tierra SOUTH FLORIDA
GEOTECHNICAL ENGINEERING / MATERIAL TESTING / INSPECTION SERVICES

December 19, 2017

Colome' & Associates, Inc.
530 24th Street
West Palm Beach, Florida 33407

Attention: Ms. Liz Colome'

Re: Geotechnical Engineering Services Report
Proposed Single Family Residence – Mason Renna
208 NW 12th Drive RE: RENNIE GKYLE
TSF File No. 7111-17-456

Dear Liz:

TIERRA SOUTH FLORIDA, INC. (TSF) is pleased to transmit our Geotechnical Engineering Services Report for the referenced project. This report includes the results of field testing, and recommendations for foundation design.

PROJECT INFORMATION

Project Authorization

TSF has completed a geotechnical exploration for the proposed Residence at 208 NW 12th Drive in Belle Glade, Florida. The work was authorized by Liz Colome' of Colome' & Associates by signing our TSF Proposal No. 1707-414, dated July 24, 2017.

Project Description

Based on information provided to this office, it is our understanding that the planned development will include one-story CBS structure with a connected garage. Based on past experience with similar type structures we anticipate column and wall loads in the order of 100 kips and 2.5 kips per linear foot, respectively.

At the time of construction, the property was occupied by a residence, sparse grass/vegetation and trees. We understand that the existing residence will be demolished and a new home constructed near or at the same location. The geotechnical recommendations presented in this report are based on the available project information, building location, and the subsurface materials described in this report. *We recommend that a series of shallow test pits be excavated within the proposed building footprint (after demolition) so the preliminary recommendations provided herein can be confirmed.*

If any of the noted information is incorrect, please inform TSF in writing so that we may amend the recommendations presented in this report if appropriate and if desired by the client. TSF will not be responsible for the implementation of its recommendations when it is not notified of changes in the project.

Purpose and Scope of Services

The purpose of this study was to explore the subsurface conditions within the proposed site, close to existing residence, to enable an evaluation of foundations for the proposed construction. The test boring location was selected by TSF staff.

Our scope of services included drilling one (1) Standard Penetration Test (SPT) boring to a depth of 20 feet below existing grade in the proposed residence/garage, plus the preparation of this geotechnical report.

SITE AND SUBSURFACE CONDITIONS

Site Location and Description

The project site is located at 208 NW 12th Drive in Belle Glade, Florida. At the time of our field work, the property was occupied by a single-story residence. Sparse grass/vegetation and trees were noted throughout the site.

Subsurface Conditions

Review of "Soil Survey of Palm Beach County Area, Florida", prepared by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS), indicates the site is mapped primarily as follows:

- Torry muck: This a nearly level, very poorly drained, deep, organic soil in broad, freshwater marshes. This soil formed in well-decomposed remains of hydrophytic plants mixed with a high content of fine textured mineral material.

Subsurface conditions at the site were explored with one (1) Standard Penetration Test (SPT) boring to a depth of 20 feet below existing grade in the proposed residence/garage, located as shown on the Boring Location Plan, Sheet 1. The SPT boring was drilled using a CME-55 drill rig, and mud rotary procedures. Samples of the in-place materials were recovered at frequent intervals using a standard split spoon driven with a 140-pound hammer freely falling 30 inches (the SPT sampling after ASTM D 1586). The samples of the in-place soils were returned to our laboratory for classification by a geotechnical engineer. The samples were classified in general accordance with the Unified Soil Classification System (ASTM D 2488).

Based on visual classifications, the materials encountered beneath the topsoil typically consisted of dark brown organic silt (OL) followed by limestone extending to the termination depth of the boring. The SPT N-value in the boring indicates that the existing organic soil is in very loose condition. The soil profiles are also presented on Sheet 1.

The above subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The soil boring profiles should be reviewed for specific information at individual boring locations. These records include soil descriptions, stratifications, and Standard Penetration resistances. The stratifications shown on the soil profiles represent the conditions only at the actual boring location. Variations may occur and should be expected at other locations.

The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual. Water level information obtained during field operations is also shown on these soil profiles. Samples collected for classification and laboratory testing will be retained for 30 days from the date of this report and then will be discarded.

Groundwater Information

Groundwater level was measured in the boring upon completion of the drilling activities. The groundwater table was about 5 to 6 feet from ground surface within the borings at the time of drilling. We expect the ground water to fluctuate with seasonal variations.

Dewatering will be required for in-the-dry construction over those sections of the site where the invert/bottom elevations of the pipelines/structures fall below the water table. Should sections of the excavation encounter the groundwater table, we expect that groundwater control can be accomplished through open pumping in those areas where draw down requirements are 1 foot or less. Open pumping dewatering can most positively be accomplished by over-excavating the trench by 6 to 12 inches and backfilling the over cut section with coarse gravel.

Water which flows through the gravel should be directed to a sump where it can be collected and pumped to a suitable discharge point. Precautions should be taken during open pumping to assure that fines are not withdrawn from the surrounding soils since this could result in undesirable settlement occurring. If the draw down requirements is greater than 1 foot, we believe well point dewatering may be required.

In general, the seasonal high groundwater level is not intended to define a limit or ensure that future seasonal fluctuations in groundwater levels will not exceed the estimated levels. The groundwater levels could exceed the normal seasonal high groundwater level estimate as a result of a series of rainfall events, changed conditions at the site that alter surface water drainage characteristics, or variations in the duration, intensity, or total volume of rainfall. We recommend that the Contractor determine the actual groundwater levels at the time of the construction to determine groundwater impact on his or her construction procedures.

FOUNDATION RECOMMENDATIONS

The geotechnical study completed for the proposed residence confirms that the site in its present condition is not suitable for the planned construction when viewed from a soil mechanics and foundation engineering perspective. In its current condition, the soft organic soils will consolidate over time and will not provide safe support to shallow spread foundations, and slab-on-grade systems. We recommend that the organic soils within the proposed building pad, and 10 feet outside, be removed and the resulting excavation backfilled with clean sands. After following proper site preparation procedures, the structures may be supported on shallow spread foundations and employ conventional slab-on-grade for the ground floors.

As an alternative to de-mucking, the proposed structures be supported on a system of deep foundation.

We also recommend that a series of shallow test pits be excavated within the proposed building footprint (after demolition) so the preliminary recommendations provided herein can be confirmed.

Removal of Organic Soils/Shallow Foundation

To prepare for construction, we recommend that any topsoil/vegetation, remnants of previous construction within the footprint of the proposed construction be stripped, removed and wasted. After demolition, stripping, the organics from footprint of the proposed building structures and 10 feet beyond should be removed (demucked) in its entirety. After removal of the organics, if ground water is encountered, the excavation should be backfilled with suitable structural fill (sand) to about 12-inches above the water table. The approved fill should be proof rolled with a self-propelled roller (Ingersoll-Rand SD100D or equivalent), following which approved fill material could be placed in no more than 12-inch-thick lifts and compacted with an Ingersoll-Rand SD100D or equivalent to 95 percent of maximum dry density (ASTM D 1557). Structural fill used to raise the site to structure bottom levels should consist of clean sand and/or sand and gravel (ASTM D 2487), with a maximum of 12 percent passing the U.S. Standard No. 200 sieve.

The soil densification should encompass the entire footprint of the structure plus a 10-foot wide perimeter that extends beyond the maximum lines of the superstructures.

As an alternative to using sand, the excavation could be backfilled and compacted with approved #57 stone up to 18-inches above groundwater. We expect about 5 feet deep excavations will, typically, be required to remove the organics.

Near existing buildings (within 50 feet), compaction should be performed in a static mode. Ground vibrations induced by the compaction operations should be closely monitored to assess if there is a potential impact to any existing adjacent structures.

We recommend performing test pits to better assess de-mucking and dewatering efforts during construction.

Following site preparation as discussed herein, the foundation areas should be excavated and the footing subgrade should be compacted with a heavy roller to the above mentioned 95% criteria. Unsuitable material or organic soils (if any) found at foundation bottoms should be removed and replaced with structural fill, as discussed above. The footings should be formed and poured in-the-dry. Prior to placing the steel for the footings, the footing subgrade should be inspected by a TSF representative.

Each lift of compacted engineered fill should be tested by a representative of the geotechnical engineer prior to placement of subsequent lifts. The edges of compacted fill should extend 10 feet beyond the edges of buildings prior to sloping.

Based on the data currently available and given the site preparation is completed as discussed above, we recommend supporting the planned structures on conventional spread foundations/turn down slabs based in engineered fill and/or the surficial granular soils of the site. The footings should be designed and proportioned for a maximum bearing pressure of 2,500 pounds per square foot (psf). Footings should bottom at least 18 inches below final grade. Footings supporting individual columns should have a minimum width of 36 inches and continuous footings a minimum width of 24 inches, even if the geometry produces a bearing pressure less than the allowable.

Given site and soil preparation that is completed before footing construction, and using the design criteria discussed above, we estimate that total and differential foundation settlements should be less than 1 inch and ½ inch, respectively. The settlement forecast is based on imposed soil bearing pressure from structural loadings not exceeding 2,500 pounds per square foot.

The foundation excavations should be observed by a representative of TSF prior to steel or concrete placements to assess those foundation materials are capable of supporting the design loads and are consistent with the materials discussed in this report. Loose soil zones encountered at the bottom of the footing excavations should be removed to the level of medium dense soils or adequately compacted structural fill as directed by the geotechnical engineer.

Helical Piers Recommendations

A helical pile/pier, sometimes called a screw pile, consists of a spiral-shaped head and galvanized steel pipe extension sections (flights). The pile is rotated into a stable bearing stratum, using a high-torque hydraulic motor, until the necessary load capacity has been achieved as verified by means of a pressure gauge. The pile is attached via a bracket to the base of the foundation to transfer the structural load to the pile. Helical pile installation creates no spoil and can be performed in limited access situations. *In limestone formations, it is recommended to use a starter section consisting of tubular shaft with rock socket lead. The pile needs to be advanced into the upper limestone to provide sufficient capacities and avoid slippage.*

A transition structural steel pile, square to tubular, with a $2^{7/8}$ -inch round (8 or 10-inch helix) double rock socket should provide sufficient support provided it is socketed at least 2 feet into limestone. Based on the boring log data, the designer can use 4.0 tsf allowable friction of the limestone. Final design recommendations will be provided by Specialty Contractor based on their experience and once structural loading information is finalized.

As a guide to assist the Contractor with obtaining costs associated with:

- Helical Piers/Dosdourian Enterprises, Inc., please contact Mr. Sam Dosdourian, cell (561) 719-8028, e-mail: sam@fixdirt.com

It will be prudent to retain the services of TSF during foundation improvements in order to verify that the recommendations provided herein are being properly followed.

FLOOR SLAB RECOMMENDATIONS

Once removal and backfill of unsuitable soils is complete, slab-on-grade construction may then be employed for the ground floor of the building. The floor slab should be suitably reinforced to make it as rigid as practical. Joints should be provided at the junctions of the slab with the walls and columns so that a small amount of independent movement can occur without causing damage. The floor slab design, if based on elastic methods, should employ a modulus of subgrade reaction of 150 pounds per cubic inch (pci).

If moisture intrusion into the floor slab is not desired, an impermeable membrane should be installed on the soil subgrade before the slab is cast. Normally, a 6-mil thick polyethylene film is satisfactory as a subgrade moisture barrier. However, some floor coverings may have a comparatively sensitive tolerance to moisture flux that a thin polyethylene film cannot suppress. Under these conditions, other types of moisture membranes may need to be considered.

The friction factor between the soil and floor slabs should be taken as 0.35 without the vapor barrier. A friction factor of 0.21 should be used for the vapor barrier-soil interface.

A structural slab is recommended if the option of deep foundations to support the structure is selected.

CONSTRUCTION CONSIDERATIONS

It is recommended that TSF be retained to provide observation and testing of construction activities involved in the foundation and related activities of this project. TSF cannot accept any responsibility for any conditions that deviate from those described in this report, nor for the performance of the foundation if not engaged to also provide construction observation and testing for this project.

Excavations

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P." This document was issued to better ensure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that excavations, whether they be utility trenches, basement excavations or footing excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottoms. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

We are providing this information solely as a service to our client. TSF does not assume responsibility for construction site safety or the contractor's or other parties' compliance with local, state, and federal safety or other regulations.

REPORT LIMITATIONS

The recommendations submitted are based on the available subsurface information obtained by TSF 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, TSF should be notified immediately to determine if changes in the preliminary foundation recommendations are required. If TSF is not retained to perform these functions, TSF will not be responsible for the impact of those conditions of the project.

The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

After the plans and specifications are more complete, the geotechnical engineer should be retained and provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents.

This geotechnical report has been prepared for the exclusive use of Colome & Associates for the specific application to the proposed Residence located at 208 NW 12th Drive in Belle Glade, Florida.

CLOSURE

We appreciate the opportunity to perform this Geotechnical Study and look forward to continued participation during the design and construction phase of this project. If you have any questions pertaining to this report, or if we may be of further service, please contact our office.

Respectfully submitted,

TERRA SOUTH FLORIDA, INC.

FRANCOIS J. THOMAS LICENSE No 56381 STATE OF FLORIDA PROFESSIONAL ENGINEER 12/19/17

Francois Thomas, P.E.
Principal Engineer
FL. Registration No. 56381

12/19/17

Raj Krishnasamy, P.E.
President

Attachments: Boring Location Plan/Soil Profiles – Sheet 1

BORING LOCATION PLAN

Approximate Location of SPT Boring

LEGEND