Applied Geotechnical Engineering Consultants, P.C.

GEOTECHNICAL INVESTIGATION

SOUTH JORDAN HIGH POINT SUBDIVISION
PHASES 3 TO 7

11000 SOUTH 4000 WEST

SOUTH JORDAN, UTAH

PREPARED FOR:

H. JONES CONSTRUCTION, LC
4505 SOUTH 5400 WEST
WEST VALLEY CITY, UTAH 84120

ATTENTION: RYNN JONES

PROJECT NO. 1060501

JUNE 12, 2006

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EXECUTIVE SUMMARY

1. The subsurface soils encountered at the site consist of approximately 5, 3, 4½, 7½ and ½ foot of fill in Test Pits TP-2, TP-3, TP-5, TP-7 and TP-10, respectively. Approximately ½ foot of topsoil was encountered at the surface of the other test pits. Approximately ½ foot of topsoil was also encountered below the fill in Test Pit TP-5. The soil below the fill and topsoil consists of gravel except in Test Pits TP-2, TP-5, TP-9, TP-12, TP-13 and TP-15. Silt and sand was encountered below the fill and topsoil in these test pits. Clay, silt and sand was also encountered below the gravel in several of the test pits.

2. No subsurface water was encountered to the maximum depth investigated, approximately 11½ feet.

3. The site is suitable for the proposed construction. The buildings may be supported on spread footings bearing on the undisturbed natural soil or on compacted structural fill and may be designed for a net allowable pressure of 1,500 pounds per square foot. Footings bearing on at least 2 feet of compacted structural fill or at least 2 feet of the undisturbed natural gravel may be designed for a net allowable bearing pressure of 2,500 pounds per square foot.

4. There was a gravel pit in a portion of the property. We anticipate that most of the fill encountered at the site is from the gravel mining operation. Care should be taken to remove fill which is not properly compacted from below proposed buildings, slabs and pavement.

5. The upper soil in Test Pits TP-9, TP-12 and TP-15 consists of silt, sand and some clay. The silt and clay may result in construction equipment access difficulties when it 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 gravel will improve site access conditions when the upper soil consists of clay or silt and is very moist to wet.

6. 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 South Jordan High Point Subdivision, Phases 3 to 7 located at 11000 South 4000 West in South Jordan, 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 May 3, 2006.

A field exploration program was conducted to obtain information on the subsurface conditions and to obtain samples for laboratory testing. Information obtained from the field and laboratory was used to define conditions at the site 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 subsurface conditions encountered. Design parameters and a discussion of geotechnical engineering considerations related to construction are included in the report.

SITE CONDITIONS

At the time of our field investigation, there were no permanent structures or pavement on the site. The site consists of an undeveloped field. We understand that a portion of the site was used as a borrow source in construction of Bangerter Highway.

The ground surface at the site generally slopes gently down toward the east. The topography has been modified by the gravel mining operation and thus there is a slightly lower area of the site in the central portion of the property.

Vegetation at the site consists of grass, weeds and some alfalfa.

The site is bordered on the east by a canal which had water in it at the time of our field investigation. The north edge of the property is bordered by Rushton View Drive. There are houses to the north of the road. There are fields to the south and west of the site.

FIELD STUDY

The field study was conducted on May 18, 2006. Fifteen test pits were excavated at the approximate locations indicated on Figure 1 using 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 Figures 2 and 3 with legend and notes of Figure 4.

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

SUBSURFACE CONDITIONS

The subsurface soils encountered at the site consist of approximately 5, 3, 4½, 7½ and ½ foot of fill in Test Pits TP-2, TP-3, TP-5, TP-7 and TP-10, respectively. Approximately ½ foot of topsoil was encountered at the surface of the other test pits. Approximately ½ foot of topsoil was also encountered below the fill in Test Pit TP-5. The soil below the fill and topsoil consists of gravel except Test Pits TP-2, TP-5, TP-9, TP-12, TP-13 and TP-15. Silt and sand was encountered below the fill and topsoil in these test pits. Clay, silt and sand was also encountered below the gravel in several of the test pits.

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

Fill - The fill encountered in Test Pits TP-7 and TP-10 consists of silty to clayey gravel with sand. It is moist and brown.

The fill encountered in the other test pits consists of silty sand with some gravel. It is slightly moist to moist, brown to dark brown and contains some roots and organics.

Topsoil - The topsoil consists of silty to clayey sand and gravel. It is slightly moist, dark brown and contains roots and organics.

Lean Clay - The clay contains some silt and sand layers. It is stiff, moist to very moist and brown.

Laboratory tests performed on a sample of the clay indicate that it has a natural moisture content of 27 percent and a natural dry density of 94 pounds per cubic foot (pcf). Results of a consolidation test performed on a sample of the clay indicate that it will compress a small to moderate amount with the addition of light to moderate loads. Results of the consolidation test are presented on Figure 5.

Sandy Silt - The silt contains some silty sand layers. It is stiff, slightly moist and brown.

Laboratory tests performed on samples of the silt indicate that it has natural moisture contents of 9 to 10 percent and natural dry densities of 90 to 93 pcf.

Silty Sand - The sand is medium dense, slightly moist and brown.

Laboratory tests performed on a sample of the silty sand indicate that it has a natural moisture content of 8 percent and a natural dry density of 88 pcf.

Clayey Gravel with Sand - The gravel is dense, slightly moist and brown.

Poorly-Graded Gravel with Silt and Sand - The gravel contains occasional cobbles. It is medium dense to dense, moist and brown.

Laboratory tests performed on a sample of the gravel indicate that it has a natural moisture content of 4 percent. Results of a gradation test performed on a sample of the gravel are presented on Figure 6.

A summary of the laboratory test results is presented on Table I and included on the logs of the test pits.

SUBSURFACE WATER

No subsurface water was encountered to the maximum depth investigated, approximately 11½ feet.

PROPOSED CONSTRUCTION

We understand the property will be subdivided for residential construction. We anticipate that the houses will be one to three-story wood frame structures with a potential for basements. We have assumed maximum column loads of 20 kips and maximum wall loads of 2½ kips per lineal foot.

Roads are planned to extend through the proposed subdivision. We have assumed traffic for the roads consisting of 1,000 cars and 2 delivery trucks per day and 2 garbage trucks per week. We anticipate that traffic will be less for cul-de-sac streets.

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

RECOMMENDATIONS

Based on the subsoil conditions encountered, the 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 only minor amounts of cut and fill for site grading.

1. Excavation

   We anticipate that excavation can be accomplished with conventional excavation equipment. Some difficulty in excavation can be expected for confined excavations in areas of cobbles.

2. Subgrade Preparation

   Prior to placing grading fill or base course, the organic material, existing fill and other deleterious material should be removed. The subgrade in pavement areas should be scarified to a depth of approximately 8 inches, the moisture adjusted to within 2 percent of optimum and the subgrade compacted to at least 90 percent of the maximum dry density as determined by ASTM D-

1557. The subgrade should then be proof-rolled to identify soft areas. Soft areas should be removed and replaced with properly compacted fill.

3. Materials

Material placed as fill to support foundations should be non-expansive granular soil. The natural sand and gravel, exclusive of oversized particles, organics, debris, topsoil and other deleterious materials may be used as structural fill, utility trench backfill and as site grading fill. The clay and silt are not considered suitable for use as structural fill within the proposed building areas. The clay and silt may be used as fill in pavement areas, or as utility trench backfill, if the topsoil, organics and other deleterious material are removed, or they may be used in landscaping areas.

Listed below are the materials recommended for imported fill.

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

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 percent
Concrete Slabs and Pavement	≥ 90 percent
Landscaping	≥ 85 percent
Retaining Wall Backfill	85 - 90 percent

To facilitate the compaction process, the fill should be compacted at a moisture content within 2 percent of the optimum moisture content as determined by ASTM D-1557.

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 exterior of the residences should be sloped away from the structures in all directions. Down spouts and drains should discharge beyond the limits of all 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, residences may be supported on spread footings bearing on the undisturbed natural soil or on compacted structural fill.

The topsoil, existing fill and other deleterious materials should be removed from below foundation areas. Structural fill placed below foundations should extend down to the undisturbed natural soil and out and away from the edge of footings a distance at least equal to the depth of fill beneath footings.

2. Bearing Pressures

Spread footings bearing on the natural undisturbed soil or on compacted structural fill may be designed for a net allowable bearing pressure of 1,500 psf. Footings bearing on at least 2 feet of compacted structural fill or at least 2 feet of undisturbed natural gravel, 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 bearing pressures indicated above may be increased by one-half for temporary loading conditions such as for wind and seismic loads.

4. Settlement

We estimate that total and differential settlement will be less than 1 inch and 3/4 of an inch, respectively for footings supported on the silt or clay. Less settlement is expected for footings supported on the sand and gravel.

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 fill or concrete 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.

The topsoil, fill, organics, debris or other deleterious materials should be removed from below proposed 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 floor slabs for ease of construction and to promote even curing of the slab concrete.

D. Lateral Earth Pressures

1. Lateral Resistance for Footings

Lateral resistance for spread footings placed on the natural soils or on compacted structural fill is controlled by sliding resistance between the footing and the foundation soils. A friction value of 0.35 may be used in the design for ultimate lateral resistance between the footings and the soil.

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 assume a horizontal surface adjacent the wall.

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

3. Seismic Conditions

Under seismic conditions, the lateral earth pressure should be increased by 28 pcf for active and at rest conditions and decreased by 28 pcf for passive conditions. This assumes a short period spectral response acceleration of 1.19g for a 2 percent probability of exceedance in a 50 year period (IBC, 2003).

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, Liquefaction and Faulting

1. Seismicity

Listed below is a summary of the site parameters for the 2003 International Building Code.

a.	Site Class	D
b.	Short Period Spectral Response Acceleration, S_S	1.19g
c.	One Second Period Spectral Response Acceleration, S_1	0.43g

2. Liquefaction

The Salt Lake County liquefaction map indicates that the site is located in an area of "very low" liquefaction potential (Salt Lake County, 1995). This represents less than 5 percent probability that the soil may be subjected to seismic ground shaking great enough to result in liquefaction during a 100-year time period.

A site specific liquefaction analysis was not performed for the project, but based on the subsurface materials encountered to the depth investigated and our experience in the area, liquefaction is not considered a hazard for the proposed development.

3. Faulting

No active faults are mapped to extend through the property. The closest mapped active fault to the site is the Granger Fault located approximately 7 miles to the north. (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 soil. Based on the results of the test and published literature, the soil has a negligible sulfate attack potential on concrete. No special cement type is needed for concrete used at the site.

G. Pavement

Based on the subsoil conditions encountered, laboratory test results and the assumed traffic as indicated in the Proposed Construction section of the report, the following pavement support recommendations are given:

1. Subgrade Support

   The subgrade soils generally consist of sand and gravel. We have assumed a CBR value of 10 percent which assumes a sand subgrade. If excavation for road subgrade extends down to the clay or silt, a thicker base course section may be needed.

2. Pavement Thickness

   Based on the subsoil conditions, assumed traffic, a design life of 20 years for flexible and 30 years for rigid pavement and methods presented by the Utah Department of Transportation, a pavement section consisting of 3 inches of asphaltic concrete overlying 6 inches of base course is calculated. The base course thickness should be increased to 8 inches where clay or silt is encountered at the subgrade level.

   Alternatively, a Portland cement concrete pavement section consisting of 5 inches of Portland cement concrete may be used.

3. Pavement Materials and Construction

a. Flexible Pavement (Asphaltic Concrete)

The pavement materials should meet the specifications for the applicable jurisdiction. 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 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 specifications for the applicable jurisdiction. The pavement thickness indicated above assumes that the concrete will have a 28 day compressive strength of 4,000 psi. 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.

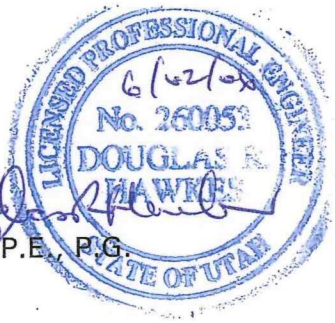
4. Jointing

Joints for concrete pavement should be laid out in a square or rectangular pattern. Joint spacings should not exceed 30 times the thickness of the slab. The joint spacings indicated should accommodate the contraction of the concrete and under these conditions steel reinforcing will not be required. The depth of joints should be approximately one-fourth of the slab thickness.

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 and the data obtained from laboratory testing. Variations in the subsurface conditions may not become evident until additional excavation is conducted. If the subsurface conditions or groundwater level is found to be significantly different from what is described above, we should be notified to reevaluate our recommendations.

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.



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

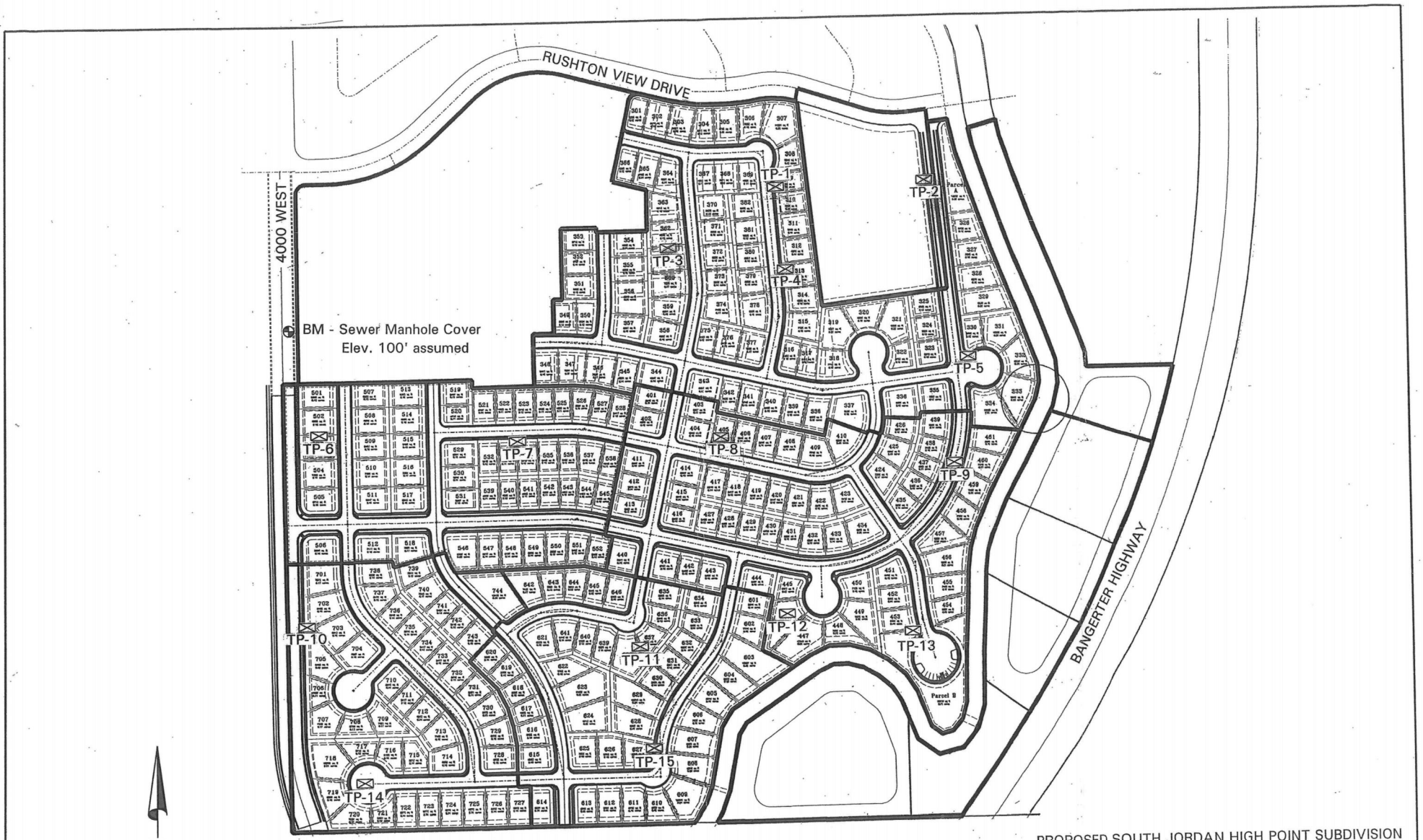
Reviewed by Jay R. McQuivey, P.E.

DRH/dc

REFERENCES CITED

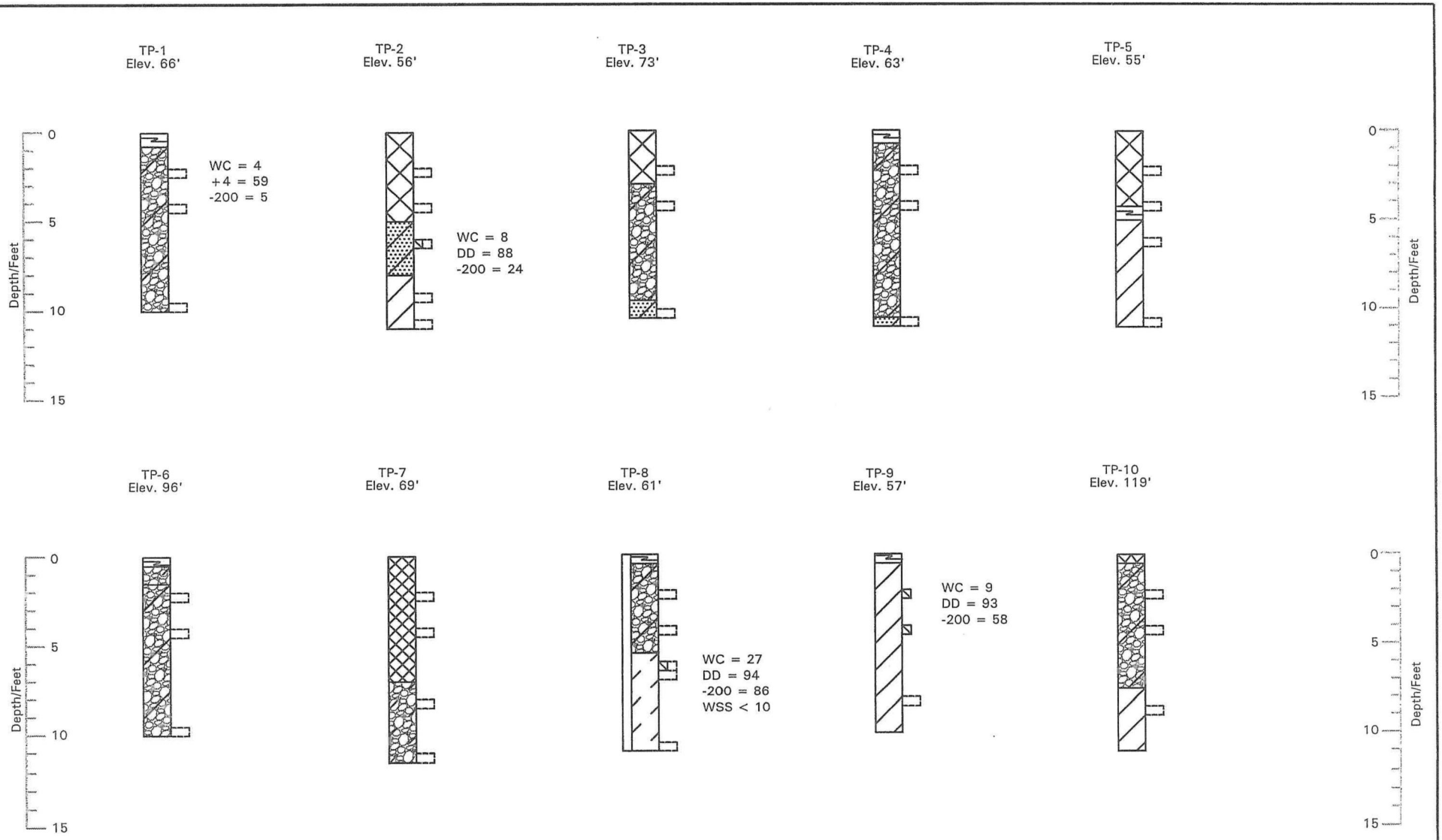
International Building Code, 2003; International Code Council, Inc. Falls Church, Virginia.

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



PROPOSED SOUTH JORDAN HIGH POINT SUBDIVISION
PHASES 3 TO 7
11000 SOUTH 4000 WEST
SOUTH JORDAN, UTAH

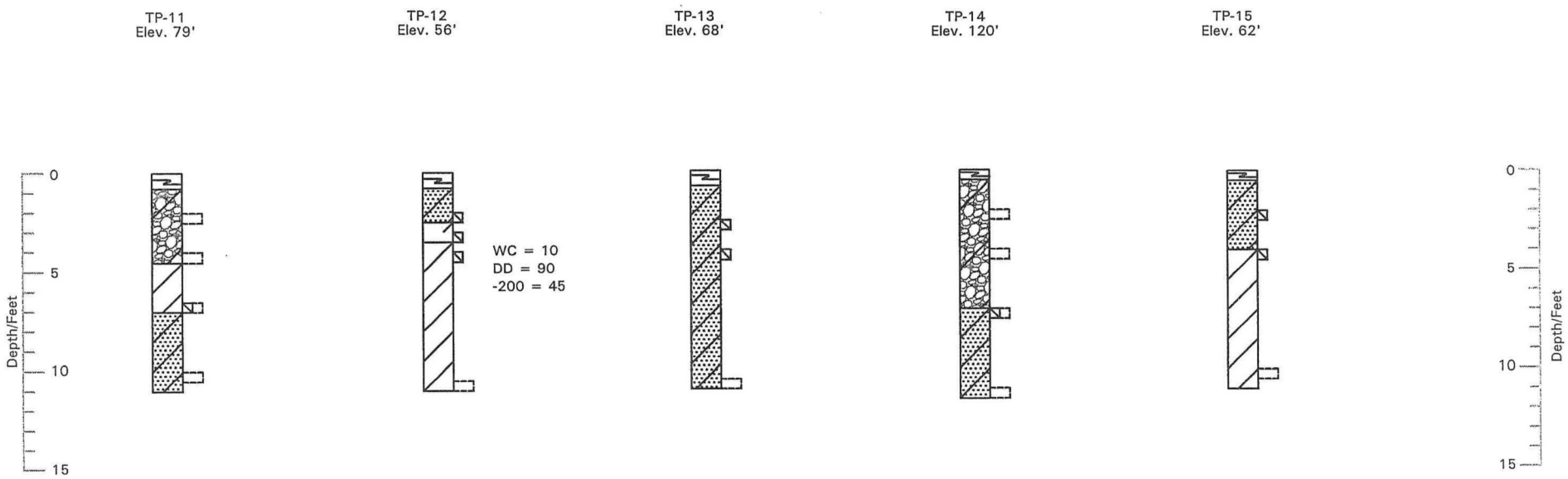
1060501	AGEC	Locations of Test Pits	Figure 1



Approximate Vertical Scale 1" = 8'

See Figure 4 for Legend and Notes

1060501	AGES	Logs of Test Pits	Figure 2



Approximate Vertical Scale 1" = 8'

See Figure 4 for Legend and Notes

1060501	AGEC	Logs of Test Pits	Figure 3

LEGEND:


Fill; silty to clayey gravel with sand, moist, brown.


Fill; silty sand, some gravel, slightly moist to moist, brown to dark brown, some roots and organics.


Topsoil; silty to clayey sand and gravel, slightly moist, dark brown, roots, organics.


Lean Clay (CL); some silt and sand layers, stiff, moist to very moist, brown.


Sandy Silt (ML); some silty sand layers, stiff, slightly moist, brown.


Silty Sand (SM); medium dense, slightly moist, brown.


Clayey Gravel with Sand (GC); dense, slightly moist, brown.


Poorly-graded Gravel with Silt and Sand (GP-GM); occasional cobbles, medium dense to dense, moist, brown.


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 May 18, 2006 with a rubber-tired backhoe.
2. Locations of test pits were determined by GPS.
3. Elevations of test pits were determined GPS and refer to the benchmark 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 free water was encountered in the test pit at the time of excavating.
7. WC = Water Content (%);
   DD = Dry Density (pcf);
   +4 = Percent Retained on the No. 4 Sieve;
   -200 = Percent Passing No. 200 Sieve;
   WSS = Water Soluble Sulfates (ppm).

1060501	AGES	Legend and Notes of Test Pits	Figure 4

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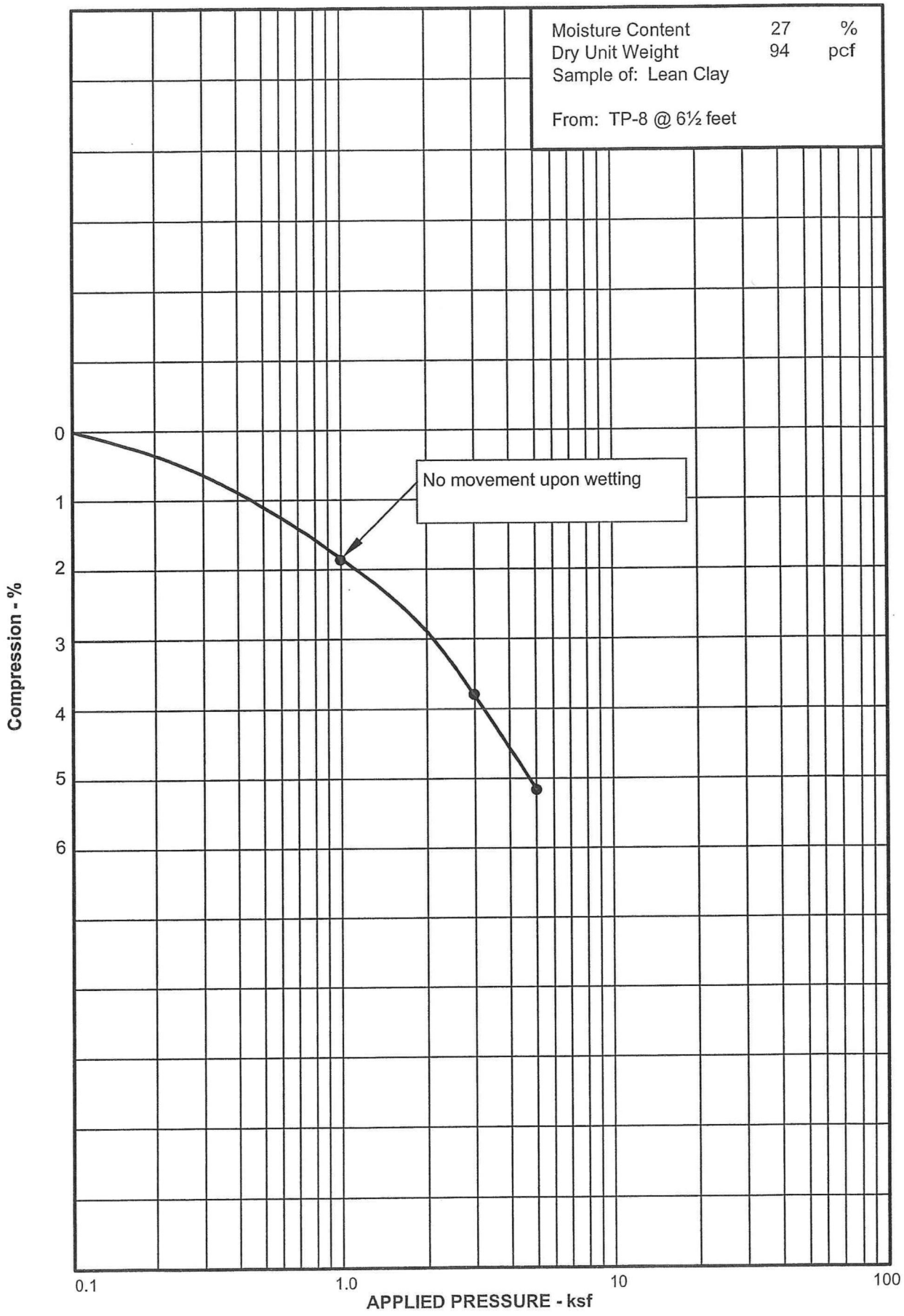
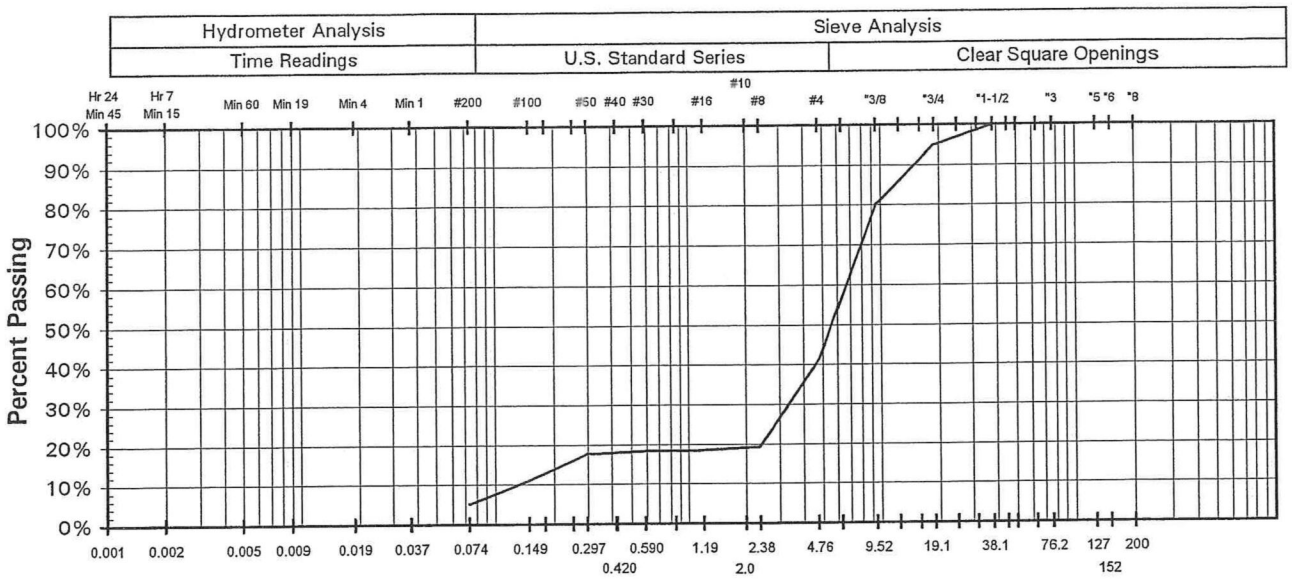


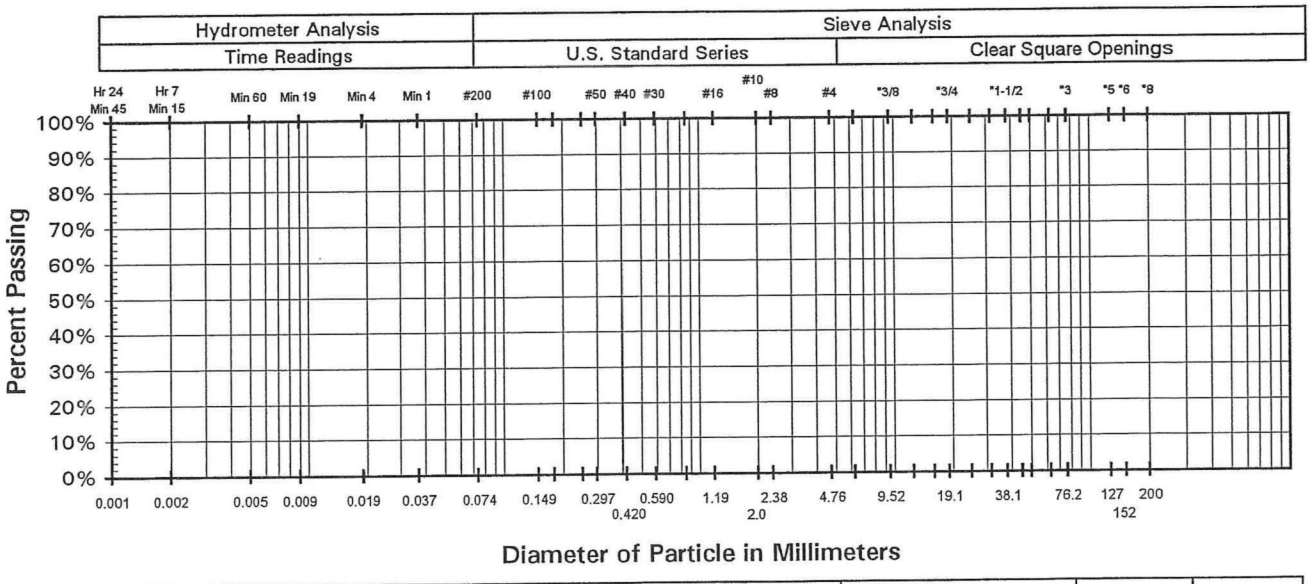
Project No. 1060501 CONSOLIDATION TEST RESULTS Figure 5

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, Inc.



Clay to Silt	Sand			Gravel		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

Gravel	59%	Liquid Limit	-
Sand	36%	Plasticity Index	-
Silt and Clay	5%	Sample Location	TP-1 @ 2 feet
Sample Description	Poory-graded Gravel with Silt and Sand		



Clay to Silt	Sand			Gravel		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

Gravel		Liquid Limit	
Sand		Plasticity Index	
Silt and Clay		Sample Location	
Sample Description			

Project No. 1060501

GRADATION TEST RESULTS

Figure 6

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TABLE I

SUMMARY OF LABORATORY TEST RESULTS

PROJECT NUMBER 1060501

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	4		59	36	5					Poorly-graded Gravel with Silt and Sand
TP-2	6	8	88			24					Silty Sand
TP-8	6	27	94			86				<10	Lean Clay
TP-9	2	9	93			58					Sandy Silt
TP-12	4	10	90			45					Silty Sand