SCOTT, COX & ASSOCIATES, INC. consulting engineers • surveyors

July 14, 2010

Boulder Housing Partners
4800 N. Broadway
Boulder, CO 80304

Attn: Ms. Laura Sheinbaum

Project: 10288

Dear Ms. Sheinbaum:

On July 2, 2010, a representative of Scott, Cox & Associates, Inc. observed the drilling and sampling of a test boring drilled for the proposed addition to the existing structure located at 4610 Arapahoe Avenue in Boulder, Colorado. The boring was drilled on the north side of the existing structure near the area of the proposed addition, where accessible with a drilling rig. We understand that the addition is to be a new exterior stairway and entry. No new below grade spaces are planned. The foundation system of the existing structure is unknown at this time, however is assumed to be spread footings.

The boring was completed with a 4-inch diameter, continuous flight augers, using a truck-mounted drilling rig. Samples were taken using a 2-inch I.D. California Spoon Sampler at various depths. The sampling procedure is similar to the Standard Penetration Test described in ASTM D1586.

A 1½-inch thick layer of topsoil was encountered at the surface. A dark brown to brown, very silty, sandy to very sandy clay was encountered at a depth of approximately 1½ feet and extended to a depth of approximately 5 feet. The clays were underlain by a silty, sand with some clay layers which extended to a depth of approximately 8 feet. Brown, silty, sand and gravel was encountered at a depth of approximately 8 feet and extended to a depth of approximately 13 feet. The surficial soils were underlain by claystone bedrock at a depth of approximately 13 feet which extended to the maximum depth explored of approximately 25 feet. Groundwater was encountered in the boring during drilling and when checked subsequent to drilling at a depth of approximately 8 feet below the existing ground surface. We are near the time of the seasonal high groundwater table, and some rise of the groundwater table is anticipated. It is not possible to forecast the seasonal high groundwater table based on short duration monitoring. The only sure method of such determination is monitoring of the water table through the spring and early summer (typical seasonal high groundwater levels occur about July 1). Improper drainage could also result in a "perched" groundwater table. Also, any ditches, streams or other water features can also influence the depths to the groundwater table at the site (refer to Figure 1, Graphic Boring Log).

Any existing fill is not considered suitable to support any foundation loadings. The laboratory testing of the upper level sandy clays indicated that they have a low expansive potential.

In general, the naturally occurring very silty, sandy to very sandy clay soils are of low expansive potential and are relatively weak. The sand and sand and gravel are considered suitable to support footings or pads. It is our opinion that the addition can be supported on conventional spread footings, either continuous spread footings or isolated pad footings, founded on the native sand or sand and gravel clay soils. Footings placed on the silty, sand or sand and gravel should be designed utilizing a uniform soils bearing pressure not to exceed 1,500 PSF. The loading should be based on the dead load plus 100% of the maximum anticipated live load. There also may be soft areas which will need to be over excavated and replaced back with a rock blanket. This will need to be determined at the time of excavation.

Any areas of existing fill, soft, loose or potentially expansive soils, which are present at the proposed footing level, should be removed down to satisfactory, undisturbed soil. Footings can be placed directly upon the native undisturbed soils or the excavation can be backfilled to the desired footing elevation with compacted, select granular fill placed in lifts not to exceed 9 inches in thickness and compacted to a minimum of 100% of maximum density as determined by the standard moisture/density relationship ASTM698.

Drilled piers into bedrock could be considered as an option. However they will require casing and may be relatively expensive. We are available to provide appropriate recommendations if you would like to pursue this option.

The soils beneath the slabs will have some swell or settlement potential. These soils are stable at their natural moisture content, but upon fluctuation of their moisture content, can cause heaving and cracking of lightly loaded slabs-on-grade. If slabs are founded on these potentially expansive soils, cracking and slab distortion is possible. Slab-on-grade construction can be used as long as the owners realize and accept the risk that some slab cracking and heaving is likely to occur. **However, the only way to eliminate damage as a result of floor slab**

movement will be to construct a structural floor, independent of the underlying expansive soils.

The actual amount of possible slab heave is very subjective due to variability in the soils resulting in variability in expansion and also the degree and depth of wetting beneath the slabs. Outlined below is a prediction of the possible slab movements for the general soils at this site based upon a typical maximum wetting depths of five feet, which is an average worse case scenario. There were typically two different soil types at the site, which could influence the slabs-on-grade, the first type being a low expansive sandy clay stratum and the second a very low expansive sand or sand and gravel stratum.

Sandy Clay, (Low expansion potential) – approximately ½ to 1½ inches
Sand or Sand and Gravel, (Very Low expansion potential) – approximately ½ inch

It should be noted that these potential movements are only a prediction based upon the typical slab movements seen from similar soils and wetting conditions.

If a slab-on-grade is utilized on this site, the following construction techniques may be utilized to help prevent secondary damage that could be caused by slab movement.

1. Separate slabs from the foundation elements with a slip joint. One method of doing this is to use two layers of tempered hardboard with a silicone lubricant between the boards. A slip joint should be used around the perimeter of the slab and adjacent to any other structural elements.

2. Moderately reinforce slabs with reinforcement continuous through interior slab joints. Slab joints must be provided to control the cracking. The floor joint grid should be designed to allow no more than 200 square feet of continuous slab area.

3. Any load bearing partitions or columns must be provided with their own foundation system and the slab separated as outlined above.

4. Provide a 2-inch minimum air space below any interior non-load bearing partition to provide for slab movement without immediate damage to the structure. If unsure of the proper construction methods to achieve the recommended air space, we should be contacted for further recommendations.

5. Any pipes rising through the slab should be provided with flexible couplings or other means to allow substantial movement without damage to the piping. Any ducts connecting to equipment founded on the slab should be equipped with flexible or crushable connections to allow for some slab movement.

6. Equipment and other building appurtenances constructed on the slab should be constructed so that slab movement will not cause damage.

Following the recommendations given above will not prevent movement of the floor slabs in the event that the moisture content of the soil beneath the slab changes. However, if movement occurs, damage will have been reduced for a relatively small investment.

Prior to pouring any slab it is essential that all debris, topsoil and organic materials be removed and all loose fill either removed or compacted to 95% of maximum density as determined by the standard moisture/density relationship test ASTM D698. If any fill is required beneath the proposed slab we recommend using a granular fill compacted in 12" maximum lifts to the standard referenced above.

Satisfactory long-term performance of any foundation system depends on prevention of infiltration of water into the foundation system. Therefore, the following recommendations are given to prevent the wetting of foundation soils.

1. Mechanically compact all fill around the building, including the backfill. Compaction by ponding or saturation must not be permitted. The backfill should be compacted to not less than 90% of maximum density as determined by the standard moisture/density relationship ASTM D698. Backfill, which is to support slabs, should be compacted to 95% of maximum dry density. Note that some moisture may need to be added to the soils in order to obtain the proper compaction.

2. Provide an adequate grade for rapid runoff of surface water away from the structure (a minimum of 10 percent for the first 10 feet away from the structure is recommended, 2 percent if paved).

3. A well constructed, leak-resistant series of gutters, or other roof drainage system, is essential.

4. Discharge roof downspouts and all other water collection systems well beyond the limits of the backfill, a minimum of 5 feet.

5. Avoid heavy watering of any foundation plantings.

6. Observe and comply with any other precautions, which may be indicated during design and construction.

It is our opinion that a perimeter drainage system is not necessary with the at or above grade construction. If plans change to include any below grade spaces, we should be contacted to provide appropriate recommendations.

At this site we recommend that the walls be designed using a lateral earth pressure equivalent to that developed by a fluid weighing 45 pcf plus any additional surcharge loads. Use of this value assumes that the wall will be backfilled with the site soils and that these soils will not be allowed to become saturated at any time during the life of the wall. Saturation can be prevented by proper site grading and drainage and installation of drainage systems at the base of any walls that are to retain soil above grade. This value is valid for walls up to 10 feet in height.

The boring completed during this investigation is believed to give a reasonably accurate knowledge of the existing subsoils. However, it is possible that conditions exist that cannot be anticipated from this investigation. We recommend that the excavation be inspected by an engineer knowledgeable in foundation soils to confirm that the soils are as anticipated for design and to make further recommendations if differences are noted.

We would like to stress that it is not possible to fully determine the seasonal groundwater table fluctuations (and, therefore, the seasonal high groundwater table) with the short duration monitoring completed during the scope of this investigation. We have presented the method necessary to do such determination. It is always possible that the groundwater table could rise to unanticipated levels, due to unknown or unrecognized groundwater sources. Unanticipated groundwater levels will also impact the recommendations, contained in this report, for the perimeter drainage system type and extent, which may be inappropriate for groundwater table levels that rise to unanticipated levels.

Due to the changing nature of geotechnical engineering practices, the information and recommendations provided in this report shall only be valid for two (2) years following the date of issue. After that time, our office should be contacted to review the information presented in this report and provide updated recommendations and design criteria appropriate for the engineering methodologies used in standard practice at that time.

Thank you for consulting with us on this phase of the project. If you have any questions concerning this report, please do not hesitate to contact us.

Sincerely,

SCOTT, COX & ASSOCIATES, INC.

By: ______________________
Kevin L. Hinds, P.E.

Reviewed

By: ______________________
M. Edward Glassgow, P.E.

Attachments

Cc: Gebau Consulting Engineers
Odell Architecture, P.C.

Graphic Boring Log

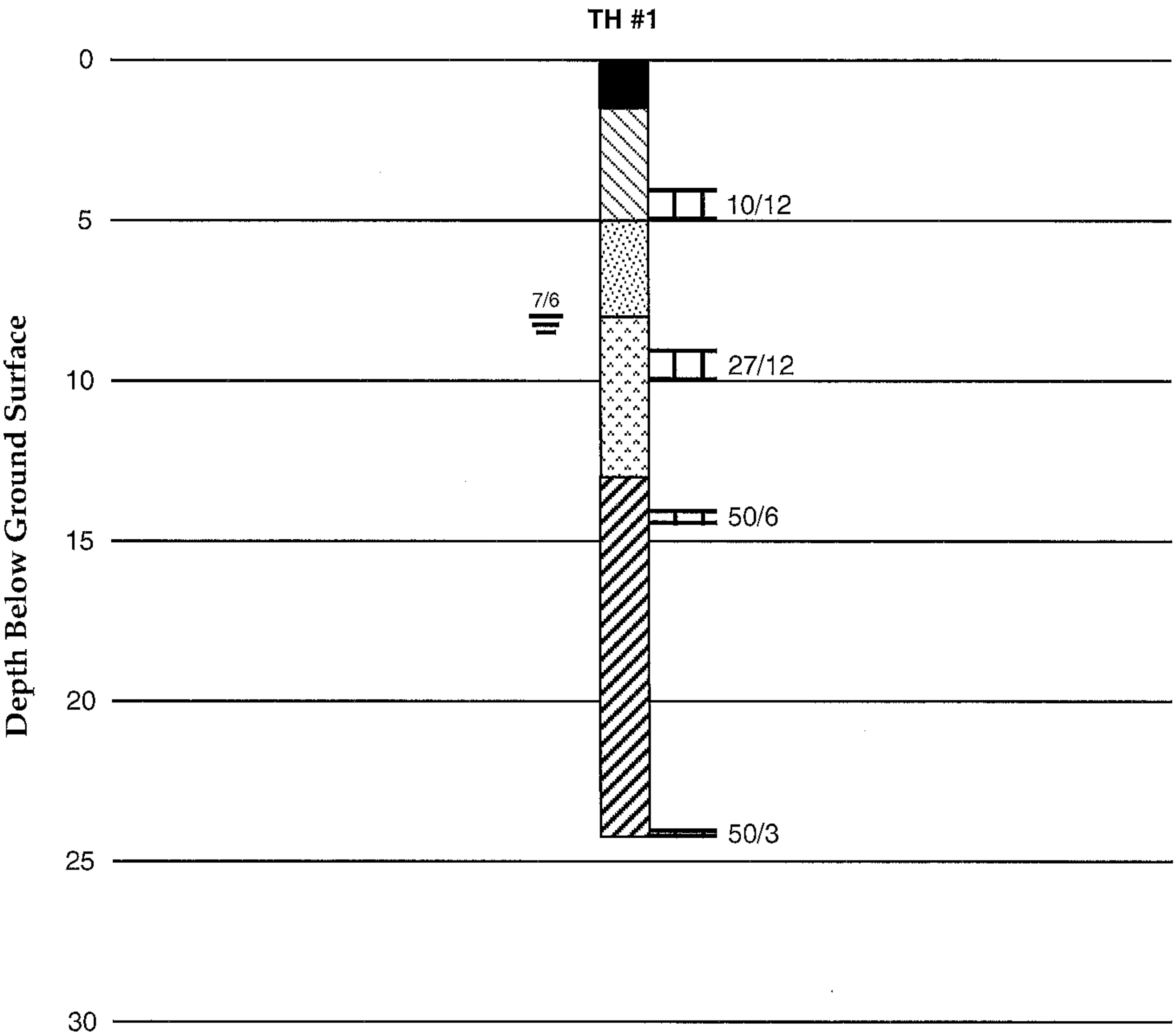

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Figure 1
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Description of Soil Types

Topsoil - Dark brown, silty, sandy clay - Contains organics

Dark brown to brown, very silty, sandy to very sandy clay

Brown, silty, sand - Contains some clay layers

Brown , silty, sand and gravel

Gray, silty, slightly sandy claystone

TH #1 Soils investigation boring number

Indicates a change in soil type - May be gradual.

12/12 — 12/12 indicates that 12 blows of a 140-pound hammer falling 30 inches were required to drive a 2-inch, inside diameter sampler 12 inches.

7/6 — Indicates the groundwater table and the date that the measurement was taken

Notes

1. Boring was performed July 2, 2010 with four-inch diameter, continuous flight power augers.

2. Boring log shown in this report is subject to the limitations, explanations and conclusions of the report.

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Table 1
Summary of Soils Properties
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PROPERTIES AT NATURAL MOISTURE CONTENT			**CONSOLIDATION/SWELL**				**DESCRIPTION**
Natural Moisture (%)	Natural Dry Density (PCF)	Unconfined Compression (PSF)	Loading (PSF)	Settlement (Dry) (%)	Settlement (Saturated) (%)	Swell (%)	
TH # 1 @ 4							
12.2	103.2	2000	100	1.20	0.70		Dark brown, very silty, very sandy clay
			1000		1.90		
			2000		2.60		
0.5 % Swell upon the addition of water							
TH # 1 @ 14							
11.9	110.7	>9000	100	0.00		2.50	Gray, silty, slightly sandy claystone (Partial Remold)
			1000			0.50	
			2000		0.50		
2.5 % Swell upon the addition of water							