APEX
ENGINEERS, INC.

November 2, 2016

Summit Custom Homes
120 SE 30th Street
Lee's Summit, MO 64082

Re: 304 SE Mill Creek Drive
Lot 97, Mill Creek

Apex Engineers, Inc. observed the excavation located at the address above. The soil conditions were evaluated.

The excavation currently terminates on material that will not adequately support the proposed house. Our firm recommends the following foundation system:

- Drill 18" diameter concrete piers per the attached layout.
- Piers shall be drilled to competent original limestone, sandstone, or shale.
- The piers shall be reinforced with (2) #4 bars for the depth of the pier.
- (2) #4 bars shall be embedded a minimum of 24" into the top of each pier and shall extend a minimum of 24" into the footings.
- All piers shall be inspected by our firm prior to the placement of concrete.
- Upon approval and completion of the piers, the foundation footings, walls, and slabs shall be placed over the piers. **If the city approved plans do not exceed the following minimum specifications, then, as needed, the foundation shall be improved per the following:**
    - 3000 psi concrete, Grade 40 reinforcing steel, Lap splices min. 24"
    - The footing shall be a minimum of 16"x8" with (2) #4 bars continuous.
    - The wall shall be a minimum of 8" thick with #4 bars at 24" o.c. each-way.
    - The walkout frost trench shall be a minimum of 12" wide by 36" deep with (2) #4 bars continuous T&B.
    - Grade beams/thickened slabs shall be a minimum of 16" wide by 12" deep with (3) #4 bars continuous T&B.
    - The garage and basement slabs shall be structural.
        - Place 5" concrete slab w/ #4 bars at 12" o.c. each-way on 1-1/2" chairs.
        - Add (4) 10'-0" long #4 bars each-way over the column pads and slab support piers. Place with 1" to 1-1/2" slab top cover (3" chairs). See attached layout and slab details for clarity.
        - The perimeter of the slab shall bear on the foundation as follows:
            - Minimum 3" keyway or footing, OR
            - Drill 5" deep and pin to foundation with #4 bars at 12" on center.

The above recommendation is based on bearing capacity only. Our firm has not been retained to determine the shrink/swell capacity of the soil and therefore cannot be held responsible for the volumetric changes of the soil (including below the basement slab). As with all houses on clay soils, the following precautions shall be followed to mitigate the potential for expansive clay issues. Install a sump pit and pump connected to the exterior foundation drain. Isolate the basement steel column to concrete pad connection from the basement slab. Non-load bearing basement stud walls shall be framed to allow 1" of vertical movement.

Slope stability and final grading shall be the responsibility of others. The contractor shall take the necessary steps to stabilize the lot (i.e. proper grading & slope per code, retaining walls, etc.).

RECOMMENDATIONS

The surface drainage must be designed to effectively move water away from the home and to prevent ponding. Poor drainage near a structure can also contribute to settlement problems. The failure to control drainage can result in the saturation and weakening of the surrounding soil causing settlement. A proper drain system, consisting of a drain tile draining to a sump pit and pump shall be installed and maintained in compliance with Section R405 and R406 of the International Residential Code. A build-up of water beneath the foundation can cause heaving of the foundation (pier pads) and basement slab resulting in sheet rock cracks and damage to the structure.

Due to the unpredictable nature of expansive clay soils, no guarantees can be made as to if and when future movement may occur. However, precautionary measures can be taken. Poor drainage increases the stresses on foundation walls, and therefore, a proper grade must be maintained away from the foundation. A positive slope of 1 inch per foot drop for 6 to 10 feet away from the house is required. Rain gutters and downspouts with extensions should be installed to direct water safe distances away from the house and from existing structures that could be adversely affected. Proper watering of the foundation system should also be maintained throughout the year, especially during extremely dry periods. In addition, all permanent slopes should be no steeper than 3:1 (horizontal to vertical) to help ensure their future stability and the accommodation of normal mowing equipment.

Apex Engineers, Inc. cannot be held responsible for the impact and/or damages caused to the structure if the aforementioned recommendations are not followed and maintained.

LIMITATIONS

The scope of our services was only to visually observe and report the existing bearing conditions (capacity only) beneath the foundation elements for the new home. When making visual observations, it should be clearly understood that certain assumptions must be made regarding the existing conditions without the aid of drilling and/or testing, which could reveal additional information that could change the recommendations and conclusions given in this report. No evaluation of slope stability, foundation wall backfill, slab-on-grade support, pavements, retaining wall structures or the suitability of any material removed from the basement excavation for any particular purpose was made unless specifically addressed herein. As a result, Apex Engineers, Inc. cannot be held responsible for the impact of those conditions on the project or future performance of the structure. Finally, a standard footing inspection should be made to verify the actual bearing conditions prior to the placement of reinforcing steel and concrete.

Shrink, swell characteristics are inherent with all clay soils and can adversely affect or jeopardize the performance of the foundation system. Apex Engineers, Inc. has not been retained to evaluate the potential expansive properties of any existing bearing material(s). Apex Engineers, Inc.'s services are not insurance, nor can it guarantee or predict future movement caused by the natural movement attributed to the shrinking and swelling of clay

APEX
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sub soils. Therefore, Apex Engineers, Inc. cannot be held responsible for future movement and/or damage to the structure associated with such movement (including, but not limited to, foundations elements supported by continuous strip footings, isolated pier pads, or drilled piers). The contractor shall retain sole liability and responsibility for the quality of work, for adhering to plans, specifications, appropriate codes, and for repairing defects, deficiencies, or damages regardless of cause and/or when they are found. Apex Engineers, Inc. has performed our services in a manner consistent with the standard of care and skill ordinarily exercised by firms of our type practicing under similar conditions at this time and locality.

To the fullest extent permitted and allowed by law, Apex Engineers, Inc.'s client shall indemnify and hold harmless Apex Engineers, Inc. and sub-consultants from and against all damage, liability and costs, including reasonable attorney's fees and cost of defense, to the extent caused by the performance of the services under this report, excepting only those damages, liabilities or costs attributable to the sole negligence or willful misconduct of Apex Engineers, Inc.

The recommendations and conclusions given in this report are based on the observed conditions at the time of this site visit. These conditions may be altered over time and/or with changes in the weather. If ground water ponds in the basement excavation, soft soil conditions may require further excavation and/or filling to provide uniform support beneath all the footings and floor slab. Therefore, if water ponds in this excavation or other changes occur that could affect any of the recommendations given in this report, Apex Engineers, Inc. shall be called back and allowed to re-evaluate our previous recommendations and/or conclusions. If changes in the condition of the site occur and Apex Engineers, Inc. is not allowed the opportunity to re-evaluate the site to respond to any of these changes, our firm cannot be responsible for the effect of any of the conditions that differed from those reported herein.

The scope of our services does not include any environmental assessment (such as, but not limited to mold, mildew, presence of hazardous or toxic materials in the soil, surface water, ground water, etc.). An environmental specialist should be consulted for these types of issues.

Please call if Apex Engineers, Inc. can be of further assistance.

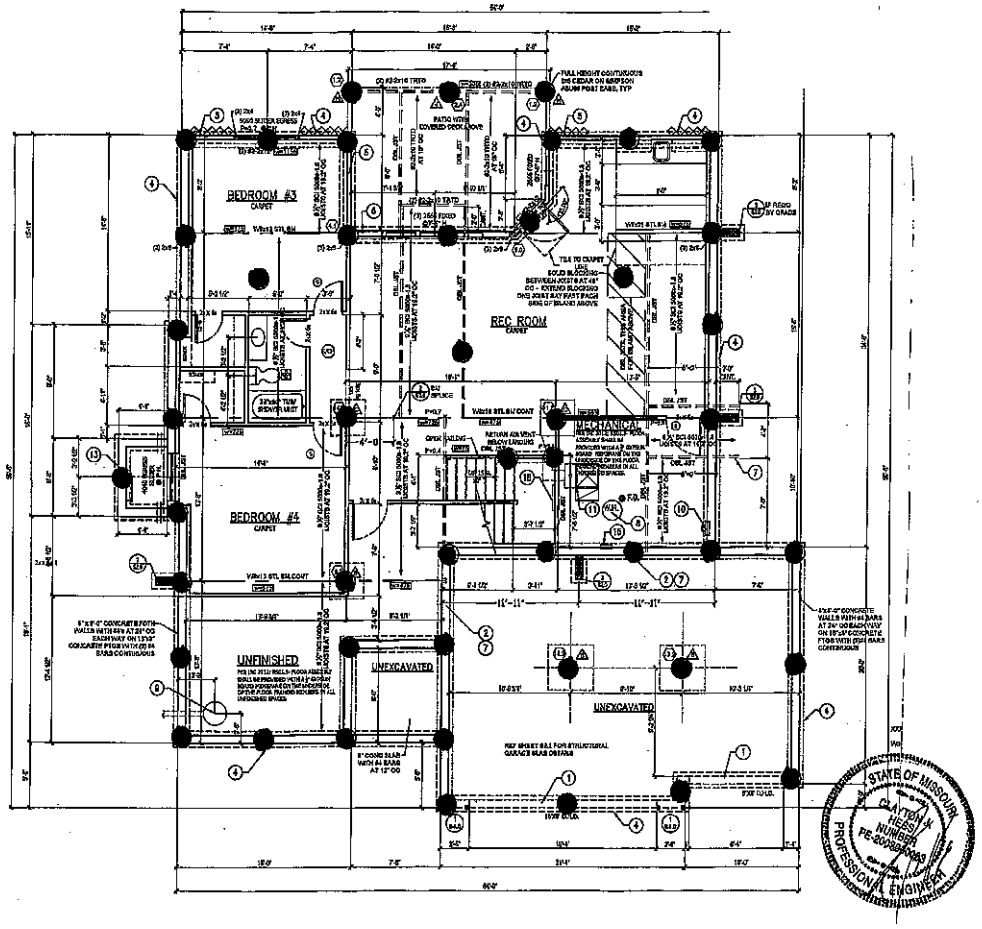
Best Regards,
Apex Engineers, Inc.

STATE OF MISSOURI
CLAYTON J. HESS
NUMBER
PE-2003000003
PROFESSIONAL ENGINEER

Clayton J. Hess, P.E.
Principal

Enclosure: Pier Layout, Pier Detail

cc: City of Lee's Summit; ABI; PTM



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STRUCTURAL DESIGN REVIEW
KANSAS ENGINEERING LICENSE: 622
MISSOURI ENGINEERING LICENSE: 2003004873

PROJECT:
304 SE Mill Creek Drive
Lot 97, Mill Creek

CLIENT:
Summit

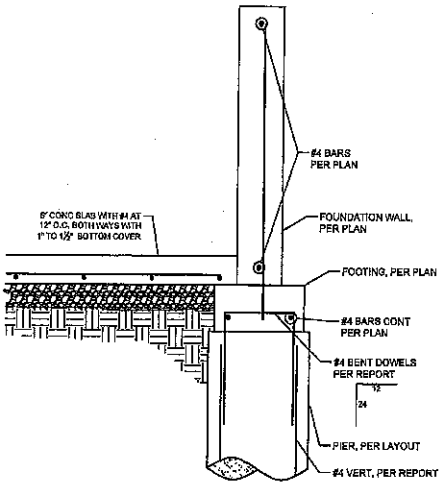
PROJECT #

DRAWING NAME
LAYOUT

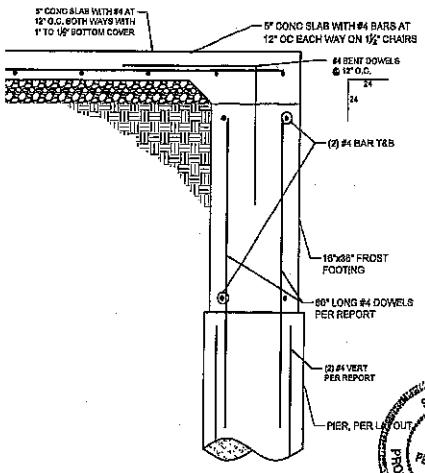
DATE:	COMMENTS:

DRAWN BY: APEX
CHECKED BY: —

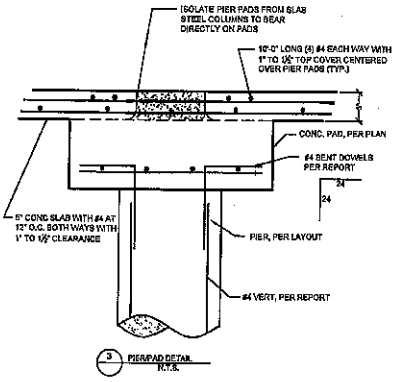
SHEET #
1 OF 2



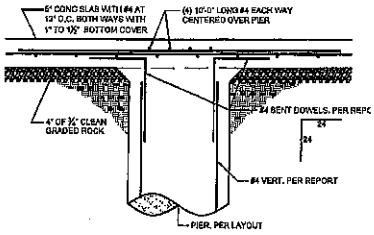
6 PIER/FOOTING DETAIL
N.T.S.



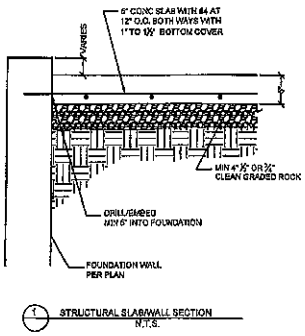
4 PIER/FROST FOOTING DETAIL
N.T.S.



3 PIER/PAD DETAIL
N.T.S.



2 SLAB SUPPORT PIER DETAIL
N.T.S.



1 STRUCTURAL SLAB/WALL SECTION
N.T.S.

STATE OF MISSOURI
CLAYTON J. HESS
NUMBER
PE-2003004573
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STRUCTURAL DESIGN REVIEW
KANSAS ENGINEERING LICENSE: 992
MISSOURI ENGINEERING LICENSE: 2003004573

PROJECT: 304 SE Mill Creek Drive
Lot 97, Mill Creek

CLIENT: Summit

PROJECT #

DRAWING NAME

DETAILS

DATE:	COMMENTS:

DRAWN BY: APEX
CHECKED BY: ---

SHEET #
2 OF 2