June 17, 2016

SUBSURFACE SOIL REPORT

For

2560 N. Mtn Estates Rd
Florisssant, CO
Lot 1364, CME #10A

Client:

Email:

Report: 1606-21

Submitted by,

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INTRODUCTION:

As requested, Sun Peak Engineering has performed a soil investigation to evaluate the subsurface conditions and provide foundation design criteria for the proposed structure. This report has been prepared from data attained from field and laboratory testing, engineering analysis, and experience of soil behavior along the Front Range and foothills of Colorado. Included in this report are recommendations for design and construction of foundations, slabs on grade, drainage, concrete, and placement of fill. Excluded from the scope of this report are geologic, natural and environmental hazards such as landslides, unstable slopes, seismicity, mud flows, snow avalanches, water flooding, corrosive soils, subsurface mining, radon, and hazardous waste. If the building site lies in an area where this is a concern, a soils stability engineer should be hired to properly analyze the site prior to construction.

One profile pit was placed within the building envelope and was dug within the proposed building envelope and soil samples were obtained.

SITE CONDITIONS:

This property is located approximately 3 miles south of the town of Florissant, CO in the Colorado Mtn Estates Subdivision on a parcel that is currently vacant. The general topography in the proposed foundation area is 30% grade to the southwest. At the time of the site visit, the property appeared to be in a natural condition with native grasses and scattered trees in the foundation footprint. A photograph illustrating the site conditions during the field investigation can be found at the back of this report.

PROPOSED CONSTRUCTION:

A single family, wood framed residence is planned for this site. It is anticipated that the residence will be on a crawl space or walkout basement foundation with a possible attached or detached garage. Expected foundation loads are to be 1000 to 3000 pounds per lineal foot with interior column loads of 25000 pounds or less. Slab on grade floors are anticipated in any potential garage, basement, and other at grade areas. Excavation is expected to be 2 to 10 feet below the site existing grades. Final grades and landscaping may result in slightly greater depth of backfill.

FINDINGS:

Based on the information gathered from the profile pits, from the ground surface down, the general profile in the pit consisted of:

Organic Surface Soils:
The surface geology is comprised generally of brown, sandy, loamy, organic topsoil supporting conifer trees, and native grasses to an approximate depth of 6". All organic surface materials must be scraped clear of the site prior to placement of any foundation components.

Weathered Decomposed Granite:
Weathered decomposed granite was encountered below the organic surface materials to the maximum depth of 8'. The weathered granite was generally reddish brown in color, medium to coarse grained with gravel, high in density, and low in moisture content. Its Unified Soil Classification symbol is SP. The decomposed granite is non expansive and possesses low swell potential. It is common for weathered granite formations to contain large boulders granite bedrock as the depth increases. If these are encountered, excavation may be difficult and require blasting.

Groundwater:
No free groundwater was encountered during the field exploration; therefore it is unlikely that groundwater conditions will affect construction of the proposed structure. However, soil moisture and groundwater levels commonly vary over time and space depending on seasonal precipitation, irrigation practices, land use, and runoff conditions. It is also possible for groundwater to flow in fractures in the soil or bedrock or for perched groundwater conditions to form after construction. These conditions and the variations that they create often are not apparent at the time of the field investigation. Accordingly, the soil moisture and groundwater data in this report pertain only to the locations and times at which the exploration was performed. They can be extrapolated to other locations and times only with caution.

The profile pits logs located at the back of this report should be reviewed for more detailed descriptions of the subsurface conditions at each of the boring locations explored. The classifications shown on the logs represent the approximate boundary between subsurface materials and the actual transition may be gradual and vary across the site.

SOIL DESIGN LOADS:

Soil Type	Soil Depth	Bearing Capacity psf	Minimum Dead Load	Equivalent Active Fluid Pressure pcf
Brown, sandy loam top soil	0-6"	Not suitable for foundation loading		
Red/brown, weathered granite	6"-8'	4000	0	35

RECOMMENDATIONS:

The following section provides recommendations for the design of the foundation components, onsite drainage, backfill, and general construction information. It is not a foundation design. A structural design engineer or architect is required to use the recommendations of this report and properly design the foundation elements to include the footing, wall thickness, pad and pier sizes, and the reinforcement schedules. To initiate the design process, please contact this office. Sun Peak Engineering has designed hundreds of foundations in the Pikes Peak Region, and is known for practical, affordable designs.

SITE PREPERATION:

Initial site work is to consist of stripping all surface vegetation, topsoil, debris, improperly compacted fill, and any other loose materials. Excavation around the site should be performed such that the potential for standing water is minimized. Drainage swales or channels should be created where necessary in order to route water away from the excavation and construction area.

FOUNDATION:

Based on the subsurface soil findings, the preferred foundation design will consist of a reinforced concrete wall on a spread footing.

1. Footings should be constructed on the natural undisturbed soil. Materials loosened during excavation process should be removed from footing areas prior to the placement of concrete.
2. A structural engineer or architect should design the footing sizes. Foundation walls should bear on footings at least 16 inches in width. Isolated columns should be supported on square pads at least 24" x 24" in the dimension. Larger sizes may be required depending upon loads and the structural system used.
3. Foundations should be designed for up to 1 inch of movement. Differential movement up to ½ inch may occur.
4. Continuous foundation walls should be reinforced, top and bottom, to withstand local anomalies in the subsoils. Reinforcement is to be adequate for unsupported spams of at least 10 feet. Reinforcement design should consider the influence of large openings on the wall performance.
5. Exterior footings must be protected from the frost with a recommended depth of 30".
6. Foundation walls should be designed to resist lateral pressures generated by the soils on the site. It should be noted that the equivalent active fluid pressure values apply to level backfill conditions. Pressures will increase

substantially depending on the steepness of the slope adjacent to the surface and any potential surcharge loading. Equivalent active fluid pressures for sloping and surcharge conditions should be determined on an individual basis.

FILL:

Foundation walls:
All fill material must be free of frozen soil, ice, snow, cobbles and boulders larger than 6", debris, stumps, construction trash, and organic material. The top one-foot of the backfill should be relatively impervious. All walls over 4' in height should have floor systems in place or be well braced prior to the backfill process to prevent damage from excessive lateral pressure. No water flooding techniques of any kind should be used. Heavy construction equipment near the foundation will cause an excessive surcharge and may cause foundation failure. It is recommended the backfill be compacted to limit settlement according to the table below.

Structural Fill:
Fill material required to achieve the proposed footing or slab elevations, should be placed on a horizontal plane in lifts not to exceed 8 inches in thickness unless otherwise accepted by this office. Compaction percentage is shown in the table below and should be in accordance with ASTM D-1557 maximum modified Proctor dry density.

Fill Type	Percent Compaction	Moisture Content	Material type
Foundation subgrade	95*	± 2% of optimum	Class 5 or 6 road base
Interior slab-on-grade subgrade	92	± 2% of optimum	Onsite soils
Exterior slab-on-grade subgrade	90	± 2% of optimum	
Exterior foundation walls (nonstructural or landscaped areas)	85	± 2% of optimum	

Any structural fill used below any foundation components must be approved by this office, compacted to 95%, and must have compaction compliance testing.

CONCRETE SLABS:

Slab-on-grade floor systems placed on the native soils or compacted structural fill, have a low potential for movement. However, it is a possible expansive materials at or near the floor levels, not indicated by the profile pits, could cause minor movement and cracking. Also varying moisture conditions or the granular soil settling slightly under load may cause some distress and minor cracking. Generally soils as found on this site experience a total movement of less than 1" and the movement is most likely to occur in the first 3 to 5 years following construction as the soils respond to changes in availability of moisture.

If finished floors such as tile, are placed on the concrete slab, the builder and homeowner must accept the risk that cracking may transfer through the finished floor and cause damage. The only positive solution to reduce the potential for slab movement is the construction of a structural wooden floor system over the subgrade or a reinforced concrete slab.

For parts of the building that require slabs-on-grade for economic or practical considerations, the following precautions are recommended for construction. The homeowner should also follow these recommendations if they finish the concrete slab areas.

1. Slab on grade floor construction should be limited to areas such as the garage and basement where slab movement and cracking are acceptable.
2. Slabs should be placed directly on the exposed subsoil or on properly compacted structural fill.
3. Slabs should be separated from exterior walls and interior load bearing members with a slip joint, which allows free vertical movement of the slabs.
4. All plumbing and utilities, which passed through slabs, should be isolated from the slabs. Heating and air-conditioning systems supported by slabs should be provided with flexible connections to allow for movement of the slab.
5. Porch roofs over patio areas should not be supported by the concrete slab.
6. Concrete slab cracking can result from expansion and shrinkage. Shrinkage control joints should be provided at a maximum of 12' on center and 3 feet from foundation walls. Control joints should be continuous across slab sections.

GRADING AND DRAINAGE:

<u>Surface:</u>
The ground surface around the structure should be sloped to drain away from the building in all directions. A recommended minimum slope of 12 inches in the first 10 feet from the structure is to be used in landscaped areas. Where concrete slabs

and paved areas are used, the slope of the ground surface can be reduced to 3%. If a 10 foot zone is not possible on the upslope side of the structure, then a well defined swale should be created a minimum of 5 feet from the foundation and sloped parallel with the wall at a minimum slope of 2% to intercept the surface water and transport it around and away from the structure. Roof drains should extend across the backfill zones and landscaped areas. Homeowners should maintain the surface grading and drainage recommended in this report to help prevent water from being directed toward and or ponding near the foundation.

Landscaping should be selected to reduce irrigation requirements. Plants used close to the foundation walls should be limited to those with low moisture requirements. Irrigated grass should not be located within 5 feet of the foundation and sprinkler heads should be oriented such that the water spray does not fall within 5' of the foundation walls. Lawn irrigation should be controlled to prevent excessive wetting of subsurface soils. Be advised that any irrigation line can leak or break releasing excessive amounts of water near the foundation and cause damage to slabs and foundation walls.

Subsurface:
A perimeter foundation drainage system is recommended around portions of the structure, which will have habitable, or storage space below the finished ground surface. This includes crawlspace areas but not the walkout trench or the basement area common with the garage, if applicable. The drain should be routed to a sump pit and pump or to a gravity discharge. A typical foundation drain detail is included in this report. If the soils have substantial gravel such as weathered granite, than a sock wrapped drain system may be used in lieu of the gravel and pipe system shown.

CONCRETE:

All concrete in contact with the soil should be made using a TYPE II cement for sulfate resistance and with a 28 day strength as determined by the foundation design engineer. A TYPE I cement may be used if protected against contact with the soil. The concrete should not be placed on frozen ground. If placed during periods of cold weather, the concrete should be kept from freezing which may require insulated blankets and heating.

OPEN HOLE INPECTION:

It is necessary to make certain that the soils from the initial site investigation are consistent with the soils in the actual excavation. The open hole inspection will verify that materials of the proper design bearing capacity have been encountered and that no soft spots or fill exists in the foundation area. This office should be contacted once the excavation is complete and prior to placing any foundation

components. A 3-day notice is required for all inspections to enable Sun Peak Engineering to schedule the service when needed. A fee of $200.00 will be charged for this service. Failure to obtain this inspection renders this report and it's recommendations null and void.

LIMITATIONS:

This report has been prepared for the exclusive use of the client listed on this report, for the referenced construction project, and for the subject property. Use by any other persons, adjacent properties, or for any other types of construction, is not permitted without approval of this office.

The recommendations contained in this report are based on the field observations, data from the profile pits, laboratory tests, and the proposed construction. It is possible that subsurface conditions could vary between or beyond the points explored. If subsurface conditions are encountered during construction, which differs from those described within this report, Sun Peak Engineering should be notified immediately in order for a review to be made, and any supplemental recommendations provided. This report was prepared in substantial accordance with the generally accepted standard of practice for geotechnical engineering as exists in the site area at the time of the investigation. No warranty is expressed or implied.

It is the responsibility of the owner or representative of the owner to make certain that the recommendations provided in this report are either incorporated into the design or provided to the architect or engineer responsible for the foundation design. Compliance inspections are not within the scope of this project and it is the owner or representative's responsibility to assure that the recommendations are complied by all contractors or subcontractors during construction.

This report becomes invalid 12 months from the date of issuance due to potential changes in the site conditions or generally accepted engineering practices. Site conditions can vary due to natural processes or manmade disturbances at this site or in its vicinity.

I appreciate this opportunity to be of service to you on this project and look forward to serving your needs in the future. Please feel free to contact this me if you have any questions or require more information.

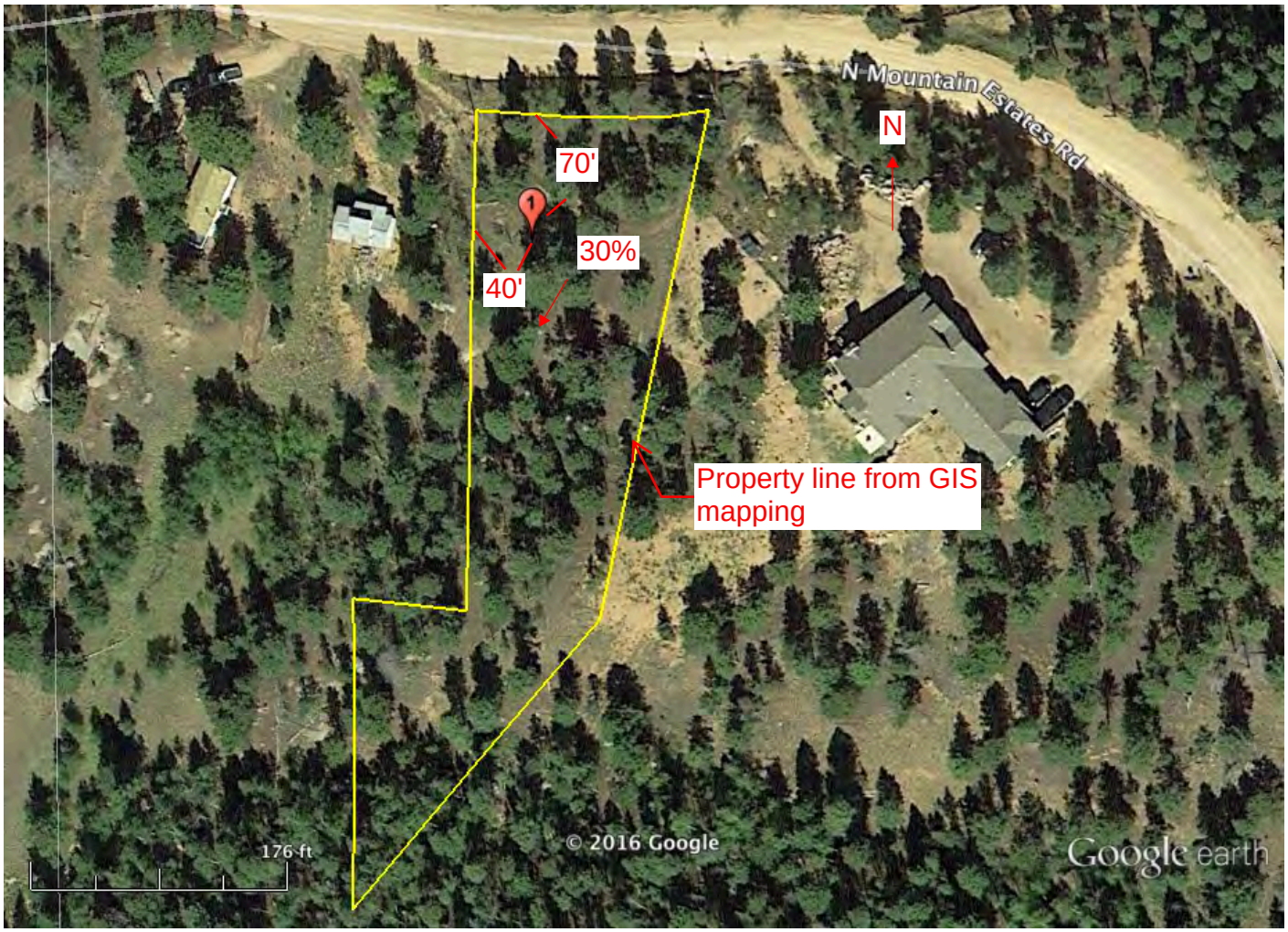
Sun Peak Engineering
Profile Pit Log

Client: Richard Garrett	Project Number: 1606-21	Date: 6/7/16	Profile Pit No. 1
Address, City, State: 2560 N. Mtn Estates Rd			
Groundwater Depth: None	Total Depth of Pit: 8'		

Depth (feet)	Sample Type	Blow Counts (blows/foot)	Graphic Log	Lithology **Soil Group Name:** modifier, color, moisture, density/consistency, grain size, other descriptors **Rock Description:** modifier color, hardness/degree of concentration, bedding and joint characteristics, solutions, void conditions.	Moisture Content (%)	Additional Test
				Brown, silty, top soil		
				Weathered granite, reddish brown in color, medium to coarse grained with gravel. Moderate to high density, low moisture content, low plasticity, low swell potential		
					5.3	
5						
					4.8	
10						
15						

Soil Sample Ground Water Table

TEST BORING LOCATION:



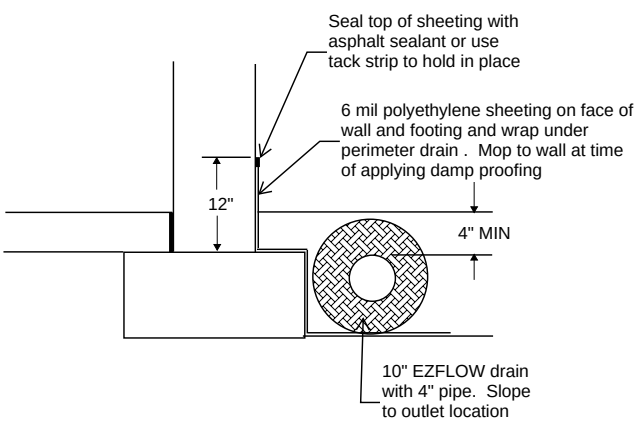
Google earth

feet 300
meters 100

SITE PHOTOGRAPH:

Perimeter Drain Detail:

EZFLOW Drain Installation



Gravel and Pipe Drain Installation