the clay indicate it has natural moisture contents ranging from 23 to 31 percent and natural dry densities ranging from 92 to 105 pounds per cubic foot (pcf).

A sample of the clay tested in the laboratory was found to have an unconfined compressive strength of 3,830 pounds per square foot (psf).

Consolidation tests conducted on samples of the clay indicate that the soil will compress a small to moderate amount with the addition of light to moderate loads. Results of the consolidation tests are presented on Figure 3.

Silty Sand - The sand is medium dense, moist to very moist and brown with iron oxide staining.

Results of the laboratory tests are summarized on Table I and are included on the logs of test pits.

SUBSURFACE WATER

No subsurface water was encountered in the test pits at the time of excavation to the maximum depth investigated, approximately 13 feet below the ground surface. Slotted PVC pipe was installed in Test Pits TP-1 and TP-2 to facilitate future measurement of the subsurface water level. No subsurface water was encountered in the PVC pipe when checked 10 days after excavating.

Fluctuations in the subsurface water level may occur over time. An evaluation of such fluctuations is beyond the scope of this report.

PROPOSED CONSTRUCTION

We understand that the property encompasses an approximately 2½ acres which will be subdivided for approximately 7 to 8 residential lots. We anticipate that houses will be one to three-story, wood frame structures with basements. We have assumed building loads consisting of wall loads up to 3 kips per lineal foot and column loads up to 20 kips.

Roads are planned to extend through the subdivision. We have assumed a traffic of 1,000 cars per day, 1 delivery truck per day and 2 garbage trucks per week.

If building loads or traffic is significantly different from what is described above, we should be notified so that we can re-evaluate the recommendations given.

RECOMMENDATIONS

Based on the subsurface conditions encountered, laboratory test results, and the proposed construction, the following recommendations are given:

A. Site Grading

Final site grading plans were not available at the time of our investigation. We anticipate that there will be less than 3 feet of grade change.

1. Subgrade Preparation

Prior to placing grading fill or base course, the topsoil, organic material, existing fill and other deleterious material should be removed.

Access difficulties can be expected when the upper soil is very moist to wet or if excavations extend down to the very moist to wet soil at depth. Increased difficulties can be expected during the winter or spring or after periods of rainfall. Care should be taken not to disturb the natural soil in proposed building and pavement areas. Placement of 1 to 2 feet of granular fill may be needed for limited access of moderately loaded rubber-tired equipment above very moist to wet clay.

2. Excavation

We anticipate that excavation at the site can be accomplished with typical excavation equipment.

3. Materials

Listed below are materials recommended for imported structural fill.

Fill to Support	Recommendation
Footings	Non-expansive granular soil Passing the No. 200 Sieve <35% Liquid Limit < 30% Maximum size 4 inches
Floor Slabs (Upper 4 inches)	Sand and/or Gravel Passing the No. 200 Sieve < 5% Maximum size 2 inches
Slab Support	Non-expansive granular soil Passing the No. 200 Sieve < 50% Liquid Limit < 30% Maximum size 6 inches

The natural soil consists of clay with some silt and sand layers. These soils are not considered suitable for use as fill below proposed buildings but may be considered for use as fill in proposed pavement areas, as utility trench backfill and site grading fill outside of building areas, if the organics, debris and other deleterious materials are removed or they may be used in landscaping areas. The moisture content of the soil is above optimum and may require drying prior to use as fill. Drying of the soil may not be practical during cold or wet times of the year.

4. Compaction

Compaction of materials placed at the site should equal or exceed the minimum densities as indicated below when compared to the maximum dry density as determined by ASTM D-1557.

Fill to Support	Compaction
Foundations	≥ 95%
Concrete Flatwork and Pavement	≥ 90%
Landscaping	≥ 85%
Retaining Wall Backfill	85 to 90%

To facilitate the compaction process, the fill should be compacted at a moisture content within 2 percent of the optimum moisture content.

The base course should be compacted to at least 95 percent of the maximum dry density as determined by ASTM D-1557.

Fill and pavement materials placed for the project should be frequently tested for compaction.

5. Drainage

The ground surface surrounding the proposed buildings should be sloped away from the buildings in all directions. Roof down spouts and drains should discharge beyond the limits of backfill.

The collection and diversion of drainage away from the pavement surface is important to the satisfactory performance of the pavement section. Proper drainage should be provided.

B. Foundations

1. Bearing Material

With the proposed construction and the subsurface conditions encountered, the residences may be supported on spread footings bearing on the undisturbed natural soil, or on compacted structural fill extending down to the

undisturbed natural soil. Structural fill placed below footings should extend out away from the footings at least a distance equal to the depth of fill beneath footings.

Topsoil, unsuitable fill and other deleterious material should be removed from below proposed building areas.

2. Bearing Pressure

Footings bearing on the undisturbed natural soil may be designed for a net allowable bearing pressure of 1,500 psf. Footings bearing on at least 2 feet of compacted structural fill may be designed for a net allowable bearing pressure of 2,500 psf. Footings should have a minimum width of 18 inches and a minimum depth of embedment of 10 inches.

3. Temporary Loading Conditions

The allowable bearing pressure may be increased by one-half for temporary loading conditions such as wind or seismic loads.

4. Settlement

We estimate that total and differential settlement will be on the order of 1 and ¾ inch, respectively, for footings designed as indicated above.

5. Frost Depth

Exterior footings and footings beneath unheated areas should be placed at least 30 inches below grade for frost protection.

6. Foundation Base

The base of footing excavations should be cleared of loose or deleterious material prior to structural fill or concrete placement.

The subgrade should not be scarified prior to structural fill placement.

7. Construction Observation

A representative of the geotechnical engineer should observe footing excavations prior to structural fill or concrete placement.

C. Concrete Slab-on-Grade

1. Slab Support

Concrete slabs may be supported on the undisturbed natural soil or on compacted structural fill extending down to the undisturbed natural soil.

Topsoil, existing fill, organics and other deleterious materials should be removed from below proposed floor slabs.

2. Underslab Sand and/or Gravel

A 4-inch layer of free draining sand and/or gravel (less than 5 percent passing the No. 200 sieve) should be placed below the concrete slabs.

D. Lateral Earth Pressures

1. Lateral Resistance for Footings

Lateral resistance for spread footings placed on the natural soil or on compacted structural fill is controlled by sliding resistance between the footing and the foundation soils. A friction value of 0.3 may be used in design for ultimate lateral resistance.

2. Subgrade Walls and Retaining Structures

The following equivalent fluid weights are given for design of subgrade walls and retaining structures. The active condition is where the wall moves away

from the soil. The passive condition is where the wall moves into the soil and the at-rest condition is where the wall does not move. The values listed below assume a horizontal surface adjacent the wall.

Soil Type	Active	At-Rest	Passive
Clay and Silt	50 pcf	65 pcf	250 pcf
Sand and Gravel	40 pcf	55 pcf	300 pcf

3. Seismic Conditions

Under seismic conditions, the equivalent fluid weight should be increased by 29 pcf for active and at-rest conditions and decreased by 29 pcf for the passive condition. This assumes a short period spectral response acceleration of 1.23g for a 2 percent probability of exceedance in a 50-year period (IBC 2000).

4. Safety Factors

The values recommended above for active and passive pressures assume mobilization of the soil to achieve the assumed soil strength. Conventional safety factors used for structural analysis for such items as overturning and sliding resistance should be used in design.

E. Seismicity and Liquefaction

The site is located in an area mapped as having a "very low" liquefaction potential (Salt Lake County, 1995). This represents a less than 5 percent probability that the soil may be subjected to ground shaking sufficient to cause liquefaction during a 100 year time period. Based on the subsurface conditions encountered to the depth investigated, the site conditions are consistent with a "very low" liquefaction potential. An evaluation of the liquefaction potential at the site would require drilling to a depth of at least 30 feet which is beyond the scope of this report.

Listed below is a summary of the site parameters for the 2000 International Building Code.

a.	Site Class	D
b.	Short Period Spectral Response Acceleration, S_S	1.23g
c.	One Second Period Spectral Response Acceleration, S_1	0.49g

The closest mapped active fault to the site is the Wasatch Fault located approximately 5.3 miles to the east (Salt Lake County, 1995).

F. Water Soluble Sulfates

One sample of the natural soil was tested in the laboratory for water soluble sulfate content. Results of the test indicate there is less than 0.1 percent water soluble sulfate in the sample tested. Based on the results of the test and published literature, the natural soil possesses negligible sulfate attack potential on concrete. No special cement type is required for concrete placed in contact with the natural soil. Other conditions may dictate the type of cement to be used in concrete for the project.

G. Pavement

Based on the subsoil conditions encountered, laboratory test results and the assumed traffic, the following pavement support recommendations are given:

1. Subgrade Support

   The near surface soil consists of lean clay. A California Bearing Ratio (CBR) of 3 percent was used in the analysis which assumes a clay subgrade.

2. Pavement Thickness

Based on the subsoil conditions, assumed traffic, a design life of 20 years and methods presented by the Utah Department of Transportation and the Portland Cement Association, a flexible pavement section consisting of 3 inches of asphaltic concrete overlying 8 inches of high-quality base course is calculated. Alternatively, a rigid pavement section consisting of 5 inches of Portland cement concrete placed on a prepared subgrade may be used.

Granular fill may be needed when the upper soil is very moist to wet clay subgrade as discussed in the subgrade preparation section of the report. The base course thickness could be reduced to 6 inches in areas where at least 6 inches of granular fill with a CBR of at least 20 percent is provided below the base course or in areas where no significant truck traffic is expected such as for cul-de-sacs.

3. Pavement Materials and Construction

a. Flexible Pavement (Asphaltic Concrete)

The pavement materials should meet the Utah Department of Transportation specifications for gradation and quality. Other materials may be considered for use in the pavement section. The use of other materials may result in the need for different pavement material thicknesses.

b. Rigid Pavement (Portland Cement Concrete)

The pavement thickness indicated assumes that the pavement will have aggregate interlock joints and that a concrete shoulder or curb will be provided.

The pavement materials should meet the Utah Department of Transportation Specifications. The pavement thickness indicated above assumes that the concrete will have a 28-day compressive strength of 4,000 pounds per square inch. Concrete should be air-entrained with approximately 6 percent air. Maximum allowable slump will depend on the method of placement but should not exceed 4 inches.

LIMITATIONS

This report has been prepared in accordance with generally accepted soil and foundation engineering practices in the area for the use of the client for design purposes. The conclusions and recommendations included within the report are based on the information obtained from the test pits excavated at the approximate locations indicated on the site plan and the data obtained from laboratory testing. Variations in the subsurface conditions may not become evident until additional exploration or excavation is conducted. If the subsurface conditions or groundwater level are found to be significantly different from those described above, we should be notified to re-evaluate our recommendations.

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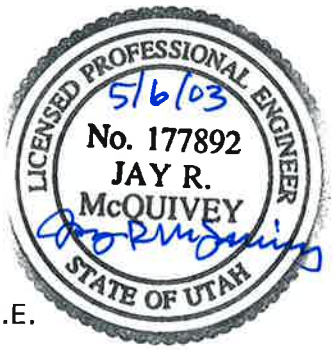


Jay R. McQuivey, P.E.

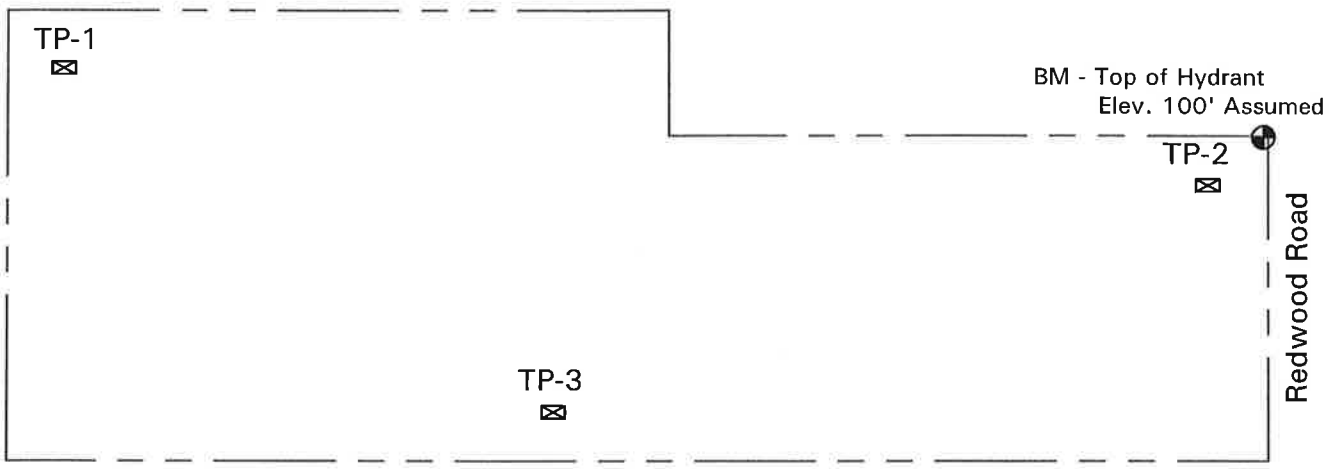
Reviewed by Douglas R. Hawkes, P.E., P.G.

JRM/dc

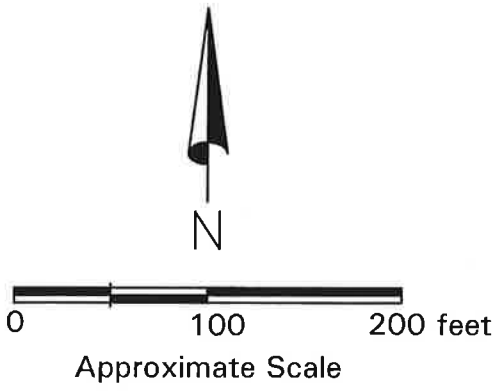
REFERENCES CITED

International Building Code, 2000; International Code Council, Inc., Falls Church, Virginia.

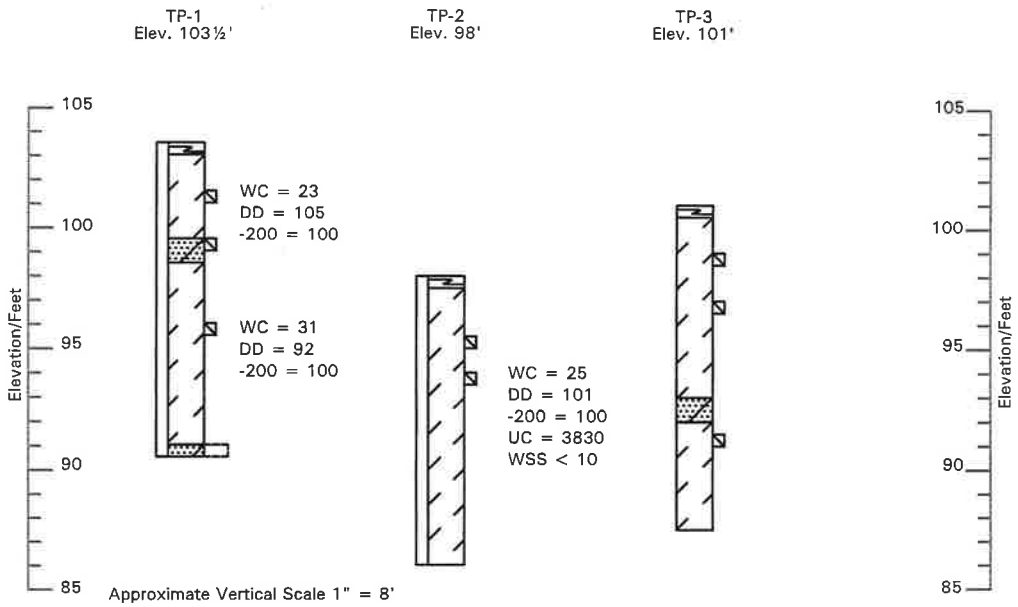
Salt Lake County, 1995; Surface Rupture and Liquefaction Potential Special Study Areas Map, Salt Lake County, Utah, adopted March 31, 1989, revised 1995, Salt Lake County Public Works - Planning Division, 2001 South State Street, Salt Lake City, Utah.



PROPOSED SUBDIVISION
12026 SOUTH REDWOOD ROAD
RIVERTON, UTAH



1030266	AGEC	Locations of Test Pits	Figure 1



LEGEND:

Topsoil; lean clay, slightly moist, brown, roots and organics.

Lean Clay (CL); occasional silty sand layers increasing with depth, stiff to very stiff, very moist, brown to grayish brown, iron oxide staining.

Silty Sand (SM); medium dense, moist to very moist, brown, iron oxide staining.

Indicates relatively undisturbed hand drive sample taken.

Indicates disturbed sample taken.

Indicates slotted 1½ inch PVC pipe installed in the test pit to the depth shown.

NOTES:

1. Test pits were excavated on April 22, 2003 with a rubber-tired backhoe.
2. Locations of test pits were measured approximately by pacing from features shown on the site plan provided.
3. Elevations of test pits were measured by hand level and refer to the bench mark shown on Figure 1.
4. The test pit locations and elevations should be considered accurate only to the degree implied by the method used.
5. The lines between the materials shown on the test pit logs represent the approximate boundaries between material types and the transitions may be gradual.
6. No subsurface water was encountered in test pits at time of excavation.
7. WC = Water Content (%);
   DD = Dry Density (pcf);
   -200 = Percent Passing No. 200 Sieve;
   UC = Unconfined Compressive Strength (psf);
   WSS = Water Soluble Sulfates (ppm).

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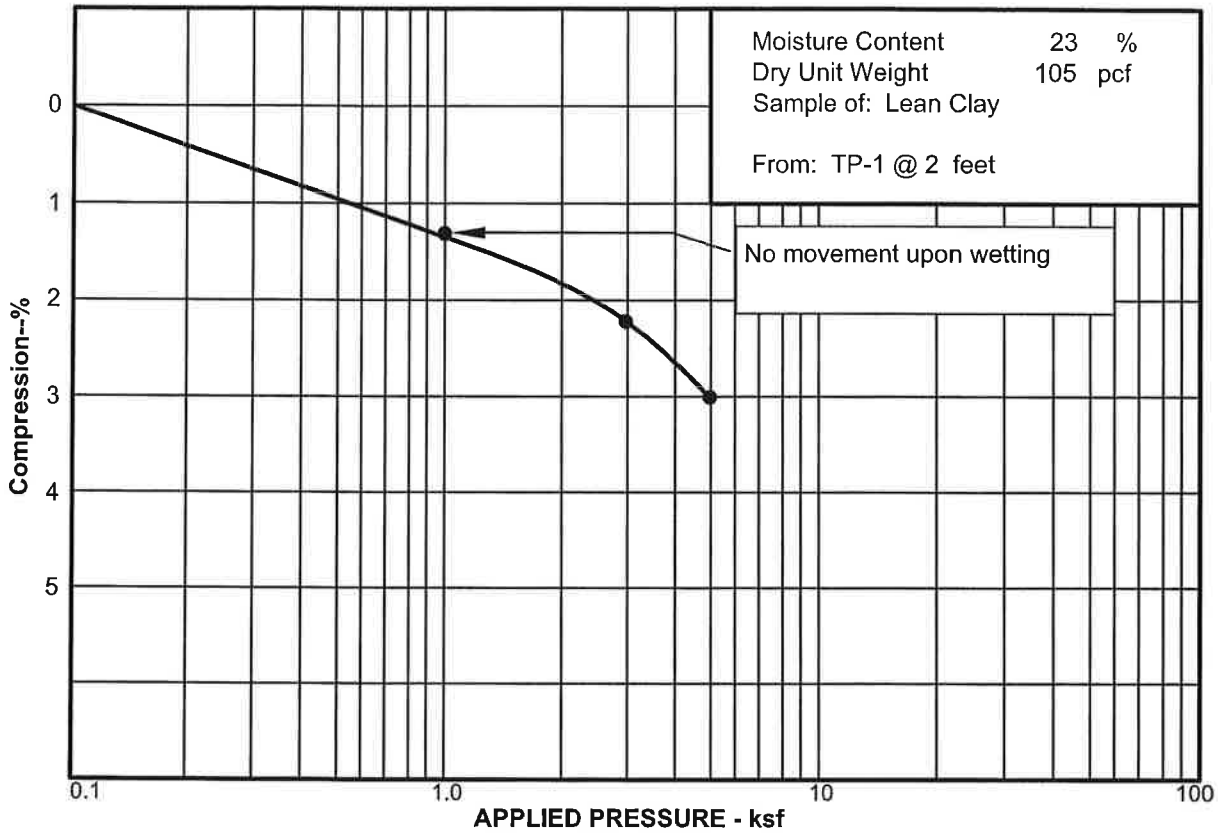

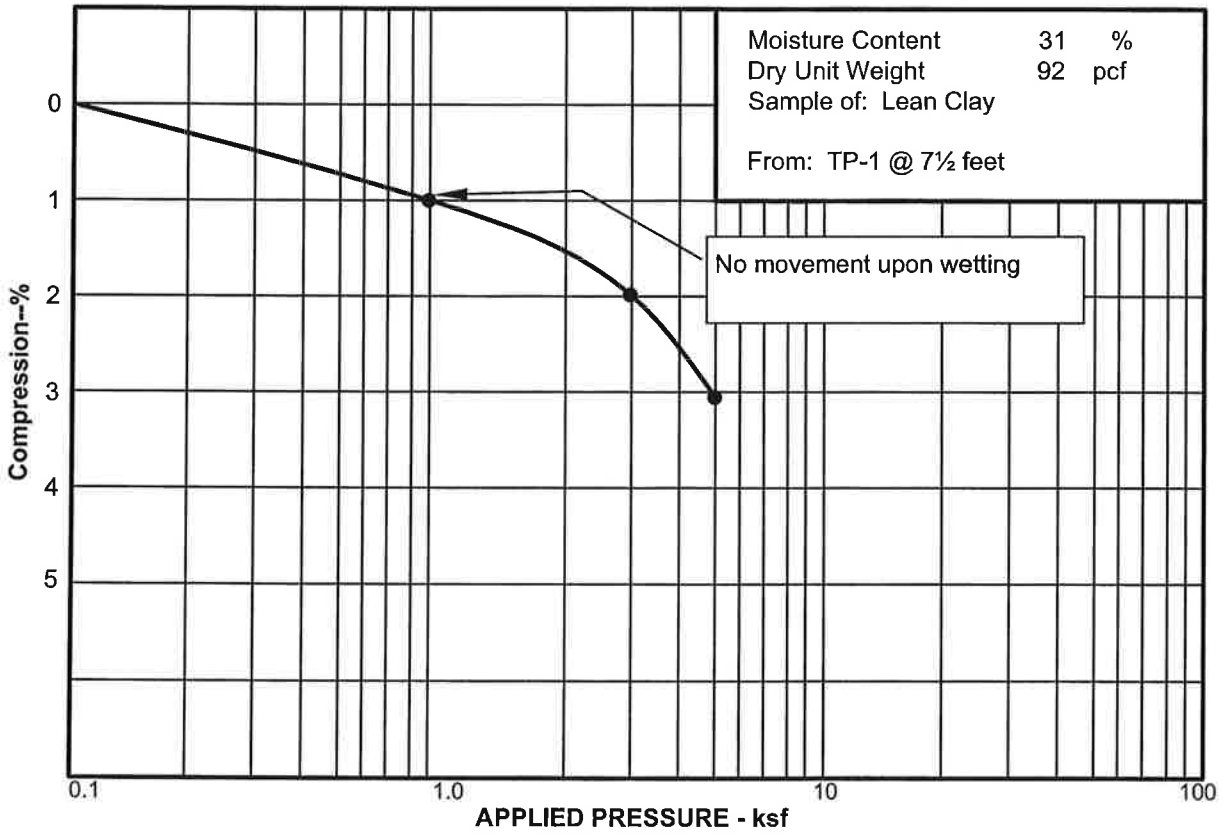

Project No. 1030266 **CONSOLIDATION TEST RESULTS** **Figure 3**

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TABLE I

SUMMARY OF LABORATORY TEST RESULTS

PROJECT NUMBER 1030266

SAMPLE LOCATION		NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (PCF)	GRADATION			ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH (PSF)	WATER SOLUBLE SULFATE (ppm)	SAMPLE CLASSIFICATION
TEST PIT	DEPTH (FEET)			GRAVEL (%)	SAND (%)	SILT/ CLAY (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)			
TP-1	2	23	105			100					Lean Clay
	7½	31	92			100					Lean Clay
TP-2	4	25	101			100			3830	<10	Lean Clay