Geotechnical Engineering Report

Panda Express Project No. S8-22-D8135
Lutz, Pasco County, Florida
May 19, 2021
Terracon Project No. H4215069

Prepared for:
Panda Express Restaurant Group, Inc.
Rosemead, CA

Prepared by:
Terracon Consultants, Inc.
Tampa, Florida

May 19, 2021

Panda Express Restaurant Group, Inc.
1683 Walnut Grove Avenue
Rosemead, CA 91770

Attn: Mr. Dan Waguespack
P: 626.799.9898
E: client.name@company.com

Re: Geotechnical Engineering Report
Panda Express Project No. S8-22-D8135
SR 54 at Ballantrae Blvd (Lot 7)
Lutz, Pasco County, Florida
Terracon Project No. H4215069

Dear Mr. Waguespack:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Task Order dated April 21, 2021. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and floor slabs for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.
Registry Number 3830

Stephen C. Knauss, P.E., D.GE
Senior Engineer
Florida Registration No.: 28202

Keith D. Bennett, P.E.
Senior Geotechnical Engineer
Florida Registration No.: 33075

This report has been digitally signed and sealed by Stephen C. Knauss, P.E. on date adjacent to the seal.

Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies

REPORT TOPICS

Note: This report was originally delivered in a web-based format. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

Note: Refer to each individual Attachment for a listing of contents.

REPORT SUMMARY

Topic [1]	Overview Statement [2]
Project Description	Single story Panda Express restaurant Maximum Wall loads: 3 kips per lineal foot Up to 2 feet of fill to achieve final grade Little excavation other than foundation construction Expected traffic for pavement areas: ■ 300 autos/light trucks per day ■ Up to 10 medium-duty delivery/trash trucks per week
Geotechnical Characterization	The soils encountered by the borings were sands with relatively few fines. Some fill may be present. Groundwater was encountered at about 4 feet during the exploration, but will likely be higher during the rainy late summer months.
Earthwork	Proof-roll the site as noted in the **Earthwork** section of the report to compact the in-place soils before placing any fill.
Shallow Foundations	The building can be supported on shallow foundations or a turned down slab. Allowable bearing pressure = 2,000 psf Expected settlements: < 1-inch total, < ½-inch differential Detect and remove zones of fill as noted in **Earthwork.**
Pavements	With subgrade prepared as noted in **Earthwork**. Concrete: ■ 6 inches Concrete in Light Duty areas ■ 8 inches Concrete in Medium Duty areas Asphalt: ■ 1-½ inches Asphalt over 6 inches base in Light Duty areas ■ 2 inches Asphalt over 8 inches base in Medium Duty areas
General Comments	This section contains important information about the limitations of this geotechnical engineering report.

1. If the reader is reviewing this report as a pdf, the topics above can be used to access the appropriate section of the report by simply clicking on the topic itself.
2. This summary is for convenience only. It should be used in conjunction with the entire report for design purposes.

Geotechnical Engineering Report

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SR 54 at Ballantrae Blvd (Lot 7)
Lutz, Pasco County, Florida

Terracon Project No. H4215069

May 19, 2021

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed Panda Express Restaurant to be located at SR 54 at Ballantrae Blvd (Lot 7) in Lutz, Pasco County, Florida. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Site preparation and earthwork
- Excavation considerations
- Dewatering considerations
- Foundation design and construction
- Floor slab design and construction
- Seismic site discussion per FBC
- Pavement design and construction

The geotechnical engineering Scope of Services for this project included the advancement of two test borings to approximately 20 feet below existing site grades. In addition, five hand auger borings were advanced to about 5 feet below the existing grade.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The site is Lot 7 of a new commercial center of SR 54 at the intersection with Ballantrae Boulevard in Lutz, Florida Latitude/Longitude approximate: 28.1939/-82.5224. See **Site Location**
Existing Improvements	The site has been rough graded.

Item	Description
Current Ground Cover	The ground cover is basically bare earth.
Existing Topography	The site is level with an elevation of about +60 feet.

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	Information was provided in an email to Matt Beheshti
Project Description	The Panda Express will be a single-story building.
Proposed Structure	The structure will presumably be constructed using a wood frame with a concrete slab-on-grade.
Building Construction	Load bearing walls.
Finished Floor Elevation	Assumed to be within 2 feet of the existing grade.
Maximum Loads	Maximum Wall Loads – less than 3 klf. Maximum Uniform Floor Slab Load – less than 100 psf.
Grading/Slopes	Assumed to be less than 2 feet of fill.
Below-Grade Structures	None are anticipated.
Free-Standing Retaining Walls	None are anticipated.
Below-Grade Areas	None are anticipated.
Stormwater Management Area	Assumed to be a part of the master planning for this development area.
Pavements (assumed)	We assume both rigid (concrete) and flexible (asphalt) pavement sections should be considered. Please confirm this assumption. Anticipated traffic is as follows: ■ Autos/light trucks: 300 vehicles per day ■ Light delivery and trash collection vehicles: 10 vehicles per week ■ Tractor-trailer trucks: <5 vehicles per week The pavement design period is 20 years.
Estimated Start of Construction	2021

GEOTECHNICAL CHARACTERIZATION

USDA Soil Survey

The USDA soil survey for Pasco County notes that the soils on the site include Myakka-Myakka, wet, fine sands, 0 to 2 percent slopes (Map unit 5) and Sellers mucky loamy fine sand (Map unit 8). The Myakka-Myakka soil consists of fine sand to the depth described, 80 inches. The seasonal high groundwater table is noted at about 6 to 18 inches. The Sellers sand is noted as mucky loamy fine sand to about 9 inches below which it is described as fine sand to 80 inches, the depth described. The seasonal high groundwater table is noted as being at the ground surface. The attached **USDA Soil Survey** shows the approximate areas of these soil types.

Subsurface Conditions

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of site preparation and foundation options. Conditions encountered at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** section and the GeoModel can be found in the **Figures** section of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	Sand	Poorly graded Sand (SP), Poorly graded Sand with silt (SP-SM) and Poorly graded Sand with clay (SP-SC)

The site was previously mass-graded; however, we were not provided with plans showing the extent of fill or excavation and it was not possible to discern the difference between natural soils and any fill.

Groundwater was measured at about 4 feet below the existing ground surface. The measurements were taken during the dry season. We estimate that the seasonal high groundwater table will be on the order of 1 to 2 feet below the ground surface during the wetter late summer months.

GEOTECHNICAL OVERVIEW

The results of the soil test borings indicate that while the site may have been mass-graded, that the underlying soils need to have their density improved to minimize the potential for future settlement.

Given the type of soils present, this can be accomplished using a large vibratory roller making a number of passes across the site. Once that has been accomplished, the structure can be supported by a shallow foundation system.

The **General Comments** section provides an understanding of the report limitations.

EARTHWORK

Earthwork is anticipated to include excavations and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

Site Preparation

Prior to placing fill, existing vegetation and root mat should be removed. Complete stripping of the topsoil should be performed in the proposed building and parking/driveway areas.

The subgrade should be proof-rolled with a vibratory roller with a minimum static weight of 20,000 pounds. The roller should make a minimum of 10 overlapping passes with the latter 5 passes at right angles to previous passes. The purpose of the proof-rolling is to not only compact the surficial soils but also to increase the density of the soils in the initial 5 to 6 feet. While the proof-rolling will not necessarily increase the density to a prescribed value, it will assist in increasing the bearing capacity while decreasing the potential for settlement of the near surface soils. The proof-rolling should be performed under the direction of the Geotechnical Engineer. Areas excessively deflecting under the proof-roll should be delineated and subsequently addressed by the Geotechnical Engineer. Such areas typically should either be removed or modified by moisture conditioned and recompacted.

Existing Fill

As noted in **Geotechnical Characterization**, the site has been rough graded and it is possible that fill was added to the site. We have no records to indicate what, if any, quality control was performed. Support of footings, floor slabs, and pavements, on or above existing fill soils, is discussed in this report. However, even with the recommended construction procedures, there is inherent risk for the owner that compressible fill or unsuitable material, within or buried by the fill will, not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill, but can be reduced by following the recommendations contained in this report.

The proof-rolling operation previously described will assist in detecting areas of poor soils and it is important that this operation be conducted.

Fill Material Types

Fill required to achieve design grade should be classified as structural fill. Structural fill is material used below, or within 10 feet of structures, pavements or constructed slopes. Earthen materials used for structural fill should meet the following material property requirements:

Soil Type [1]	USCS Classification	Acceptable Parameters (for Structural Fill)
Imported Fill	SP, SP-SM, SP-SC	Less than 12% Passing No. 200 sieve
On-Site Soils	SP, SP-SM, SP-SC	Less than 12% Passing No. 200 sieve

1. Structural fill should consist of approved materials free of organic matter and debris. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.

Fill Compaction Requirements

Fill should meet the following compaction requirements.

Item	Structural Fill
Maximum Lift Thickness	12 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used
Minimum Compaction Requirements [1]	98% of max. within 1 foot of footing bottom and finished pavement subgrade 95% of max. above foundations, below floor slabs, and more than 1 foot below the footing bottom and finished pavement subgrade
Water Content Range [1]	As required to achieve min. compaction requirements

1. Maximum density and optimum water content as determined by the modified Proctor test (ASTM D 1557).

Utility Trench Backfill

All trench excavations should be made with sufficient working space to permit construction including backfill placement and compaction. Given the few fines in the soils it is likely that deeper excavations may require shoring.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the building.

Exposed ground should be sloped and maintained at a minimum 5% away from the building for at least 10 feet beyond the perimeter of the building. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After building construction and landscaping have been completed, final grades should be verified to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted, as necessary, as part of the structure's maintenance program. Where paving or flatwork abuts the structure, a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Earthwork Construction Considerations

Shallow excavations for the proposed structure are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of floor slabs. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to floor slab construction.

The groundwater table could affect over-excavation efforts, especially for over-excavation and replacement of lower strength soils. The groundwater could also affect the installation of underground utilities and a grease trap. A temporary dewatering system consisting of sumps with pumps or a well point system could be necessary to achieve the recommended depth of excavation.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local, and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety, or the contractor's activities; such responsibility shall neither be implied nor inferred.

Construction Observation and Testing

The earthwork efforts should be monitored under the direction of the Geotechnical Engineer. Monitoring should include documentation of adequate proof-rolling, and mitigation of areas delineated by the proof-roll to require mitigation.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, until approved by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested

for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the building areas and 5,000 square feet in pavement areas. One density and water content test should be performed for every 50 linear feet of compacted utility trench backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated under the direction of the Geotechnical Engineer. If unanticipated conditions are encountered, the Geotechnical Engineer should recommend mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

SHALLOW FOUNDATIONS

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

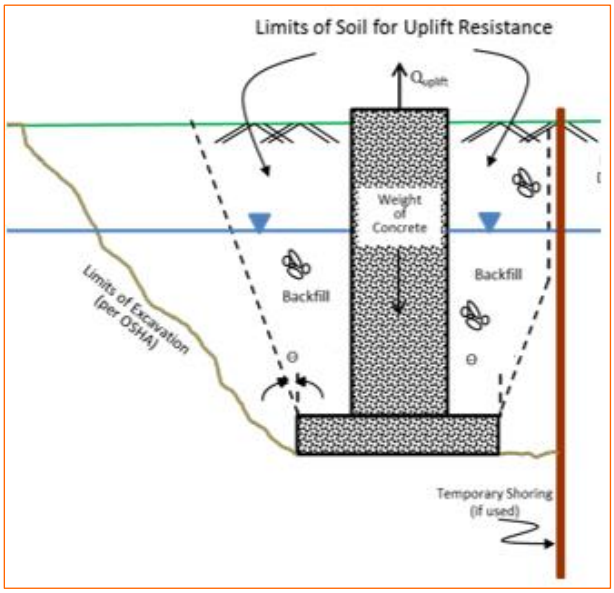
Design Parameters – Compressive Loads

Item	Description
Maximum Net Allowable Bearing pressure [1, 2]	2,000 psf
Minimum Foundation Dimensions	Columns: 30 inches Continuous: 18 inches
Ultimate Passive Resistance [4] **(equivalent fluid pressures)**	45 pcf
Ultimate Coefficient of Sliding Friction [5]	0.45
Minimum Embedment below Finished Grade	12 inches turned down slab foundation 18 inches independent shallow foundations
Estimated Total Settlement from Structural Loads [2]	Less than about 1 inch
Estimated Differential Settlement [2, 6]	About 1/2 of total settlement

Item	Description
1.	The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has been applied.
2.	Values provided are for maximum loads noted in **Project Description**.
3.	Unsuitable or soft soils should be over-excavated and replaced per the recommendations presented in the **Earthwork**.
4.	Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted structural fill be placed against the vertical footing face.
5.	Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions.
6.	Differential settlements are as measured over a span of 50 feet.

Design Parameters - Uplift Loads

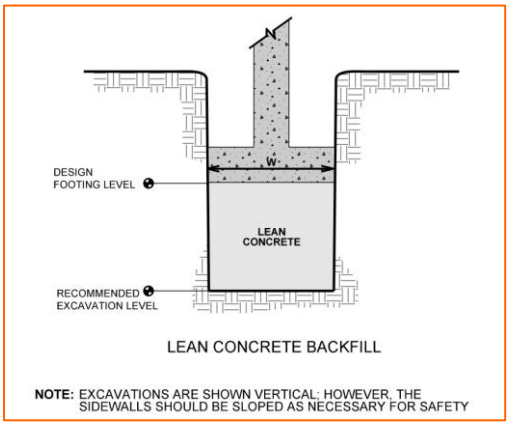
Uplift resistance of spread footings can be developed from the effective weight of the footing and the overlying soils. As illustrated on the subsequent figure, the effective weight of the soil prism defined by diagonal planes extending up from the top of the perimeter of the foundation to the ground surface at an angle, θ, of 20 degrees from the vertical can be included in uplift resistance. The maximum allowable uplift capacity should be taken as a sum of the effective weight of soil plus the dead weight of the foundation, divided by an appropriate factor of safety. A maximum total unit weight of 110 pcf should be used for the backfill. This unit weight should be reduced to 50 pcf for portions of the backfill or natural soils below the groundwater elevation.



Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the direction of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

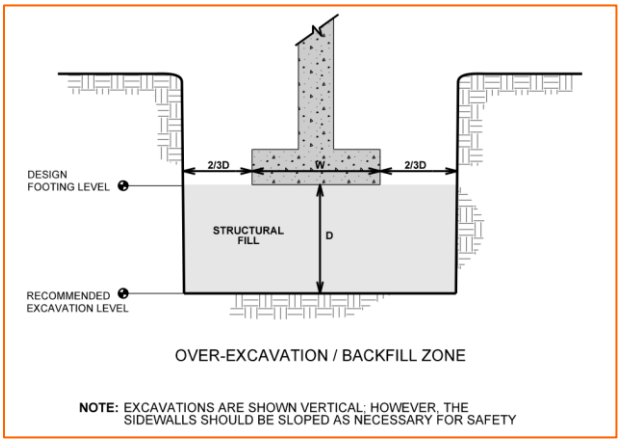
If unsuitable bearing soils are encountered at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils, and the footings could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. This is illustrated on the sketch below.



LEAN CONCRETE BACKFILL

NOTE: EXCAVATIONS ARE SHOWN VERTICAL; HOWEVER, THE SIDEWALLS SHOULD BE SLOPED AS NECESSARY FOR SAFETY

Over-excavation for structural fill placement below footings should be conducted as shown below. The over-excavation should be backfilled up to the footing base elevation, with structural fill or No. 57 stone placed, as recommended in the **Earthwork** section.



OVER-EXCAVATION / BACKFILL ZONE

NOTE: EXCAVATIONS ARE SHOWN VERTICAL; HOWEVER, THE SIDEWALLS SHOULD BE SLOPED AS NECESSARY FOR SAFETY

SEISMIC CONSIDERATIONS

Florida is under the jurisdiction of its own building code as opposed to the International Building Code. The code is explicit that seismic provisions should not be utilized in Florida.

FLOOR SLABS

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab.

Floor Slab Design Parameters

Item	Description
Floor Slab Support [1]	Minimum 6 inches of free-draining (less than 5% passing the U.S. No. 200 sieve) soil compacted to at least 95% of ASTM D 1557 [2, 3, 4]
Estimated Modulus of Subgrade Reaction [2]	125 pounds per square inch per inch (psi/in) for point loads

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation. This does not apply if the foundation system consists of a turned down slab.
2. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.
3. Free-draining granular material should have less than 5% fines (material passing the No. 200 sieve). Other design considerations such as cold temperatures and condensation development could warrant more extensive design provisions.
4. Soils identified as Model Layer 01 may meet this criteria.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or cracks should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and

slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Settlement of floor slabs supported on existing fill materials cannot be accurately predicted, but could be larger than normal and result in some cracking. Mitigation measures, as noted in **Existing Fill** within **Earthwork**, are critical to the performance of floor slabs. In addition to the mitigation measures, the floor slab can be stiffened by adding steel reinforcement, grade beams and/or post-tensioned elements.

Floor Slab Construction Considerations

Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should approve the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

PAVEMENTS

General Pavement Comments

Pavement designs are provided for the traffic conditions and pavement life conditions as noted in **Project Description** and in the following sections of this report. A critical aspect of pavement performance is site preparation. Pavement designs noted in this section must be applied to the site which has been prepared as recommended in the **Earthwork** section.

Pavement Design Parameters

The design of the pavements has utilized the Florida Department of Transportation (FDOT) procedures for flexible and rigid pavements.

A Limerock Bearing Ratio (LBR) of 20 for existing soils, subgrade LBR of 40, and base LBR of 100 was used for the asphalt pavement designs. The existing soils likely do not have an LBR of 40 without stabilization and it is unlikely that typical imported fill material will have an LBR of 40 without stabilization. A modulus of subgrade reaction of 150 pci was used for the concrete pavement designs. The values were empirically derived based upon our experience with the

describe soil type subgrade soils and our understanding of the quality of the subgrade as prescribed by the Site Preparation conditions as outlined in Earthwork.

Pavement Section Thicknesses

The following table provides options for asphalt and concrete Sections:

Typical Pavement Section (inches)						
Traffic Area	**Alternative**	**Asphalt Surface Course**	**Limerock, or Crushed Concrete Base Course** [1, 2]	**Stabilized Subgrade** [,]	**Concrete**	**Free Draining Subgrade**
Car Parking Only (Light Duty)	Concrete	--	--	--	6	12
	Asphalt	1-½	6	12	--	--
Truck Parking (Heavy Duty)	Concrete	--	--	--	8	12
	Asphalt	2½	8	12	--	--
Trash Container Pad [3]	Concrete	--	--	--	6	12

1. Base course materials should comply with FDOT Specification 911.
2. Use coarse granular materials such as recycled crushed concrete, shell, or gravel when seasonal high groundwater is within 4 feet of the profile grade.
3. The trash container pad should be large enough to support the container and the tipping axle of the collection truck.

The asphalt pavement that will be primarily traversed by cars and light trucks may use an SP-9.5 asphaltic mix. However, in areas where the trucks with high pressure tires (80 psi is typical of tractor trailer trucks) an SP-12.5 mix should be used because this mix is better able to withstand the higher tire pressures and turning from these trucks. If asphalt is used, we recommend that concrete pavement be used in the dumpster pad areas as noted in the concrete pavement design due to the higher loading of the garbage trucks.

The above sections represent minimum design thicknesses and, as such, periodic maintenance should be anticipated. The concrete pavement should have a minimum 28-day compressive strength of 4,000 psi with a maximum slump of 4 inches. The recommended sections are

unreinforced however, we recommend that tie bars be installed on longitudinal joints and dowels be installed at transverse joints.

The estimated pavement sections provided in this report are minimums for the assumed design criteria, and as such, periodic maintenance should be expected. Edge restraints (i.e. concrete curbs or aggregate shoulders) should be planned along curves and areas of maneuvering vehicles. A maintenance program including surface sealing, joint cleaning and sealing, and timely repair of cracks and deteriorated areas will increase the pavement's service life. As an option, thicker sections could be constructed to decrease future maintenance.

Proper joint spacing will also be required to prevent excessive slab curling and shrinkage cracking. Joints should be spaced no more than 15 feet apart. Sawcut joints should extend to ¼ of the slab thickness. Joints should be sealed to prevent entry of foreign material and dowelled where necessary for load transfer.

Where practical, we recommend early-entry cutting of crack-control joints in concrete pavements. Cutting of the concrete in the "green" state typically reduces the potential for micro-cracking of the pavements prior to the crack control joints being formed, compared to cutting the joints after the concrete has fully set. Micro-cracking of pavements may lead to crack formation in locations

Concrete pavements will perform better than asphalt in areas where short radii turning, and braking are expected (i.e., entrance/exit aprons) due to better resistance to rutting and shoving. In addition, concrete pavement will perform better in areas subject to large or sustained loads. An adequate number of longitudinal and transverse control joints should be placed in the rigid pavement in accordance with ACI and/or AASHTO requirements. Expansion (isolation) joints must be full depth and should only be used to isolate fixed objects abutting or within the paved area.

Areas for parking of heavy vehicles, concentrated turn areas, and start/stop maneuvers could require thicker pavement sections. Edge restraints (i.e. concrete curbs or aggregate shoulders) should be planned along curves and areas of maneuvering vehicles. A maintenance program including surface sealing, joint cleaning and sealing, and timely repair of cracks and deteriorated areas will increase the pavement's service life. As an option, thicker sections could be constructed to decrease future maintenance.

Where practical, we recommend early-entry cutting of crack-control joints in concrete pavements. Cutting of the concrete in its "green" state typically reduces the potential for micro-cracking of the pavements prior to the crack control joints being formed, compared to cutting the joints after the concrete has fully set. Micro-cracking of pavements may lead to crack formation in locations other than the sawed joints, and/or reduction of fatigue life of the pavement.

Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subgrade.

Pavement Maintenance

The pavement sections represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore, preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Maintenance consists of both localized maintenance (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Preventive maintenance is usually the priority when implementing a pavement maintenance program. Additional engineering observation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2%.
- Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
- Install joint sealant and seal cracks immediately.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

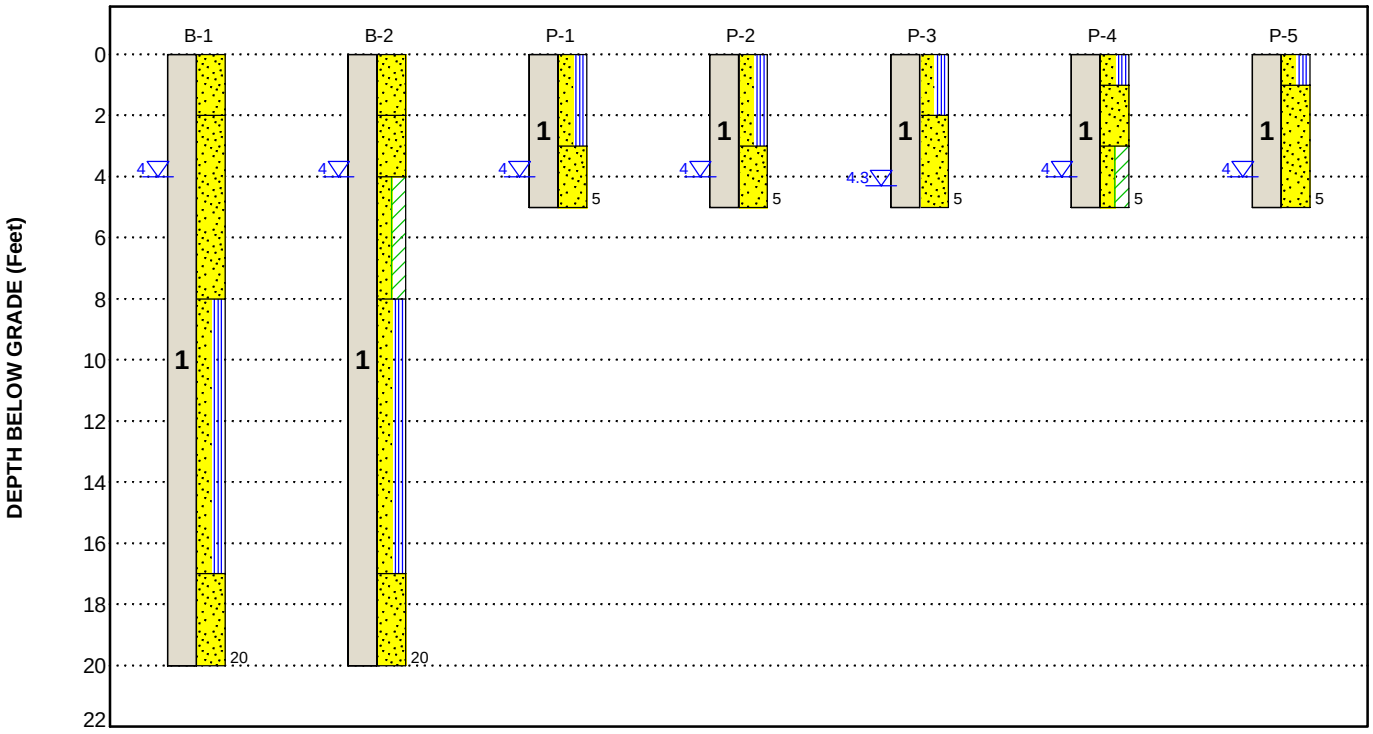
Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

FIGURES

Contents:

GEOMODEL

Panda Express ■ Lutz, FL
Terracon Project No. H4215069



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	SAND	Poorly graded SAND (SP), Poorly graded SAND with silt (SP-SM) and Poorly graded SAND with clay (SP-SC)

LEGEND

- Poorly-graded Sand
- Poorly-graded Sand with Silt
- Poorly-graded Sand with Clay

▽ First Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time. Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.
Numbers adjacent to soil column indicate depth below ground surface.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Number of Borings	Boring Depth (feet)	Planned Location
2	20	buildings
5	5	pavement / utilities

Boring Layout and Elevations: Unless otherwise noted, Terracon personnel provided the boring layout. Coordinates were obtained with a handheld GPS unit (estimated horizontal accuracy of about ±10 feet) If elevations and a more precise boring layout are desired, we recommend boring locations be surveyed.

Subsurface Exploration Procedures: We advanced the borings with a track-mounted, rotary drill rig using slurry drilling methods. Five samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon for each six-inch penetration is recorded. The 2nd and 3rd six-increments are added together and reported as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. We observed and recorded groundwater levels during drilling and sampling. For safety purposes, all borings were backfilled with bentonite chips after their completion.

The hand auger boring procedure consisted of manually turning a 3-inch diameter, 6-inch long sampler into the soil until it was full. The sampler was then retrieved and the soils in the sampler were visually examined and classified. This procedure was repeated until the desired termination depth was achieved. Samples of representative strata were obtained for further visual examination and classification in our laboratory. Groundwater levels were measured in the boreholes at the time of our field exploration to evaluate the depth to groundwater. These borings were then backfilled with soil cuttings upon completion.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests to understand the engineering properties of the various soil strata, as necessary, for this project. Based on the soils encountered, laboratory testing was not deemed necessary to provide the recommendations included in this report.

The laboratory testing program included visual classification of soil samples by an engineer. Based on the material's texture and plasticity, we described and classified the soil samples in accordance with the Unified Soil Classification System.

SITE LOCATION, SOIL SURVEY AND EXPLORATION PLANS

Contents:

SITE LOCATION

Panda Express Project No. S8-22-D8135 ■ Lutz, Pasco County, Florida
May 19, 2021 ■ Terracon Project No. H4215069

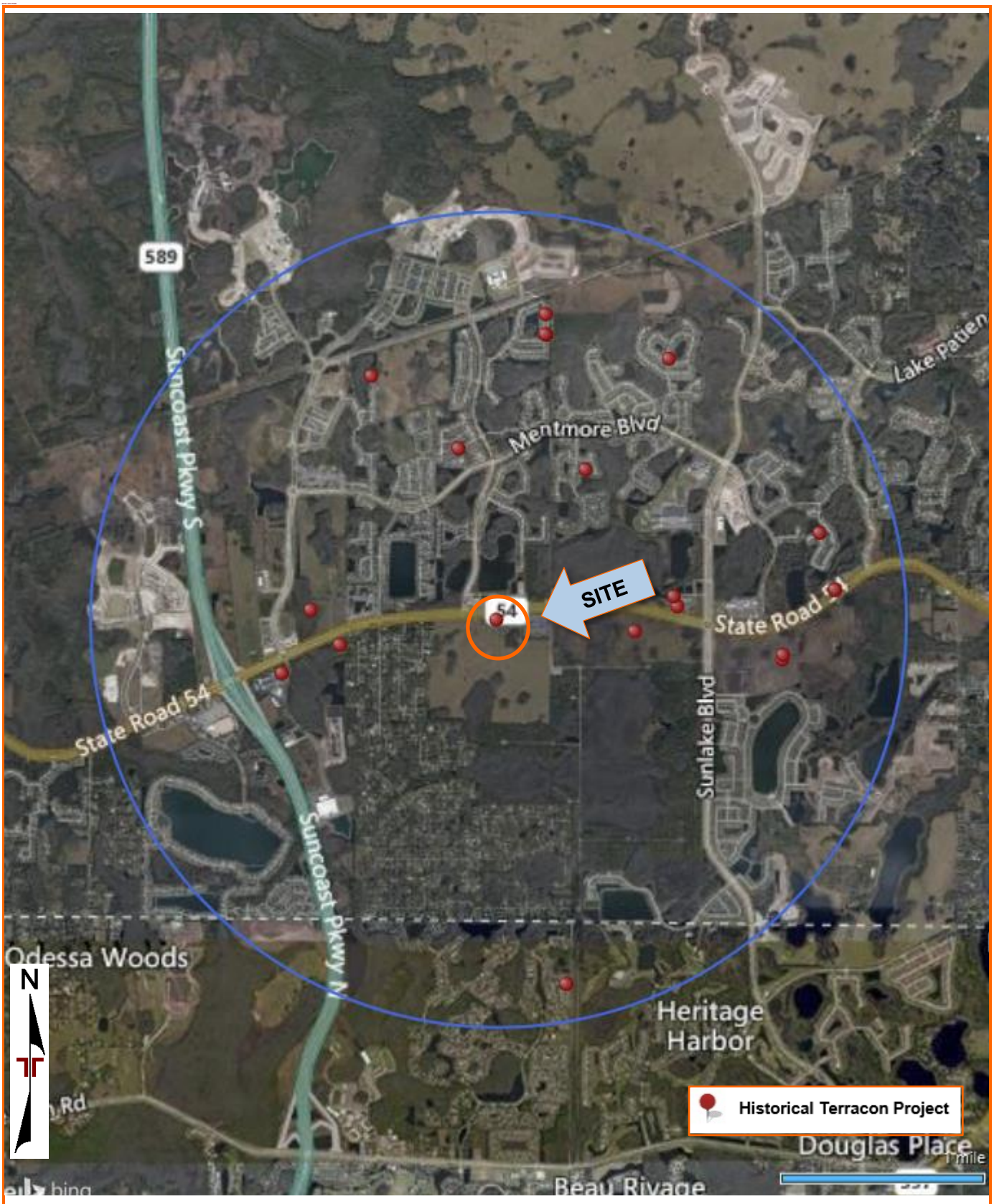


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

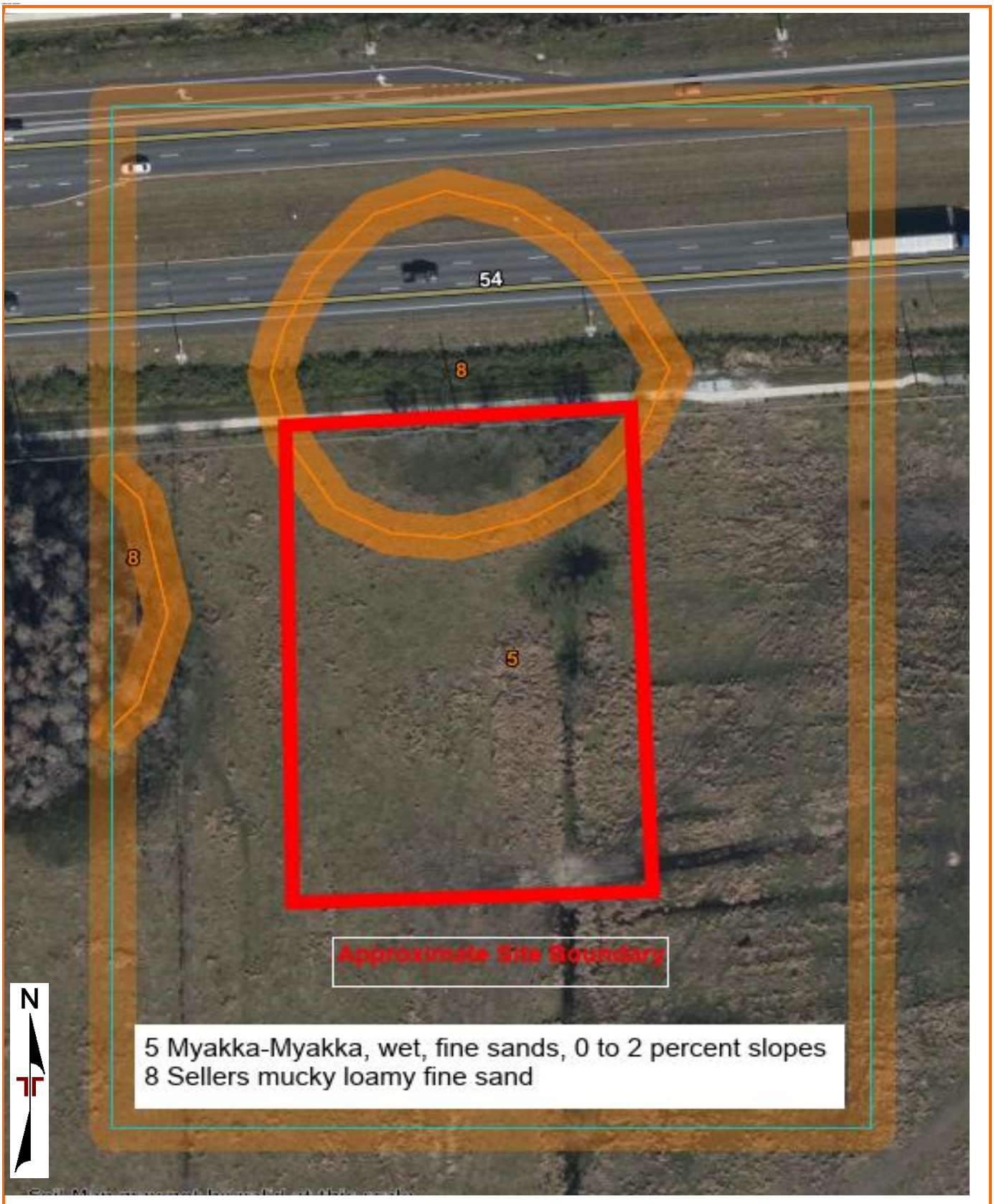


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

Contents:

BORING LOG NO. B-1

PROJECT: Panda Express

CLIENT: Panda Restaurant Group Inc
Rosemead, CA

SITE: State Road 54
Lutz, FL

LOCATION See Exploration Plan

Latitude: 28.1941° Longitude: -82.5224°

MODEL LAYER	DEPTH		WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS
1	0.0	**POORLY GRADED SAND (SP)**, fine grained, dark reddish brown			
	2.0	**POORLY GRADED SAND (SP)**, fine grained, light gray			
		brown, loose	▽		2-3-2-3 N=5
					2-3-4-4 N=7
	8.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine grained, dark brown to black, medium dense			4-7-11-15 N=18
					5-6-6 N=12
	17.0	**POORLY GRADED SAND (SP)**, fine grained, dark gray, medium dense			
	20.0				6-6-12 N=18
		Boring Terminated at 20 Feet			

5 10 15 20

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Auger to 6 feet, mud-rotary below 6 feet

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
5463 W Waters Ave Ste 830
Tampa, FL

Boring Started: 05-10-2021 | Boring Completed: 05-10-2021

Drill Rig: BR 2500 | Driller: J Coolidge

Project No.: H4215069

BORING LOG NO. B-2

PROJECT: Panda Express

CLIENT: Panda Restaurant Group Inc
Rosemead, CA

SITE: State Road 54
Lutz, FL

LOCATION See Exploration Plan

Latitude: 28.1939° Longitude: -82.5225°

MODEL LAYER	DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS
1	0.0	**POORLY GRADED SAND (SP)**, fine grained, dark brown				
	2.0	**POORLY GRADED SAND (SP)**, fine grained, light gray/brown		▽		
	4.0	**POORLY GRADED SAND WITH CLAY (SP-SC)**, fine grained, gray, loose	5			2-1-2-1 N=3
		very loose				1-1-1-3 N=2
	8.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine grained, dark brown, loose				1-2-3-3 N=5
		gray, medium dense	10			
			15			5-6-7 N=13
	17.0	**POORLY GRADED SAND (SP)**, fine grained, gray, medium dense				
	20.0	***Boring Terminated at 20 Feet***	20			5-6-6 N=12

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Auger to 6 feet, mud-rotary below 6 feet

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
5463 W Waters Ave Ste 830
Tampa, FL

Boring Started: 05-10-2021 | Boring Completed: 05-10-2021

Drill Rig: BR 2500 | Driller: J Coolidge

Project No.: H4215069

BORING LOG NO. P-1

PROJECT: Panda Express

CLIENT: Panda Restaurant Group Inc
Rosemead, CA

SITE: State Road 54
Lutz, FL

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 28.1941° Longitude: -82.5223° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS
1		**POORLY GRADED SAND WITH SILT (SP-SM)**, fine grained, dark brown to black				
		3.0				
		POORLY GRADED SAND (SP), fine grained, light gray		▽		
		5.0	5			
		Boring Terminated at 5 Feet				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: N/A

Advancement Method:
Hand auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *At completion of drilling*

Terracon
5463 W Waters Ave Ste 830
Tampa, FL

Boring Started: 05-10-2021 | Boring Completed: 05-10-2021

Drill Rig: N/A | Driller: J Coolidge

Project No.: H4215069

BORING LOG NO. P-2

PROJECT: Panda Express

CLIENT: Panda Restaurant Group Inc
Rosemead, CA

SITE: State Road 54
Lutz, FL

LOCATION See Exploration Plan

Latitude: 28.1941° Longitude: -82.5226°

MODEL LAYER	GRAPHIC LOG	DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS
1		0.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine grained, dark brown				
		3.0	**POORLY GRADED SAND (SP)**, fine grained, light brown		▽		
		5.0	***Boring Terminated at 5 Feet***	5			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: N/A

Advancement Method:
Hand auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *At completion of drilling*

Terracon
5463 W Waters Ave Ste 830
Tampa, FL

Boring Started: 05-10-2021 | Boring Completed: 05-10-2021

Drill Rig: N/A | Driller: J Coolidge

Project No.: H4215069

BORING LOG NO. P-3

PROJECT: Panda Express

CLIENT: Panda Restaurant Group Inc
Rosemead, CA

SITE: State Road 54
Lutz, FL

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 28.1937° Longitude: -82.5227° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS
		POORLY GRADED SAND WITH SILT (SP-SM), fine grained, dark brown				
		2.0				
1		**POORLY GRADED SAND (SP)**, fine grained, brown dark brown gray/brown		▽		
		5.0	5			
		Boring Terminated at 5 Feet				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: N/A

Advancement Method:
Hand auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *At completion of drilling*

Terracon
5463 W Waters Ave Ste 830
Tampa, FL

Boring Started: 05-10-2021 | Boring Completed: 05-10-2021

Drill Rig: N/A | Driller: J Coolidge

Project No.: H4215069

BORING LOG NO. P-4

PROJECT: Panda Express

CLIENT: Panda Restaurant Group Inc
Rosemead, CA

SITE: State Road 54
Lutz, FL

LOCATION See Exploration Plan

Latitude: 28.1938° Longitude: -82.5224°

MODEL LAYER	GRAPHIC LOG	DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS
1		1.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine grained, dark brown				
		3.0	**POORLY GRADED SAND (SP)**, fine grained, dark gray/brown brown				
		5.0	**POORLY GRADED SAND WITH CLAY (SP-SC)**, fine grained, gray/brown		▽		
			Boring Terminated at 5 Feet	5			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: N/A

Advancement Method:
Hand auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *At completion of drilling*

Terracon
5463 W Waters Ave Ste 830
Tampa, FL

Boring Started: 05-10-2021 | Boring Completed: 05-10-2021

Drill Rig: N/A | Driller: J Coolidge

Project No.: H4215069

BORING LOG NO. P-5

PROJECT: Panda Express

CLIENT: Panda Restaurant Group Inc
Rosemead, CA

SITE: State Road 54
Lutz, FL

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 28.1937° Longitude: -82.5222° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS
		POORLY GRADED SAND WITH SILT (SP-SM), fine grained, dark brown to black 1.0				
1		**POORLY GRADED SAND (SP)**, fine grained, brown light gray/brown 5.0		▽		
		Boring Terminated at 5 Feet	5			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: N/A

Advancement Method:
Hand auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *At completion of drilling*

Terracon
5463 W Waters Ave Ste 830
Tampa, FL

Boring Started: 05-10-2021 | Boring Completed: 05-10-2021

Drill Rig: N/A | Driller: J Coolidge

Project No.: H4215069

SUPPORTING INFORMATION

Contents:

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS
Panda Express ■ Lutz, FL
Terracon Project No. H4215069

Terracon GeoReport

SAMPLING

WATER LEVEL

Water Initially Encountered

Water Level After a Specified Period of Time

Water Level After a Specified Period of Time

Cave In Encountered

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

N	**Standard Penetration Test Resistance (Blows/Ft.)**
(HP)	**Hand Penetrometer**
(T)	**Torvane**
(DCP)	**Dynamic Cone Penetrometer**
UC	**Unconfined Compressive Strength**
(PID)	**Photo-Ionization Detector**
(OVA)	**Organic Vapor Analyzer**

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

LOCATION AND ELEVATION NOTES

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		**CONSISTENCY OF FINE-GRAINED SOILS** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**
Very Loose	< 3	Very Soft	less than 0.25	0 - 1
Loose	3 - 8	Soft	0.25 to 0.50	1 - 3
Medium Dense	8 - 24	Medium Stiff	0.50 to 1.00	3 - 5
Dense	24 - 40	Stiff	1.00 to 2.00	6 - 12
Very Dense	> 40	Very Stiff	2.00 to 4.00	12 - 24
		Hard	> 4.00	> 24

RELEVANCE OF SOIL BORING LOG

The soil boring logs contained within this document are intended for application to the project as described in this document. Use of these soil boring logs for any other purpose may not be appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM

Terracon GeoReport

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu ≥ 4 and 1 ≤ Cc ≤ 3 [E]		GW	Well-graded gravel [F]
			Cu < 4 and/or [Cc<1 or Cc>3.0] [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu ≥ 6 and 1 ≤ Cc ≤ 3 [E]		SW	Well-graded sand [I]
			Cu < 6 and/or [Cc<1 or Cc>3.0] [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A"		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K, L, M, N]
			Liquid limit - not dried			Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K, L, M]
			PI plots below "A" line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K, L, M, P]
			Liquid limit - not dried			Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.