METCO

MIDWEST ENGINEERING & TESTING CORPORATION

GEOTECHNICAL ENGINEERING SERVICES REPORT

For the
PROPOSED ELEMENTARY SCHOOL ADDITION
PERKINS-TRYON PUBLIC SCHOOLS
PERKINS, OKLAHOMA

Prepared for
LWPB ARCHITECTS & PLANNERS, P.C.
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METCO PROJECT NO: OGR-11063
MAY 2011

METCO

MIDWEST ENGINEERING & TESTING CORPORATION

May 27, 2011

LWPB Architects & Planners, P.C.
5909 Northwest Expressway, Suite 600
Oklahoma City, Oklahoma 73132
Telephone: 405-722-7270
Fax: 405-722-8373

Attn: Mr. Wayne Leatherbury, Associate

Subject: Geotechnical Engineering Services Report
Proposed Elementary School Addition
Perkins-Tryon Public Schools
Perkins, Oklahoma
METCO Project No: OGR-11063

Dear Mr. Leatherbury:

Midwest Engineering & Testing Corporation (METCO) is pleased to submit this Geotechnical Engineering Services Report for the above-referenced project. The purpose of our services was to assist the design team in designing foundation and general pavement systems and preparing plans and specifications for construction of the proposed project. Our services were completed in general accordance with the scope of work as outlined in METCO proposal number OGP-11086 dated May 1, 2011. Written authorization was provided by Mr. Wayne Leatherbury, Project Manager, of LWPB Architects & Planners, P.C., on May 2, 2011. A summary report along with our formal detailed geotechnical engineering services report is enclosed for your review. **The entire report should be read in its entirety prior to utilizing any of the presented information for design or construction purposes.**

Executive Summary

A total of 7 soil borings were drilled using truck-mounted solid-stem type drilling equipment. As per the scope of work requested by LWPB Architects & Planners, P.C., the borings were drilled within the general vicinity of the proposed building addition and parking areas. These borings were drilled to an approximate depth of 6.5 feet to 21.5 feet below the existing grade. Location and depth of the borings were selected by LWPB Architects & Planners, P.C. Locations of the proposed building addition as well as the soil borings are shown on the Boring Location Plan. Logs of the borings are presented in the Appendix.

Indications of possible fill soils were not encountered at the site in the general vicinity of our borings, but fill soils may exist to various depths at other site locations. Below approximately 3 inches of grass and topsoil, the borings generally encountered soils consisting of clay and sand to boring termination depths of approximately 6.5 feet to 21.5 feet below existing grade. Standard penetration resistances (N-values) recorded in the soils ranged from 4 to 21 blows per foot (bpf) of penetration indicating firm to very stiff consistencies and loose to medium relative densities.

Based on laboratory testing, the subsurface tested soils are susceptible to low swell potential. Groundwater was not encountered in our borings at the time of drilling and end of day. However, it is possible that transient over saturated ground conditions could develop at shallower depths at a later time due to periods of heavy precipitation, landscape watering, leaking water lines or other unforeseen causes. **It is recommended that the contractor determine the actual groundwater levels at time of construction.**

Summary of Recommendations

In general, we recommend that all structural improvement areas be stripped of surface vegetation, if any, topsoil materials, if any, play installations, if any, existing underground utilities, if any, existing fill, if any, **soft soils**, and any other deleterious materials encountered at the time of construction. In keeping with local practice, we have presented foundation and site drainage recommendations, which are intended to reduce (but not eliminate) the potential for differential movement related to the swell/collapse of the upper soils. Following the removal of all unsuitable onsite debris and vegetation and excavation to the proposed subgrade level, the construction area should be proof-rolled with a tandem axle dump truck or similar rubber tired vehicle. Soils which are observed to rut or deflect excessively under the moving load should be undercut; moisture conditioned and recompacted in place or replaced with properly compacted fill. The proof-rolling and undercutting activities should be witnessed by a representative of the geotechnical engineer and should be performed during a period of dry weather. The subgrade soils should be scarified and compacted to at least 95 percent of the standard Proctor maximum dry density ASTM D 698 for a depth of at least 8-inches below the exposed surface. Fill soils should be placed in 8-inch loose lifts and compacted to at least 95% of maximum dry density as determined by ASTM Designation D 698 at –2 to +2 percent of the optimum moisture content.

Based on the results obtained from our exploration and analysis, the proposed building can be supported on conventional shallow spread footings founded on existing soil or properly compacted and tested engineered fill. Shallow spread footings for building columns and continuous footings for bearing walls should be designed for a total allowable soil bearing pressure of 2,500 and 2,000 pounds per square foot, respectively at a minimum depth of 30 inches below final grade.

The foundation excavations should be observed and tested by METCO representatives. A field observation and testing letter report should be issued and reviewed by the architect, owner, and/or contractor.

The floor slab can be grade supported on existing non-expansive soils or on a minimum of 2.0 feet of properly compacted, non-expansive structural tested fill materials. Proof-rolling, as discussed in this report, should be accomplished to identify any soft or unstable soils, which should be removed from the floor slab area prior to new fill placement and/or floor slab construction.

It is recommended that free draining granular mat be placed beneath the floor slab to enhance drainage and provide increased subgrade strength. Polyethylene sheeting should be placed on the granular mat to act as a vapor barrier. The floor slabs should have an adequate number of joints to reduce cracking resulting from any differential movement and shrinkage. The floor slab

should not be rigidly connected to columns, walls, or foundations, if possible. **Detailed floor slab recommendations are presented in section 5.3 of this report.**

Although possible fill material was not encountered in the general vicinity of our borings, it is possible that fill material may exist to various depths at other site locations within the proposed construction area. **Typically, we do not recommend relying on fill placed without technical observation for building support. Any existing fill should be removed in its entirety and be replaced with properly compacted low plasticity structural fill**.

It is anticipated that properly compacted structural fill material will settle approximately 1 to 2 percent of the fill height. The higher the clay content, the longer it will take the fill to settle.

The scope of services did not include an environmental site assessment for determining the presence or absence of toxic or hazardous materials in the soil, surface water, groundwater, or air on, below, or around the site. Any statements regarding colors, odors, suspicious, or unusual items are strictly for informational purposes. Prior to further development of this site, an environmental assessment is advisable.

General

The attached entire report should be read and the contents evaluated prior to utilizing our recommendations in the preparation of the design and construction documents. Please refer to the attached report for a more detailed summary of our analysis and recommendations. It is recommended that METCO be retained to provide observation and testing services during construction. Please do not hesitate to contact our office at 405-681-6737.

Respectfully Submitted,

Midwest Engineering & Testing Corporation
CA No. 4198, Expires 06/30/2011

9/27/2011

Nasir Marakah, P.E.
President

(3 copies submitted)

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Geotechnical Engineering Services Report
Proposed Elementary School Addition
Perkins-Tryon Public Schools
Perkins, Oklahoma
METCO Project No: OGR- 11063
May 2011

1.0 Introduction

Midwest Engineering & Testing Corporation (METCO) has completed a geotechnical exploration and evaluation of the subsurface conditions for the above-referenced project site in general accordance with METCO proposal number OGP-11086 dated May 1, 2011. Written authorization was provided by Mr. Wayne Leatherbury, Project Manager, of LWPB Architects & Planners, P.C., on May 2, 2011.

2.0 Project Description

Based on project information provided by Mr. Leatherbury, we understand the proposed construction will consist of the following:

Building	Single Story Building Addition Without A Basement Ground supported Floor Slabs Approximately 19,000 Square Feet of Ground Cover Less than 40 Kip Column Loads, 3 KLF Continuous Loads
Grading	Less Than 4 Feet of Cut / Fill
Pavement	Asphaltic Concrete and/or Rigid Pavement

It is our understanding that the new addition will not be structurally connected to the existing building. It was indicated that the existing building is supported on shallow spread footings and the existing building visually appeared to be performing satisfactory.

The location of the site is shown on the Site location Map.

3.0 Scope of Work

The purpose of this exploration and evaluation was to assess the subsurface soil conditions at the project site, at the boring locations, in order to help in the evaluation of acceptable foundation and general pavement systems for the proposed project.

Our scope of services included the items presented in the following sections.

3.1 Subsurface Exploration

A total of 7 soil borings were drilled using truck-mounted solid-stem type drilling equipment. As per the scope of work requested by LWPB Architects & Planners, P.C., the borings were drilled within the general vicinity of the proposed building addition and parking areas. These borings were drilled to approximate depths of 6.5 feet to 21.5 feet below the existing grade. Location and depth of the borings were selected by LWPB Architects & Planners, P.C. Locations of the

proposed building as well as the soil borings are shown on the Boring Location Plan. Logs of the borings are presented in the Appendix.

Soil samples were taken at regular intervals during the drilling process. Samples were identified in the field, placed in sealed plastic bags, and transported to the laboratory for further classification and testing.

When the split spoon sampler was used, Standard Penetration Tests (SPT's) were performed at regular intervals in general accordance with ASTM Designation D1586, samples collected, and results presented on the boring logs. The SPT used in soil borings is performed by driving a 2-inch, O.D., split-spoon sampler into the undisturbed formation located at the bottom of the advanced auger with repeated blows of a 140-pound, pin-guided, hammer falling a vertical distance of 30 inches. The number of blows required to drive the sampler one foot is a measure of the soil consistency.

3.2 Laboratory Evaluation

Selected samples of the subsurface soils were tested in the laboratory to determine materials properties for further evaluation and approximate Unified soil classifications were determined by visual inspection. The laboratory evaluation consisted of visual and textural examinations, moisture content, Atterberg limit tests, and percent passing the No. 200 sieve. Results of the tests are shown on the attached logs of borings.

3.3 Engineering Analysis

Engineering analysis and recommendations regarding general foundation design including allowable soil bearing pressures, minimum depth requirements, and estimates of foundation settlement are included in this report. In addition, recommendations were developed addressing site preparation, placement and compaction of fill materials, and site preparation of the floor slab areas.

This geotechnical engineering report presents recommendations derived from existing and available information pertaining to the proposed project; relevant laboratory data, information, and test results; subsurface materials encountered in our borings, and the proposed building location. The attached entire report should be read and the contents evaluated so that to facilitate any changes that may be desired. If any changes or corrections are desired, please inform METCO in writing so that we may amend the presented recommendations.

METCO cannot be responsible for the interpretation or implementation of this report by others. METCO should be retained to provide observation and testing during construction. Foundations, earthwork, and other construction related activities should be observed by METCO. If METCO is not so retained, it will not accept any responsibility for the performance of the structure nor will it accept any responsibility for any conditions which deviated from those described in this report.

4.0 Surface and Subsurface Features

4.1 Site Description

The subject property is located at Perkins-Tryon Elementary School, located at 1008 E. Kirk Avenue in Perkins, Oklahoma. The proposed construction area was covered with grass and visually appeared to be relatively level. Some utilities and a play ground existed in the general vicinity of the proposed construction site. The surface conditions were dry and our truck-mounted drill rig experienced no difficulty in moving around the site.

4.2 Soil Subsurface Conditions

Indications of possible fill soils were not encountered at the site in the general vicinity of our borings, but fill soils may exist to various depths at other site locations. Below approximately 3 inches of grass and topsoil, the borings generally encountered soils consisting of clay and sand to boring termination depths of approximately 6.5 feet to 21.5 feet below existing grade. Standard penetration resistances (N-values) recorded in the soils ranged from 4 to 21 blows per foot (bpf) of penetration indicating firm to very stiff consistencies and loose to medium relative densities.

Laboratory tests indicated that the site tested soils had plasticity indices ranging from NP to 15 and grain size distribution tests show that the tested soils contain about 22 to 62 percent fines (that material passing a No. 200 mesh sieve). The encountered soils were classified as SC, SC-SM, SM, CL, and CL-ML in accordance with the Unified Soil Classification System.

Based on the results of our laboratory-tests and our experience with other sites in the general vicinity, the on-site tested soils are susceptible to low swell potential. In keeping with local practice, we have presented foundation and site drainage recommendations, which are intended to reduce (but not eliminate) the potential for differential movement related to the collapse/swell of the upper soils.

Although possible fill material was not encountered in the general vicinity of our borings, it is possible that the fill material may exist at other site locations and the depth of the fill material may vary across the site within the proposed construction area. **Typically, we do not recommend relying on fill placed without technical observation for building support. Any existing fill should be removed in its entirety and be replaced with properly compacted low plasticity structural fill or stockpiled and processed to remove deleterious materials and recompacted.**

Typically, it is anticipated that properly compacted structural fill material will settle approximately 1 to 2 percent of the fill height. The higher the clay content, the longer it will take the fill to settle.

The above description of the subsurface conditions constitutes a generalization that emphasizes the subsurface stratification features and characteristics. The data and information at the specific boring locations are recorded in the boring logs. These logs present a description of subsurface soil, applicable laboratory and field test results, sample location, and general stratification. Variations in the stratification presented in the boring logs should be

expected across the site and between boring locations as the presented strata description is only indicative of the boring locations.

4.3 Groundwater

Groundwater was not encountered in our borings at the time of drilling and end of day. However, it is possible that transient over saturated ground conditions could develop at shallower depths at a later time due to periods of heavy precipitation, landscape watering, leaking water lines, or other unforeseen causes. **The contractor should determine the actual groundwater levels at time of construction.**

4.4 Seismic Considerations

IBC Seismic Zone Coefficients

Earthquake related design parameters may be obtained from the International Building Code 2003 Edition, using *a Site Class **E** Definition.*

If site-specific earthquake response spectra or other specific design parameters are deemed necessary by the project structural engineer, or are required by the local governmental agency who has jurisdiction over the project, the geotechnical engineer should be promptly informed so that the appropriate analysis can be performed. In addition, design of structures should comply with the requirements of the governing jurisdiction's building codes and standard practices of Oklahoma.

5.0 Evaluation and Recommendations

Based on the results of our fieldwork, laboratory evaluation, and engineering analysis, the proposed building can be supported on shallow spread footings founded on existing soil or properly compacted engineered fill at a minimum depth of 2.5 feet below final grade. Other types of foundation systems can be evaluated, if desired. Additional drilling should be performed prior to construction.

5.1 Site Preparation

Prior to general site grading, all vegetation, all topsoil, all play ground equipment, any existing fill material, gravel, organic material, deleterious materials, existing underground and/or overhead utilities and any other deleterious materials encountered at the time of construction, **and soft soils** should be stripped from the proposed construction area. The depth of required removal should be evaluated by a representative of the geotechnical engineer at the time of construction. The resulting excavations should be widened, as necessary, to allow access to compaction equipment. Topsoil thickness was measured to be approximately 3 inches in our borings, but topsoil thickness may vary at other site locations.

Once the proposed subgrade level has been exposed, the construction area should be proof-rolled during a period of dry weather. A representative of the geotechnical engineer should observe the exposed subgrade for soils that rut or deflect under the moving load. Such soils

should be recompacted or replaced with properly compacted fill. After proof-rolling is completed, the top 8 inches of the exposed subgrade should be scarified; moisture conditioned, if necessary, and compacted to 95 percent of the standard Proctor maximum dry density ASTM D698.

Any fill should have a liquid limit of 35 or less and a plasticity index of 15 or less, be 3 inches or less in particle size, and should be free of organic or any deleterious materials. Fill should be placed in loose 8-inch lifts and should be compacted at 2 percent below optimum to 2 percent above the optimum moisture content. The first layer of fill material should be placed in a relatively uniform horizontal lift and be keyed into the prepared subgrade soils.

Based on the laboratory test results, some of the on site tested soils are not suitable for use as structural fill. However, these soils should be tested in bulk at the time of construction. If a fine-grained clay soil is used for fill, close moisture content control will be required to achieve the recommended degree of compaction. If water is added, it should be uniformly applied and thoroughly mixed into the soil. Structural fill should be compacted to at least 95 percent of standard Proctor maximum dry density as determined by ASTM Designation D 698.

It should be noted that the site tested soils could be utilized for structural fill, if necessary. Additional effort would be required when utilizing this type of material due to the nature of these soils.

It is recommended that each compacted-engineered lift be tested by a representative of the geotechnical engineer prior to placement of subsequent lifts. It is also recommended that the compacted fill be extended 5 feet beyond the edges of the building.

5.2 Foundation Support

Based on the results obtained from our exploration and analysis, the proposed structure can be supported on a shallow foundation system. Shallow spread footings for building columns and continuous footings for bearing walls should be designed for a total allowable soil bearing pressure of 2,500 and 2,000 pounds per square foot, respectively, bearing on existing soil or properly compacted engineered fill at a minimum depth of 30 inches below final grade. To reduce the possibility of local bearing capacity failure, minimum dimensions of 24 inches for column footings and 18 inches for continuous footings should be used in foundation design. The footings should be provided with appropriate reinforcement as determined by the structural engineer.

The foundation excavations should be observed and tested by METCO representatives. A field observation and testing letter report should be issued and reviewed by the architect, owner, and/or contractor.

A one third increase in bearing value can be used for wind and seismic load considerations. Since the recommended bearing value is a net value, the weight of the concrete in the footings may be assumed to be 50 pounds per square foot. The weight of the soil backfill may be neglected for downward load contribution.

A representative of METCO should observe the foundation excavations prior to steel or concrete placement to assess that the foundation materials are capable of supporting the

design loads and are consistent with the materials discussed in this report. **Soft or loose soil zones encountered at the bottom of the footing excavations should be removed to the level of stiff or dense soil as directed by the geotechnical engineer.** Cavities formed as a result of excavation of soft or loose soil zones should be backfilled with engineered fill, as determined by the geotechnical engineer. METCO should be contacted to evaluate moisture issues, if needed.

An ultimate coefficient of friction of 0.47 can be used between the base of footings and the floor slab and the supporting soils to resist lateral loads. In addition, lateral loads can be resisted by a uniform ultimate passive key resistance of 450 pounds per square foot, for keys embedded at least 2.5 feet below final grade. A one third increase in the passive value can be used for wind and seismic loads. The frictional resistance and the passive resistance of the soils can be combined without any reductions in determining the total lateral resistance.

We estimate that foundations designed and constructed in accordance with the above recommendations will experience total settlements generally less than 1-inch with differential settlements generally less than ¾ inches within the building area. **It should be noted that additional settlements of approximately 1 to 2 percent of placed fill height should be accounted for in the design**. Consolidation testing was beyond the scope of this exploration.

The location of the existing foundations should be determined so that the proposed construction does not damage or encounter existing construction. Once the final design is complete, METCO should be contacted for further evaluation. The potential for the additional settlement of the existing building can also be evaluated once the final design is complete.

5.3 Floor Slab Recommendations

Floor slabs should be supported on existing non-expansive soils or on a minimum of 2.0 feet of properly compacted and tested non-expansive structural tested fill materials. **Floor slabs should be supported directly by 4 inches of Aggregate Base Course (ABC); over non-expansive soil meeting the requirements outlined above**. This material will act as a leveling base and aid in concrete curing. This material will not act as a positive moisture break to prevent moisture rise to the slab. If the floor covering is considered moisture sensitive, plastic sheeting should be placed over the base course. **Any existing fill should be removed prior to fill placement and/or floor slab construction.**

A modulus of sub-grade reaction (k) of 100 pounds per cubic inch is recommended for floor slabs overlying the graded gravel base and a compacted subgrade. The floor slabs should have an adequate number of joints to reduce cracking resulting from possible differential movements. The floor slabs should not be rigidly connected to columns, walls, or foundations, if possible. **Floor slab design is not typically the area of expertise of the Geotechnical Engineer and should be verified by the Structural Engineer of Record**.

All construction activity may cause damage and deterioration to the prepared subgrade. We recommend our field representative observe the final subgrade prior to placement of the slab on grade, and perform further testing as necessary.

5.4 Pavement Recommendations

We have assumed typical area soil parameters for pavement design. Our study did not include CBR testing or detailed pavement analysis for the subgrade soils or imported soils. A more detailed analysis of the subgrade and traffic conditions should be made in large areas of pavement, or where pavements are subject to significant traffic. The results of such analysis will provide the needed information for the design of an economical and serviceable pavement. The project civil engineer should design the actual pavements based on site-specific traffic information.

The pavement thicknesses presented in the table below are considered area typical and minimum for the assumed parameters. Thinner pavement sections than those presented in the table might be warranted due to budgetary considerations. However, LWPB Architects & Planners, P.C., and all parties involved should be aware that increased maintenance costs and lower pavement life might be expected with thinner pavement sections. The subgrade should be prepared as recommended in this report.

With an assumed CBR value of 3, a typical standard pavement section consisting of the following could be used:

Asphalt Concrete Flexible Pavement Thickness (Inches)		
Pavement Materials	Car Parking	Driveways
Asphaltic Surface Course	2"	2"
Asphaltic Binder Course	3"	5"
Crushed Stone Base	6"	6"
Concrete Rigid Pavement Thickness (Inches)		
Pavement Materials	Car Parking	Driveways, trash dumpsters area, areas of large loads from small steel wheels
Concrete Pavement	5"	7"
Crushed Stone Base	4"	4"

Providing the proper pavement type and thickness will result in better distribution of surface loads to the subgrade without causing deformation of the surface. Proper compaction, fine grading and proof-rolling should supercede pavement placement. The work should be done in accordance with Oklahoma State Department of Transportation guidelines or other applicable guidelines.

The base stone should not get saturated and water should not be allowed to pond behind curbs. To allow water entering the base stone a path to exit, base stone should extend through the slope in down grade areas.

5.5 Fly Ash Stabilization

Consideration should be given to fly ash stabilization to improve the parking and driveway subgrade soils. Stabilizing the top 8 inches of the subgrade soil in the parking and driveway areas with fly ash improve the subgrade soils. **The actual fly ash percentage should be determined at the time of construction. Sulfate tests and other appropriate tests should be performed prior to the final selection of the stabilizing material.**

5.6 Drainage Considerations

Due to adverse effect on structures, it is recommended that water not be allowed to collect in the foundation excavation or on prepared subgrade of the construction area either during or after construction. Undercut or excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, or positive runoff. The contractor should exercise care in creating drainage paths for water during the construction phase of the project. Curbing adjacent to landscaped areas should be designed deep enough to act as a barrier between the landscape irrigation and the subgrade soil. Surface run-off from roofs, parking areas, etc., should be discharged away from the structures. To reduce infiltration of surface water around the perimeter of the building and beneath the floor slabs, positive drainage should be provided. If groundwater issues are encountered during construction, METCO should be contacted.

5.7 Excavation and Temporary Slopes

The contractor, designated as "responsible person" in OSHA Construction Standards for Excavations, 29 CFR Part 1926, is solely responsible for planning and implementing all safety procedures. All excavation height, slope, and depth must adhere to all specifications outlined in local, state, and federal safety regulations.

METCO does not assume any responsibility for construction site safety or any party's, including the contractor, compliance with the applicable local, state, and federal safety regulations or any other applicable regulations.

5.8 Trench Backfill

All required trench backfill should be mechanically compacted in layers to at least 95% of the standard Proctor maximum dry density as determined by ASTM Designation D 698. Some settlement of the backfill may be expected and any utilities within the trenches or concrete walks supported on the trench backfill should be designed to accept these differential movements.

5.9 Weather Considerations

The upper soils encountered at this site maybe sensitive to moisture variations and construction traffic disturbances during wet weather. The soil strength is significantly reduced when the soil is wet and significant delays in the grading and compaction activities can take place. Thus, it is advantageous to perform construction activities during periods of dry weather.

5.10 Construction Monitoring

METCO should be retained to provide observations and testing of soil exposures created during project construction in order to verify that soil conditions are as anticipated and are as encountered in our borings. Construction activities pertaining to earthwork, foundations, and all other related activities should also be observed by METCO representatives. METCO cannot accept any responsibility for the performance of the foundations for this project if not retained to provide construction observation and testing. Furthermore, METCO cannot accept any responsibility for conditions which deviated from those described in this report.

6.0 General

The conclusions and recommendations presented in this report are subject to the following general conditions:

6.1 Use of Report

This report has been prepared for the exclusive use of LWPB Architects & Planners, P.C., for the specific application to the Proposed Elementary School Addition in Perkins, Oklahoma. This report should not be appropriate for other structures or purposes. We recommend that parties contemplating other structures or purposes contact us. Unless our written approval is provided, we make no representation and assume no responsibility to other parties regarding this report.

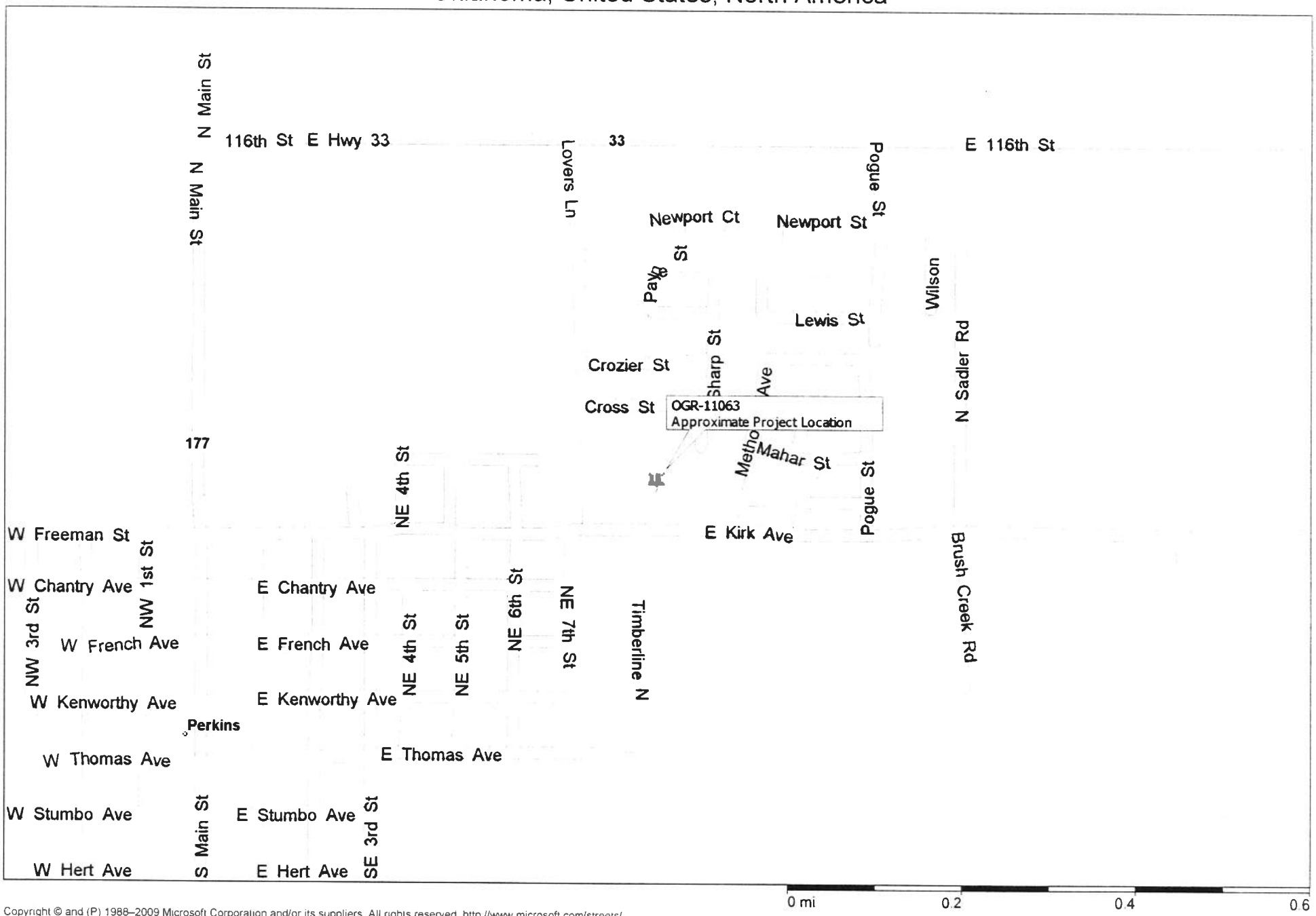
6.2 Level of Care

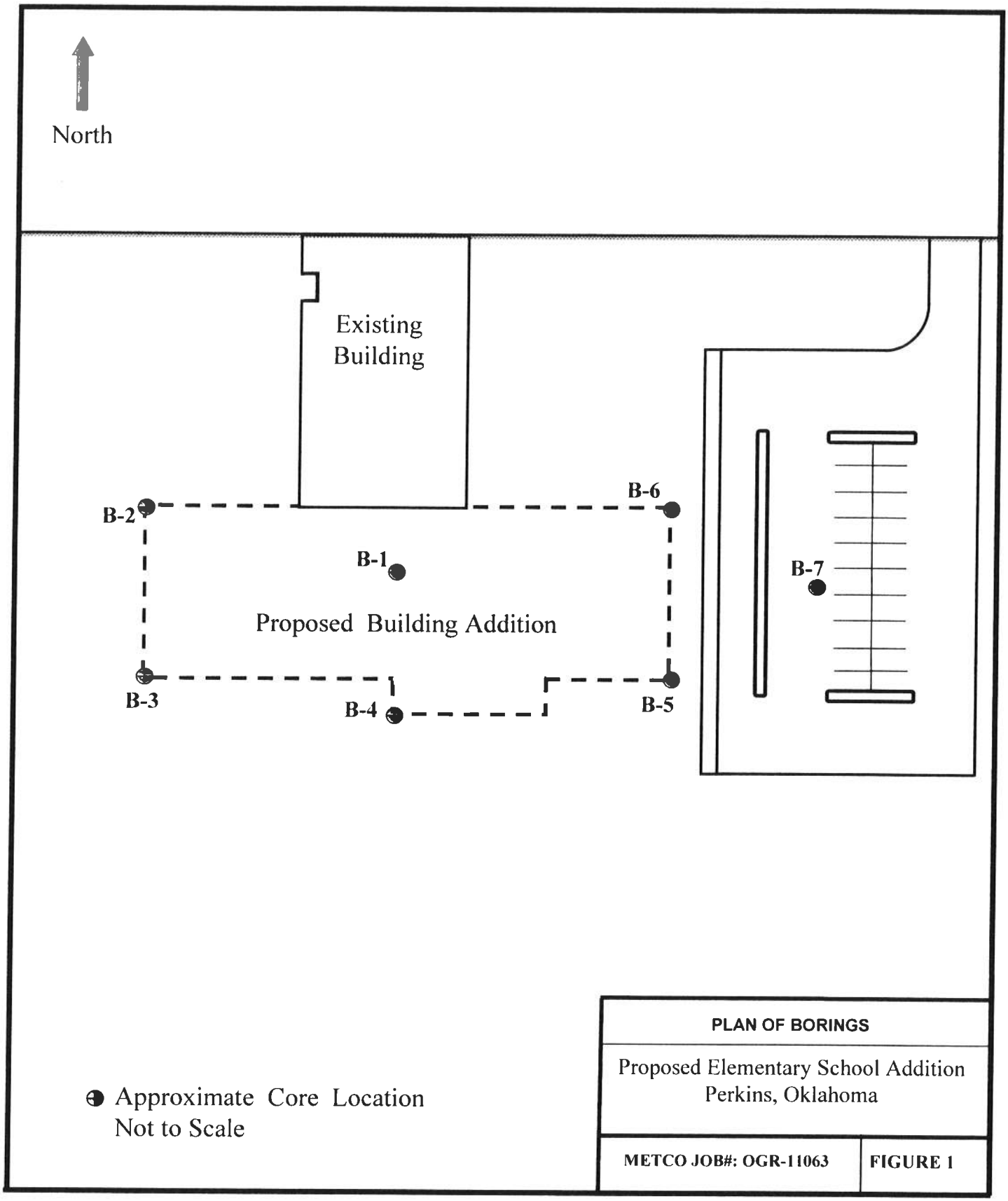
The recommendations contained in this report are based on the available subsurface information obtained by METCO, and design details furnished for the proposed project. If there are any revisions to the plans for this project, or if deviations from the subsurface conditions noted in this report are encountered during construction, METCO should be notified immediately to determine if changes in the foundation recommendations are required. If METCO is not retained to perform these functions, METCO will not be responsible for the impact of those conditions on the project.

Services performed by the geotechnical engineer for this project have been conducted with that level of care and skill ordinarily exercised by members of the profession currently practicing in this area. No warranty, expressed or implied, is made.

APPENDIX

Oklahoma, United States, North America





PLAN OF BORINGS

Proposed Elementary School Addition
Perkins, Oklahoma

METCO JOB#: OGR-11063 | FIGURE 1

METCO

LOG OF BORING B-1

PROJECT: Proposed Elementary School Addition, Perkins, Oklahoma — Project No.: OGR-11063

Date Drilled: 5/18/2011 — Location: See Plan of Borings (Figure 1) — Elevation: N/A

Depth To Water At Completion: Dry — Depth To Water On: End of Day — Was: Dry

Drilled By: Jason — Logger: Ricky — Approximate Completion Depth: 21.5'

DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	#200 %	swell %	PP TSF
1–3		5/6" 4/6" 4/6"	3" Grass and topsoil Brown clayey Sand w/ iron stains, loose (SC)	12	22	13	9	38		
4–5		4/6" 6/6" 8/6"	Brown silty clayey Sand w/ iron stains, medium (SC-SM)	13	29	22	7	47		
6–10		4/6" 4/6" 6/6" 3/6" 5/6" 7/6"	Brown silty Sand, medium to loose (SM)	8	NP	NP	NP	27		
11–15		5/6" 8/6" 8/6"		8 5						
16–20		2/6" 2/6" 2/6"		9						
21		2/6" 3/6" 3/6"		18						
22–30										

NOTES:

METCO

FIGURE 2

LOG OF BORING B-2

PROJECT: Proposed Elementary School Addition, Perkins, Oklahoma — Project No.: OGR-11063

Date Drilled: 5/18/2011 — Location: See Plan of Borings (Figure 1) — Elevation: N/A

Depth To Water At Completion: Dry — Depth To Water On: End of Day — Was: Dry

Drilled By: Jason — Logger: Ricky — Approximate Completion Depth: 21.5'

DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	#200 %	swell %	PP TSF
1–3		2/6" 2/6" 2/6"	3" Grass and topsoil Brown silty Sand w/ iron stains, loose (SM)	15	24	21	3	48		
4–5		2/6" 4/6" 5/6"	Brown silty clayey Sand w/ iron stains, loose (SC-SM)	15	30	24	6	44		
6–9		4/6" 5/6" 6/6" 5/6" 8/6" 9/6"	Brown silty Sand, medium to loose (SM)	10 11	NP	NP	NP	25		
10–15		6/6" 10/6" 10/6"		7						
16–20		2/6" 4/6" 8/6"		17						
21–25		2/6" 3/6" 6/6"		20						
26–30										

NOTES:

METCO

FIGURE 3

LOG OF BORING B-3

PROJECT: Proposed Elementary School Addition, Perkins, Oklahoma — Project No.: OGR-11063

Date Drilled: 5/18/2011 — Location: See Plan of Borings (Figure 1) — Elevation: N/A

Depth To Water At Completion: Dry — Depth To Water On: End of Day — Was: Dry

Drilled By: Jason — Logger: Ricky — Approximate Completion Depth: 21 5'

DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	#200 %	swell %	PP TSF
1–3		3/6" 3/6" 3/6"	3" Grass and topsoil Brown sandy lean Clay w/ iron stains, firm (CL)	13	29	14	15	57		
4–5		3/6" 3/6" 6/6"	Brown clayey Sand w/ iron stains, loose (SC)	14	29	15	14	43		
6–10		3/6" 4/6" 5/6" 3/6" 6/6" 6/6"	Brown silty Sand, loose to medium (SM)	11 12	NP	NP	NP	26		
11		4/6" 5/6" 6/6"		8						
12–20		4/6" 4/6" 4/6"	Brown silty Sand, medium to loose (SM)	6						
21		3/6" 3/6" 4/6"		20						
22–30										

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FIGURE 4

LOG OF BORING B-4

PROJECT: Proposed Elementary School Addition, Perkins, Oklahoma — Project No.: OGR-11063

Date Drilled: 5/18/2011 — Location: See Plan of Borings (Figure 1) — Elevation: N/A

Depth To Water At Completion: Dry — Depth To Water On: End of Day — Was: Dry

Drilled By: Jason — Logger: Ricky — Approximate Completion Depth: 21.5'

DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	#200 %	swell %	PP TSF
1–5		3/6" 3/6" 5/6"	3" Grass and topsoil Brown sandy silty Clay w/ iron stains, firm (CL-ML)	14	24	19	5	58		
4–5		3/6" 5/6" 8/6"	Brown silty clayey Sand w/ iron stains, medium (SC-SM)	12	24	18	6	42		
6–20		5/6" 5/6" 6/6" 4/6" 7/6" 8/6" 6/6" 7/6" 8/6" 2/6" 3/6" 5/6" 3/6" 3/6" 6/6"	Brown silty Sand, medium to loose (SM)	10 9 8 8 19	NP	NP	NP	24		
21–30										

NOTES:

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FIGURE 5

LOG OF BORING B-5

PROJECT: Proposed Elementary School Addition, Perkins, Oklahoma — Project No.: OGR-11063

Date Drilled: 5/18/2011 — Location: See Plan of Borings (Figure 1) — Elevation: N/A

Depth To Water At Completion: Dry — Depth To Water On: End of Day — Was: Dry

Drilled By: Jason — Logger: Ricky — Approximate Completion Depth: 21.5'

DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	#200 %	swell %	PP TSF
1–3		2/6" 3/6" 3/6"	3" Grass and topsoil Brown sandy lean Clay w/ iron stains, firm (CL)	15	32	18	14	62		
4–5		4/6" 5/6" 8/6"	Brown clayey Sand w/ iron stains, medium (SC)	13	25	15	10	36		
6–7		6/6" 6/6" 8/6"	Brown silty Sand, medium to loose (SM)	9	NP	NP	NP	22		
8–10		6/6" 8/6" 9/6"		11						
11–15		8/6" 8/6" 9/6"		12						
16–20		4/6" 6/6" 8/6"		11						
21–25		3/6" 3/6" 5/6"		23						
26–30										

NOTES:

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FIGURE 6

LOG OF BORING B-6

PROJECT: Proposed Elementary School Addition, Perkins, Oklahoma — Project No.: OGR-11063

Date Drilled: 5/18/2011 — Location: See Plan of Borings (Figure 1) — Elevation: N/A

Depth To Water At Completion: Dry — Depth To Water On: End of Day — Was: Dry

Drilled By: Jason — Logger: Ricky — Approximate Completion Depth: 21.5'

DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	#200 %	swell %	PP TSF
1–3		2/6" 4/6" 4/6"	3" Grass and topsoil Brown sandy lean Clay w/ iron stains, firm (CL)	13	26	18	8	55		
4–5		4/6" 5/6" 8/6"	Brown silty Sand, medium (SM)	10	21	18	3	22		
6–10		4/6" 6/6" 6/6"		8	NP	NP	NP	47		
8–10		6/6" 7/6" 12/6"		12						
11–15		7/6" 10/6" 11/6"		9						
16–20		5/6" 7/6" 7/6"		11						
21–25		2/6" 3/6" 7/6"		21						
26–30										

NOTES:

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FIGURE 7

LOG OF BORING B-7

PROJECT: Proposed Elementary School Addition, Perkins, Oklahoma — Project No.: OGR-11063

Date Drilled: 5/18/2011 — Location: See Plan of Borings (Figure 1) — Elevation: N/A

Depth To Water At Completion: Dry — Depth To Water On: End of Day — Was: Dry

Drilled By: Jason — Logger: Ricky — Approximate Completion Depth: 6.5'

DEPTH FEET	SYMBOL	SAMPLE TYPE	DESCRIPTION	MC %	LL	PL	PI	-#200 %	swell %	PP TSF
1		3/6"	3" Grass and topsoil							
2		3/6"	Brown sandy lean Clay w/ iron stains, stiff (CL)	11	30	21	9	58		
3		6/6"								
4		5/6"	Brown clayey Sand w/ iron stains, medium (SC)	10	30	19	12	46		
5		6/6"								
6		8/6"								
7		5/6"	Brown silty Sand, medium (SM)	8	NP	NP	NP	28		
8		5/6"								
9		6/6"								
10										
11										
12										
13										
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NOTES:

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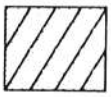
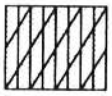
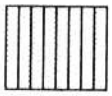
FIGURE 8

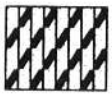
KEY TO SYMBOLS & PATTERNS USED ON BORING LOGS


Clayey Sand


Silty Clayey Sand


Silty Sand


Sandy lean Clay


Sandy Silty Clay


Standard Penetration Test


Bag Sample


Texas Cone Penetrometer Test

ABBREVIATIONS USED

MC, %	Moisture Content expressed in percentage
LL, %	Liquid Limit expressed in percentage
PI, %	Plasticity Index expressed in percentage
DD, PCF	Dry Density expressed in pounds per cubic feet
-#200, %	Soil Fraction Passing No. 200 Sieve expressed in percentage
swell, %	Free swell under overburden pressure expressed in percentage
PP, TSF	Pocket Penetrometer Reading expressed in tons per square feet

8/31/2011