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GEOLOGIC HAZARD STUDY

348 Spruce Rd
Site 145, Crystal Park
El Paso County, Colorado

PREPARED FOR:

Palace Homes
1216 W. Colorado Ave. #110
Colorado Springs, CO 80904

JOB NO. 196392

May 3, 2024

Respectfully Submitted,
RMG – Rocky Mountain Group

Kelli Zigler

Kelli Zigler
Project Geologist

Reviewed by,
RMG – Rocky Mountain Group

COLORADO REGISTERED
ANTHONY P. MUNGER
5/3/24
39818
PROFESSIONAL ENGINEER

Tony Munger, P.E.
Sr. Geotechnical Project Manager

Scope of Investigation

This report presents the findings of an evaluation performed by RMG – Rocky Mountain Group of the above-referenced site in El Paso County, Colorado. The purpose of our report is to evaluate the site conditions and present our opinions of the observed conditions on the proposed development with respect to the intended usage.

Revisions and modifications to the conclusions and recommendations presented in this report may be issued subsequently by RMG based upon additional observations made during grading and construction (which may indicate conditions that require re-evaluation of some of the criteria presented in this report) and/or upon receipt of review comments from El Paso County and/or any third-party reviewing agencies.

Qualifications of Preparers

This Geologic Hazard Study was prepared by a professional geologist as defined by Colorado Revised Statures section 34-1-201(3) and by a qualified geotechnical engineer as defined by policy statement 15, "Engineering in Designated Natural Hazards Areas" of the Colorado State Board of Registration for Professional Engineers and Professional Land Surveyors. (Ord. 96-74; Ord. 01-42)

The principle investigators for this study are Kelli Zigler, P.G. and Tony Munger, P.E. Ms. Zigler is a professional Geologist with over 23 years of experience in the geological and geotechnical engineering field. Ms. Zigler holds a Bachelor of Science in Geology from the University of Tulsa. Ms. Zigler has supervised and performed numerous geological and geotechnical field investigations in Colorado. Tony Munger is a licensed professional engineer with over 23 years of experience in the construction engineering (residential) field. Mr. Munger and holds a Bachelor of Science in Architectural Engineering from the University of Wyoming.

Existing and Proposed Land Use

The site currently consists of an approximately 30,928 square-foot vacant residential lot. The proposed land use is to construct a new single-family residence. The subject property is identified as Site S-145 (AR) within the Crystal Park subdivision, Filing No. 2, zoned as “PUD” Planned Unit Development per El Paso County zoning. The approximate location of the site is shown on the Site Vicinity Map, Figure 1.

Project Description

It is our understanding that the proposed development of this site is to consist of the construction of a single-family dwelling with an on-site wastewater treatment system and a well. This geologic hazard study was performed to evaluate geologic conditions that may impact the proposed development and provide recommendations for mitigation (if needed) and design for residential construction. A site plan prepared by LGA Studios, dated September 11, 2023, showing the location of the home is included in Figure 2.

Site Evaluation Techniques

The information included in this report has been compiled from:

1. Field reconnaissance
2. Geologic maps
3. Review of previous reports performed by RMG in the same subdivision
4. Available aerial photographs
5. Geologic research and analysis
6. Site plan prepared by others

Geophysical investigations were not considered necessary for characterization of the site geology.

Previous Studies and Field Investigations

One report of previous geotechnical engineering for this site by A Better Soil Solution, LLC was considered in the preparation of this report and is listed below and included in Appendix A.

1. *Soils Report, Lot#145, Crystal Park Subdivision, 0 Spruce Road, El Paso County, Colorado*, prepared by A Better Soil Solution, Job#23-0406, dated September 4, 2023.

Site Conditions

We performed a field reconnaissance on April 16, 2024. At the time of the field reconnaissance, the site consisted of vacant, undeveloped land that is near the top of the mountain, generally located about 3 miles from the gated entrance in the northeast portion of the Crystal Park subdivision. A gravel driveway slopes up to the proposed building pad.

The ground surface within the proposed building and septic area had been cleared of vegetation. Surrounding the building and septic field pads, vegetation consisted of moderate- to high-growth coniferous trees, small rocks, boulders, native grasses and weeds. Topographically, the site resides atop a mountain which generally slopes down towards the east at approximately 30 percent. The site has generally good drainage in the form of surficial sheet flow directed to the east.

Based on Google Earth Pro aerial imagery and imagery provided by historicaerials.com, it appears Spruce Road has had a similar roadway alignment since prior to 1999.

General Geology

Based upon mapping presented by the Colorado Geological Survey (CGS) ([1]Keller et al, 2003), the bedrock underlying the subject site is comprised of the Pikes Peak Granite (Middle Proterozoic) geologic map unit Ypp, as indicated by the salmon color below. The blue pin indicates the approximate site location.

[1] Keller, John W., Siddoway, Christine, Morgan, Matthew L., Route, Erik E., Grizzell, Matthew T., Sacerdoti, Raffaello, and Stevenson, Adair, 2003 ***Geologic Map of the Manitou Springs Quadrangle, El Paso and Teller Counties, Colorado,*** Colorado Geological Survey, Open File Map 03-19.

The rocks of this mountain and surrounding area represent the Pikes Peak Batholith, a fairly large, late Mesoproterozoic-aged igneous intrusion that was emplaced approximately 1.8 billion years ago. Pikes Peak Granite is comprised of feldspar-biotite migmatite, quartzose gneiss, biotite schist, and amphibolite gneiss. The granite was exposed in the driveway and at the surface across the site. The surficial deposits observed during our site visit consisted primarily of decomposed granite and gravel rock fragments. Evidence of recent natural rockfall or debris flow deposits were not observed in the vicinity of the building site.

The site is located west of the Ute Pass Fault zone. The Ute Pass Fault is located more than 2 miles east of the site. In addition to the Ute Pass Fault, multiple faults are located within the Crystal Park subdivision. The majority of the faults are concealed by younger deposits but are exposed throughout Crystal Park. According to information presented by the CGS ([2]Kirkham et al, 2004-2007), several earthquakes have occurred in the vicinity of the Ute Pass Fault near Colorado Springs and Woodland Park. The earthquakes, with magnitudes in the range of 3.0 to 3.9, occurred approximately from 1962 to 2007.

Subsurface Materials

Based on the review of the *Soils Report* referenced above, one test boring was performed on August 10, 2023. The subsurface materials encountered in the boring generally consisted of well-graded gravel extending to approximately 4 feet below the existing surface. Auger refusal was encountered at 4 feet, according to the boring log, refusal was due to the granite. Water was reportedly not encountered below the existing ground surface during drilling.

BEARING OF GEOLOGIC FACTORS UPON PROPOSED DEVELOPMENT

General Geologic Conditions

Based upon our evaluation of the geologic conditions, it is our professional opinion that the proposed residential development is feasible. The geologic hazards identified are not considered unusual for mountainous regions of Colorado. Mitigation of geologic hazards is most effectively accomplished by avoidance. However, where avoidance is not a practical or acceptable alternative, geologic hazards should be mitigated by implementing appropriate planning, engineering, and local construction practices.

Potentially Unstable Slopes

Unstable slopes or apparent signs of ongoing slope movement were not observed on the property. Visible evidence of slope movement was not observed on the site. Coniferous trees and native vegetation local to the area showed no obvious signs of slope movement (such as "pistol-butting", etc.).

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[2] Kirkham, R. M., Rogers, W. P., Powell, L., Morgan, M. L., Matthews, V., and Pattyn, G. R., 2004-2007, ***Colorado Earthquake Map Server.*** Colorado Geological Survey Bulletin 52b.

Due to the nature of the bedrock encountered at the site and the vegetated slopes in the immediate area of the site, the potential for relatively rapid downslope movement at the site is considered to be low. It is also our opinion that the risk of landslide activity on this lot is no greater than the risk on surrounding lots within the same development. The risk of destabilization of localized slopes below the home is a permanent risk, and one that may be adversely affected by factors outside the control of the owner or resident of the subject property. The mitigation recommendations presented herein for the proposed residence are not intended to resist lateral ground movements related to landslides.

Downslope Creep

Downslope creep, which is the slow downslope movement of superficial soil and rock materials, is common to the area. The structural design of the residence should consider its placement on the hillside and the additional surcharge pressures that could be generated by downslope creep and by retaining upslope materials.

It is also recommended that the foundation be designed with additional rigidity to help reduce the effect of potential lateral movement of subsurface soils. This may include (but is not limited to) the use of tie beams, counterforts, and added reinforcing to help the foundation move as a unit. This approach should reduce potential cracking and damage resulting from differential movement within the foundation system and superstructure.

Boulders, if present within the building site, are to be removed during the construction phase of the development, and all disturbed areas are to be revegetated with native grass.

Rockfall

The subject site does have a generally steep slope down to the east, above and below the proposed build area. The subject site does not have an exposed road cut or steep slopes above it to generate rockfall. The site is not considered to be prone to rockfall. If rocks were to dislodge from the mountainside above, based on their orientation they are not expected to bounce, roll or tumble towards the site. Rather, they will likely be captured in the heavily forested mountain valley northeast of the site.

Debris Flows and Debris Fans

Terrain features consistent with the formation of debris flows and debris fans are not present in the vicinity of the property.

Seismicity

The Pikes Peak Regional Building Code, 2017 Edition, indicates maximum considered earthquake spectral response accelerations of 0.224g for a short period (S_s) and 0.061g for a 1-second period (S_1). Based on the results of our experience with similar subsurface conditions, we recommend the site be classified as Site Class B, with average shear wave velocities ranging from 2,500 to 5,000 fneet per second for the materials in the upper 100 feet.

Specific recommendations should be provided by the Geotechnical Engineer of Record during the design phase of the project.

Floodplain

The Federal Emergency Management Agency (FEMA) *Community Panel No. 08041C0705G*, effective December 7, 2018 and the online ArcGIS El Paso County Risk Map indicate that the site lies outside of the 500-year floodplain of Douglas Creek Drainage Basin.

Surface Drainage/Irrigation and Erosion

The decomposed granite on the site is mildly to moderately susceptible to water erosion. Loosely compacted soils will be the most susceptible to water erosion. Residually weathered soils are also susceptible to water erosion, but generally less so than loosely compacted materials that have been transported downhill by wind or water and then deposited on the site.

However, care should be taken (both during construction and in the final grading of the lot) in redirecting surface drainage (and any resulting debris) around the structure. The new drainage flow path should maintain a minimum 10-foot separation from the structure. Care should also be taken to discharge the diverted drainage water and debris to a location which will not significantly alter the overall drainage of the development or result in the need for additional drainage mitigation measures at the time of construction on nearby lots. If the drainage path is to be modified or redirected, the proposed mitigation measures are to be identified on a lot-specific grading plan.

The permeability of the fractured bedrock at the site is generally considered to be high. Surface runoff could also be rapid and the potential for rapid erosion of unvegetated slopes is considered to be high. Long-term slopes should not be steeper than 3:1 (horizontal:vertical) in cut or fill areas. Revegetation of any disturbed areas should be performed as soon as possible with revegetation/erosion mats placed as required. Excavation cuts and soil disturbance should be kept to a minimum. Proper surface drainage, as recommended in the soils report referenced above, should be established during construction and maintained (over the life of the structure) by the Homeowner.

Roof drains should extend across backfill zones and landscaped areas to a region that is graded to direct flow away from the structure. Owners should maintain the surface grading and drainage recommended in the *Soil Report* referenced above to help prevent water from being directed toward and/or ponding near the foundations.

Landscaping should be selected to reduce irrigation requirements. Plants used close to foundation walls should be limited to those with low moisture requirements; and irrigated grass should not be located within 5 feet of the foundation. To help control weed growth, geotextiles should be used below landscaped areas adjacent to foundations. Impervious plastic membranes are not recommended.

Irrigation devices should not be placed within 5 feet of the foundation. Irrigation should be limited to the amount sufficient to maintain vegetation. Application of more water will increase the likelihood of slab and foundation movements.

The recommendations in this and the referenced reports are intended to address normal surface drainage conditions, assuming the presence of groundcover (established vegetation, paved surfaces, and/or structures) throughout the regions upslope from this structure. However, groundcover may not be present due to a variety of factors (ongoing construction/development, wildfires, etc.). During periods when groundcover is not present in the "upslope" regions, higher than normal surface drainage conditions may occur, resulting in perched water tables, excess runoff, flash floods, etc. In these cases, the surface drainage recommendations presented herein (even if properly maintained) may not mitigate all groundwater problems or moisture intrusion into the structure.

Radioactivity/Radon Gas

Radon is a gas that can move feely within the soil and air but can become trapped in structures constructed on the soil. Radon is a byproduct of the natural decay of uranium and radium. Trace amounts of radioactive nuclides are common in the soils and bedrock that underlie this region and site.

***"Radon Act 51** passed by Congress set the natural outdoor level of radon gas (0.4 pCi/L) as the target radon level for indoor radon levels. The US EPA has set an action level of 4 pCi/L. At or above this level of radon, the EPA recommends you take corrective measures to reduce your exposure to radon gas".*

Most of Colorado is generally considered to have the potential for high indoor levels of radon gas, based on the geology, soils, construction type and aerial radiation measurements that have been gathered from indoor testing by the Colorado Department of Public Health and Environment (CDPHE), Radon Outreach Program and Colorado Environmental Public Health Tracking the information provided at:
https://www.elpasocountyhealth.org/sites/default/files/CDPHERadonMap.pdf

There is not believed to be unusually hazardous levels of radioactivity from naturally occurring sources at this site. However, the granular materials found in the area are often associated with the production of radon gas and concentrations may exceed those currently accepted by the EPA.

Radon hazards are best mitigated at the building design and construction phases. Providing increased ventilation of basements, crawlspaces, creating slightly positive pressures within structures, and sealing of joints and cracks in the foundations and below-grade walls can help mitigate radon hazards. Passive radon mitigation systems are also available.

Passive and active mitigation procedures are commonly employed in this region to effectively reduce the buildup of radon gas. Measures that can be taken after the residence is enclosed during construction include installing a blower connected to the foundation drain and sealing the joints and cracks in concrete floors and foundation walls. If the occurrence of radon is a concern, it is

recommended that the residence be tested after they are enclosed and commonly utilized techniques are in place to minimize the risk.

Closing

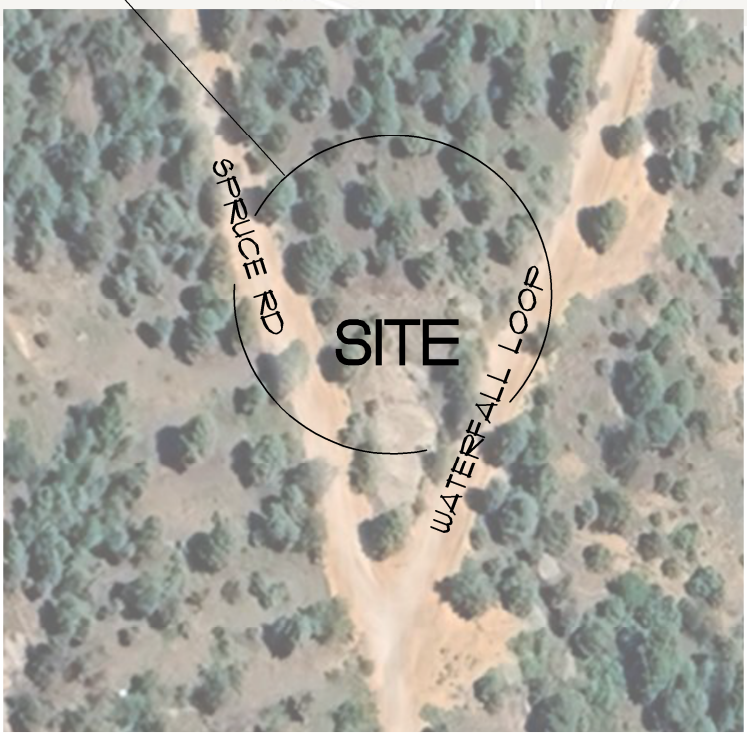
This report has been prepared for the exclusive purpose of providing geologic hazards information and recommendations for development described in this report. RMG should be retained to review the final construction documents prior to construction to verify our findings, conclusions and recommendations have been appropriately implemented.

This report has been prepared for the exclusive use by **Palace Homes** for application as an aid in the design and construction of the proposed development in accordance with generally accepted geotechnical and geological engineering practices. The analyses and recommendations in this report are based in part upon data obtained from site observations and the information presented in referenced reports. The nature and extent of variations may not become evident until construction. If variations then become evident, RMG should be retained to review the recommendations presented in this report considering the varied condition, and either verify or modify them in writing.

Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by geotechnical engineers practicing in this or similar localities. RMG does not warrant the work of regulatory agencies or other third parties supplying information which may have been used during the preparation of this report. No warranty, express or implied, is made by the preparation of this report. Third parties reviewing this report should draw their own conclusions regarding site conditions and specific construction techniques to be used on this project.

The scope of services for this project does not include, either specifically or by implication, environmental assessment of the site or identification of contaminated or hazardous materials or conditions. Development of recommendations for the mitigation of environmentally related conditions, including but not limited to biological or toxicological issues, are beyond the scope of this report. If the Client desires investigation into the potential for such contamination or conditions, other studies should be undertaken. If we can be of further assistance in discussing the contents of this report or analysis of the proposed development, from a geotechnical engineering point-of-view, please feel free to contact us.

If we can be of further assistance in discussing the contents of this report or analysis of the proposed project, from a geotechnical engineering point-of-view, please feel free to contact us.



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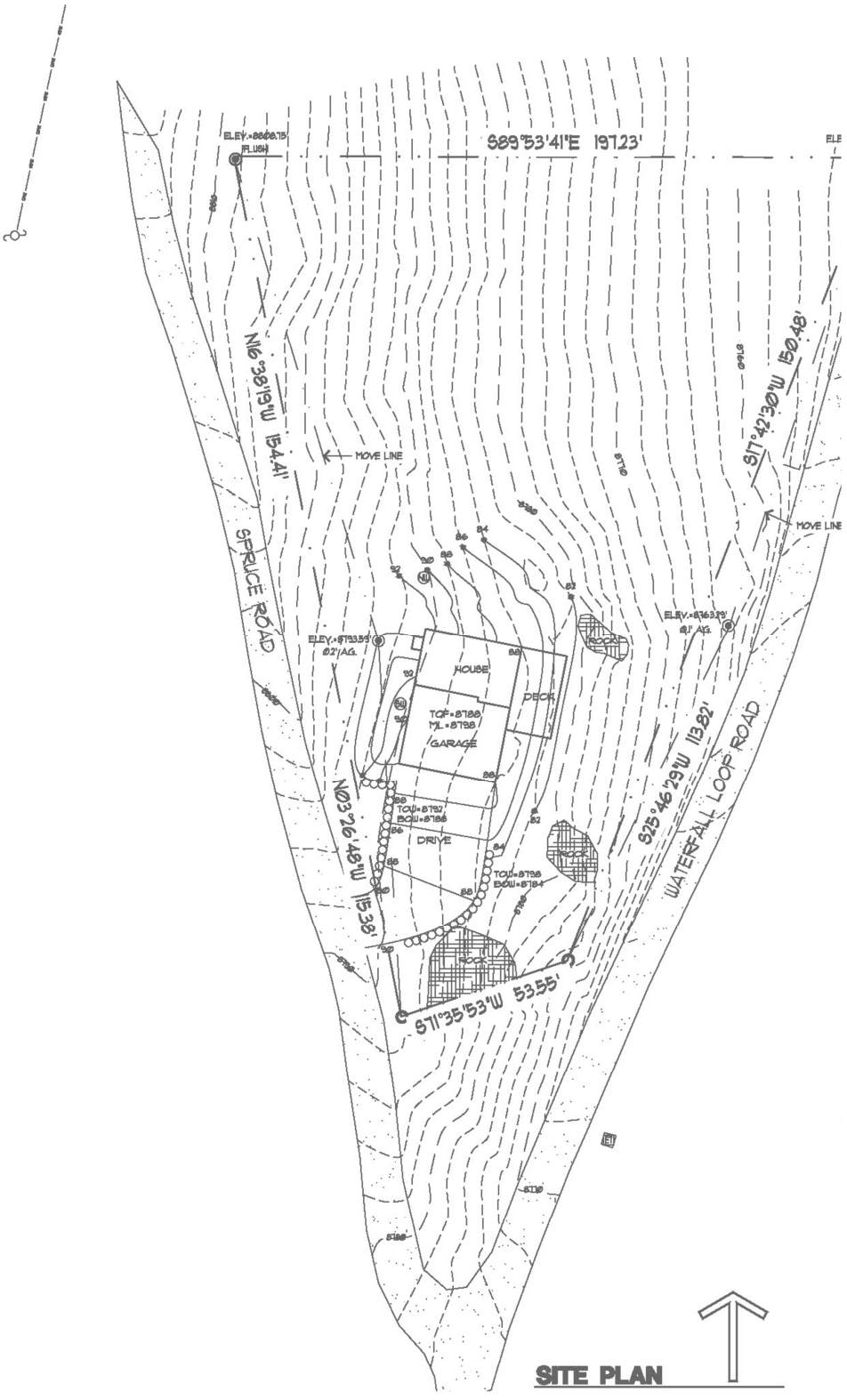
SITE VICINITY MAP

BARILE RESIDENCE
348 SPRUCE ROAD
CRYSTAL PARK, SITE -145
EL PASO COUNTY, CO
PALACE HOMES

JOB No. 196392

FIG No. 1

DATE 5-3-2024



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SITE PLAN PREPARED BY LGA STUDIOS

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SITE PLAN

BARILE RESIDENCE
348 SPRUCE ROAD
CRYSTAL PARK, SITE -145
EL PASO COUNTY, CO
PALACE HOMES

JOB No. 196392

FIG No. 2

DATE 5-3-2024

APPENDIX A

Soils Report, Lot#145, Crystal Park Subdivision, 0 Spruce Road, El Paso County, Colorado, prepared by A Better Soil Solution, Job#23-0406, dated September 4, 2023.

4 September 2023

A BETTER SOIL SOLUTION

SOILS REPORT

FOR

PALACE HOMES

JOB #23-0406

Lot #145,
Crystal Park Subdivision,
0 Spruce Road,
El Paso County,
Colorado

Sincerely,

Charles E. Milligan, P.E.

COLORADO LICENSED
CHARLES E. MILLIGAN
34608
4 SEP 23
PROFESSIONAL ENGINEER

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INTRODUCTION

The owners must be made aware of the contents of this report. If there are any questions or concerns regarding the information in this report, please contact A Better Soil Solution, Inc. It is the responsibility of the contractor on this project to make subsequent owners aware of the contents of this report. This is to ensure that the recommendations and requirements of the report, especially regarding the surface drainage, are acknowledged and followed. This report is prepared for **Palace Homes, builder, on Lot #145, Crystal Park Subdivision, 0 Spruce Road, El Paso County, Colorado.** This report is prepared with the understanding that a new home is planned for this site. The site does not have existing structures.

CONCLUSIONS

A satisfactory foundation for this structure is a properly designed shallow foundation system consisting of foundation components resting directly on undisturbed materials. Foundation components resting directly on undisturbed native materials shall be designed for a loading of not greater than **5,000 pounds per square foot. Any design by any engineer is subject to revision based on the results of the open hole observation.** The compressibility of this material is low. This bearing capacity is calculated with a safety factor of three. The type of foundation configuration used depends on the building loads applied. The depth of foundation elements shall be determined by the foundation engineer but should be at least as deep as the minimum depth required by the governing building authority. **The laboratory testing revealed that the on-site soil is Well Graded Sand (U.S.C.S. Classification Symbol SW). The unit weight of equivalent fluid soil pressure of this material is 35 pounds per cubic foot.** The expected values are from ASCE 7-22, Table 3.2-1. The native material is suitable and may be used as backfill material around the perimeter of the foundation. **Foundation components should bear on soils of similar bearing capacity. Foundation components bearing on dissimilar soils should be avoided. The owners shall be made aware that movement will occur if surface or subsurface water is allowed to collect around the foundation wall.**

GENERAL

The investigation was made to reveal important characteristics of the soils and of the site influencing the foundation design. Also evaluated during the investigation were subsurface conditions that affect the depth of the foundation and subsequent loading design, such as ground water levels, soil types, and other factors which affect the bearing capacity of the soils. Design loadings are based on soils characteristics and represent the maximum permissible loads for these conditions. The bearing capacity is calculated with a safety factor of three.

FIELD AND LABORATORY INVESTIGATION

One exploratory hole was drilled on August 10, 2023, at the location shown on the enclosed site map. The location of this test hole was determined by Palace Homes. The test hole was drilled with a 4-inch diameter auger. At intervals anticipated to be the foundation depths, and as determined by the soils conditions, the drill tools were removed, and samples were taken by the use of a 2-inch split barrel sampler connected to a 140-pound drop-hammer. This hammer is dropped 30 inches to drive the penetration sampler into the soil **(ASTM D-1586).** The depths and descriptions of the materials encountered in each test boring at which the samples were taken are shown on the enclosed log sheets. All samples were classified both in the field and in the laboratory to evaluate the physical and mechanical properties of the materials encountered.

TOPOGRAPHY

The topography of this site is that of an incline sloping down towards the south at 5%.

WEATHER

The weather at the time of the soil examination consisted of cloudy skies with hot temperatures.

DESIGN AND CONSTRUCTION CONSIDERATIONS

Slabs-on-grade may move and crack. Vertical slab movement of up to one and a half inches should be expected for native soils with low expansion potential. In some cases, vertical movement may exceed this range. If movement and associated damage to basement floors and finishes cannot be tolerated, a structural floor system should be installed. If compaction is not performed, settlement may occur causing cracking of foundation walls and floors. Soil located beneath concrete walls shall be compacted to at least 95% Modified Proctor density **(ASTM D-1557)**. Soil located beneath concrete slabs shall be compacted to at least 85% Modified Proctor density. Special care is to be taken to re-compact the material above utility lines to a minimum of 85% Modified Proctor density. During construction, conditions that could cause settlement shall be eliminated. Interior non-bearing partition walls shall be constructed such that they do not transmit floor slab movement to the roof or overlying floor. The gap or void (1.5 inch min.) installed in these non-bearing partitions may require re-construction over the life of the structure to re-establish the gap or void to allow for vertical slab movement. Stairwells, doorways, and sheeted walls should be designed for this movement.

The following are general recommendations of on-grade slabs:

1. Slabs shall be placed on well-compacted, non-expansive materials, and all soft spots shall be thoroughly excavated and replaced with non-expansive fill materials as stated above.

2. Slabs shall be separated from all foundation walls, load bearing members, and utility lines.

3. At intervals not to exceed 12 feet in each direction, provide control joints to reduce problems with shrinkage and curling as recommended by the American Concrete Institute **(ACI 360R-10)**. Moisten the ground beneath the slab prior to the placement of concrete.

4. All concrete placed must be cured properly as recommended by the American Concrete Institute **(ACI 360R-10)**. Separate load bearing members from slabs, as discussed above. Care must be exercised to prevent excess moisture from entering the soil under the structure, both during and after construction.

5. Due to the exposure of exterior concrete to variations in moisture fluctuations, heaving and cracking of exterior slabs-on-grade should be expected. Placement of at least 3 feet of non-expansive fill beneath the slabs can help to reduce the impact of differential movement and cracking but may not eliminate movement. Exterior concrete shall slope away from the structure a minimum of 2% grade.

6. The SW has been analyzed for its expansion and/or consolidation potential. Basement slabs, garage slabs, and all concrete floor slabs, exert a very low dead-load pressure on the soil. Since almost any soil contains at least a small amount of swell/consolidation potential, slabs may crack and heave or settle if excess water is allowed to penetrate the subgrade. For example, column openings to pads below the placed slab, if exposed to precipitation during construction, will conduct water to the subgrade, possibly causing it to expand/consolidate. Also, if the slab is placed with concrete too wet, expansion/consolidation may occur. We recommend 3,000 psi concrete placed at a maximum slump of 4 inches.

RECOMMENDATION REMARKS

The recommendations provided in this report are based upon the observed soil parameters, anticipated foundation loads, and accepted engineering procedures. The recommendations are intended to minimize differential movement resulting from the heaving of expansive soil or from the settlement induced by the application of loads. **It must be recognized that the foundation will undergo some movement on all soil types.** In addition, concrete floor slabs will move vertically, therefore, adherence to those recommendations which isolate floor slabs from columns, walls, partitions or other structural components is extremely important if damage to the superstructure is to be minimized.

Any subsequent owners should be apprised of the soil conditions and advised to maintain good practice in the future with regard to surface and subsurface drainage and partition framing, drywall and finish work above floor slabs.

A Better Soil Solution, Inc. does not assure that the contractor and/or homeowner will comply with the recommendations provided in this report. A Better Soil Solution, Inc. provides recommendations only and does not supervise, direct or control the implementation of the recommendations.

Failure to follow the recommendation provided by A Better Soil Solution, Inc. and follow observation requirements may jeopardize the construction project and A Better Soil Solution, Inc. shall be absolved from any and all responsibility for any damages arising from the failure to obtain proper site observation and follow recommendations.

COLD TEMPERATURE CONSIDERATIONS

1. Concrete shall not be placed upon wet or frozen soil.

2. Concrete shall be protected from freezing until it has been allowed to cure for at least 7 days after placement in forms.

3. Snow or other frozen water shall not be allowed in the forms during placement of concrete.

4. Concrete shall be cured in forms for at least 72 hours.

5. Concrete shall be vibrated or rodded in forms to avoid segregation and cold joints.

6. The site shall be kept well drained at all times. Ponding of water should be avoided in the excavation area.

SURFACE DRAINAGE

After construction of foundation walls, the backfill material shall be well compacted to 80% Modified Proctor density, to reduce future settlement. Any areas that settle after construction shall be filled to eliminate ponding of water adjacent to the foundation walls. **The finished grade shall have a positive slope away from the structure with an initial slope of 6 inch in the first 10 feet.** 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 2% grade to intercept the surface water and carry it around and away from the structure. Homeowners shall maintain the surface grading and drainage installed by the builder to prevent water from being directed in the wrong direction. All downspouts shall have extensions that will remove runoff to the outside of the backfilled areas. Shrubs and plants requiring minimal watering shall be established in this area. Irrigated grass shall not be located within 5 feet of the foundation. Sprinklers shall not discharge water within 5 feet of the foundation. Irrigation should be limited to the minimum amount sufficient to maintain vegetation. Application of more water will increase the likelihood of floor slab and foundation movement.

All exterior grading and location of downspouts and their performance shall be inspected by A Better Soil Solution, Inc. The native material is suitable and may be used as backfill material around the perimeter of the foundation. If on-site soils are not suitable for the backfill, the backfill material shall consist of clean non-cohesive granular soils or road base material as described previously. Imported material is to be approved by A Better Soil Solution, Inc. prior to placement. **We recommend imported granular backfill with a maximum equivalent fluid soil pressure of 45 pounds per cubic foot**. It is the responsibility of the contractor to schedule all inspections**.**

SUBSURFACE DRAINAGE

Perimeter drains are required around all walls of the habitable or usable area portion of the structure that are below finished grade including all common wall(s) adjacent to the basement. Crawlspaces, slab on grade, and walkout areas need not be drained unless specified at the time of the Open Hole Observation. Perimeter drains may be required during the open hole due to high moisture or grade that slopes toward the excavation. The final determination of the necessity for perimeter drains will be made at the time of the Open Hole Observation. An Exterior Drain Detail is provided in this report. Drains should daylight away from the structure or discharge to a sump pump. Even if drains are not required, areas below grade may experience moisture problems if unusual conditions are present in the future.

REINFORCING

The concrete foundation walls shall be properly reinforced as per the specific design for this foundation by a **Colorado Registered Professional Engineer. Exact requirements are a function of the design of the structure. Questions concerning the specific design requirements shall be referred to the design engineer.**

FOOTING DESIGN

The design for footings, pads, and/or piers for this structure is determined by applying the dead load and full live load to the foundation walls.

CONSTRUCTION DETAILS

It is necessary with any soils investigation to assume that the materials from the test holes are representative of the materials in the area. On occasion variations in the subsurface materials do occur, therefore, should such variations become apparent during construction, the owner is advised to contact this office for a determination as to whether these variations will affect the design of the structure's foundation. If anomalies are observed during the excavation for the structure, this office should be contacted to determine whether the layers will adversely affect the design.

MINIMUM MATERIALS SPECIFICATIONS

1. Minimum materials specifications of the concrete, reinforcing, etc., shall be determined by the Professional Foundation Design Engineer.
2. Compact beneath foundation walls a minimum of 95% Modified Proctor density to prevent settlement.
3. Compact all backfill material located around the perimeter of the foundation to a minimum of 80% Modified Proctor density.
4. Concrete shall be vibrated or rodded in forms to avoid segregation and cold joints.
5. The site shall be kept well drained at all times.

OPEN HOLE OBSERVATION (added cost)

If anyone other than A Better Soil Solution, Inc. performs the Open Hole Observation, that person/company assumes liability for the soils, and any possible changes to the foundation design.

The owner, or a representative of the construction company shall contact **A Better Soil Solution, Inc.** a minimum of **24 hours** prior to excavating for the foundation. An Open Hole Observation must be performed on each individual structure prior to the placement of concrete, and preferably prior to the placement of forms in the excavated area. **The failure to request or obtain an Open Hole Observation prior to the placement of foundation components may result in this Soils Report being declared null and void.** This is to ensure that soft areas, anomalies, etc., are not present in the foundation region. At the time of the open hole observation the **foundation type recommendations, maximum allowable bearing capacity may be revised** according to soil conditions found at that time. If revisions are made to the Soils Report due to the soil conditions of the excavation, **the Foundation Design Engineer must be notified of all revisions.**

COMPACTION TESTING (added cost)

A Better Soil Solution, Inc. shall perform compaction testing on any replaced material. Soil shall be compacted in maximum 6-inch lifts. Testing shall be performed at intervals not to exceed 24 inches (or as required by the design engineer). Modified Proctor Density must be provided to A Better Soil Solution, Inc. prior to compaction testing, see below.

The owner, or a representative of the construction, shall contact A Better Soil Solution, Inc. a **minimum of 24 hours prior to the time the compaction test is requested. The failure to properly compact and/or obtain proper compaction testing may result in this Soils Report being declared null and void.**

MODIFIED PROCTOR DENSITY TESTING (added cost)

Modified Proctor Density test must be provided to A Better Soil Solution, Inc. prior to compaction testing. If a Proctor cannot be provided, a Modified Proctor Density test must be completed prior to compaction testing. Two 5-gallon valid samples of the soil to be used, must be provided for testing, at least 2 weeks prior to the placement and compaction of the material.

The failure to provide this data may result in this Soils Report being declared null and void.

FINAL OBSERVATIONS (added cost)

The owner, or a representative of the construction company, shall contact A Better Soil Solution, Inc. at the time final grading and landscaping procedures are completed. This is to ensure that sprinkler systems are not installed adjacent to the structure and that only shrubs or plants that require minimal watering are established in this area. All exterior grading as well as the location of downspouts and their performance shall be inspected by A Better Soil Solution, Inc. Any additional landscaping or grading changes performed by subsequent contractors and/or owners shall be inspected and approved. It is the responsible of the contractor and/or owner to schedule all these inspections at the appropriate times. **The failure to obtain this inspection may result in this Soils Report being declared null and void.**

LIMITATIONS

This report is issued based on the understanding that the owner or his representative will bring the information, data, and recommendations contained in this report to the attention of the project engineer and architect, in order that they may be incorporated into the plans for the structure. It is also the owner's responsibility to ensure that all contractors and sub-contractors carry out these recommendations during the construction phase.

This report was prepared in accordance with generally accepted professional geotechnical/engineering methods. However, A Better Soil Solution, Inc. makes no other warranty, express or implied, as to the findings, data, specifications, or professional advice rendered hereunder. **Due to circumstances outside of A Better Soil Solution, Inc.'s control, including improper construction, failure to follow recommendations, and unforeseen events, the Limits of Liability extend only to fees rendered for the professional services provided.**

This report is considered valid as of the present date. The owner acknowledges, however, that changes in the conditions of the property might occur with the passage of time, such as those caused by natural effects or man-made changes, both on this land and on abutting properties. Further, changes in acceptable tolerances or standards might arise as the result of new legislative actions, new engineering advances, or the broadening of geotechnical knowledge. Thus, certain developments beyond our control may invalidate this report, in whole or in part.

This report and its recommendations do not apply to any other site than the one described herein and are predicated on the assumption that the soil conditions do not deviate from those described. In the event that any variations or undesirable conditions should be detected during the construction phase or if the proposed construction varies from that planned as of this report date, the owner shall immediately notify A Better Soil Solution, Inc. in order that supplemental recommendations can be provided, if so required.

This report excludes possible environmental issues, geologic hazards, flooding, or any other natural or man-made hazards that affect this site. These are outside the scope of work, for this report.

APPENDIX

Solid Stem Auger (STA) Log TH-1

Project Info.
Project : 0 Spruce Rd
Client : Palace Homes
Location : Manitou Springs, CO
Job No. : 23-0406

Borehole Info.
Depth: 4 (ft)
GWL: - (ft)
Drill Date: 8/10/23
Logged By: NB+TD

Elevation:
Latitude: 38.829858
Longitude: -104.938769
Method: Solid Stem Auger

Company Info.
A Better Soil Solution

Depth (ft)	GWL (ft)	Sample Type	Field Tests (* SPT)	USCS / AASHTO	Symbol	Lithology Description	Depth (ft)	w (%)	Particle Analysis Test: Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Atterberg Limits: LL (%)	PL (%)	PI (%)	Remarks & Comments
0						**Topsoil**	0									
1						**Well Graded Sand** *Fine-Coarse Grained* *Very High Density* *Low Moisture Content* *Low Clay Content* *Non Plastic* *Reddish Yellow in Color*	1								
2							2									
3							3									
4		U	* (100)	SW A-1-b(0)		End of Log @ 4 (ft)	4	2.8	45	50.2	4.8		NLL	-	NPI	Refusal/ Granite at 4 Ft

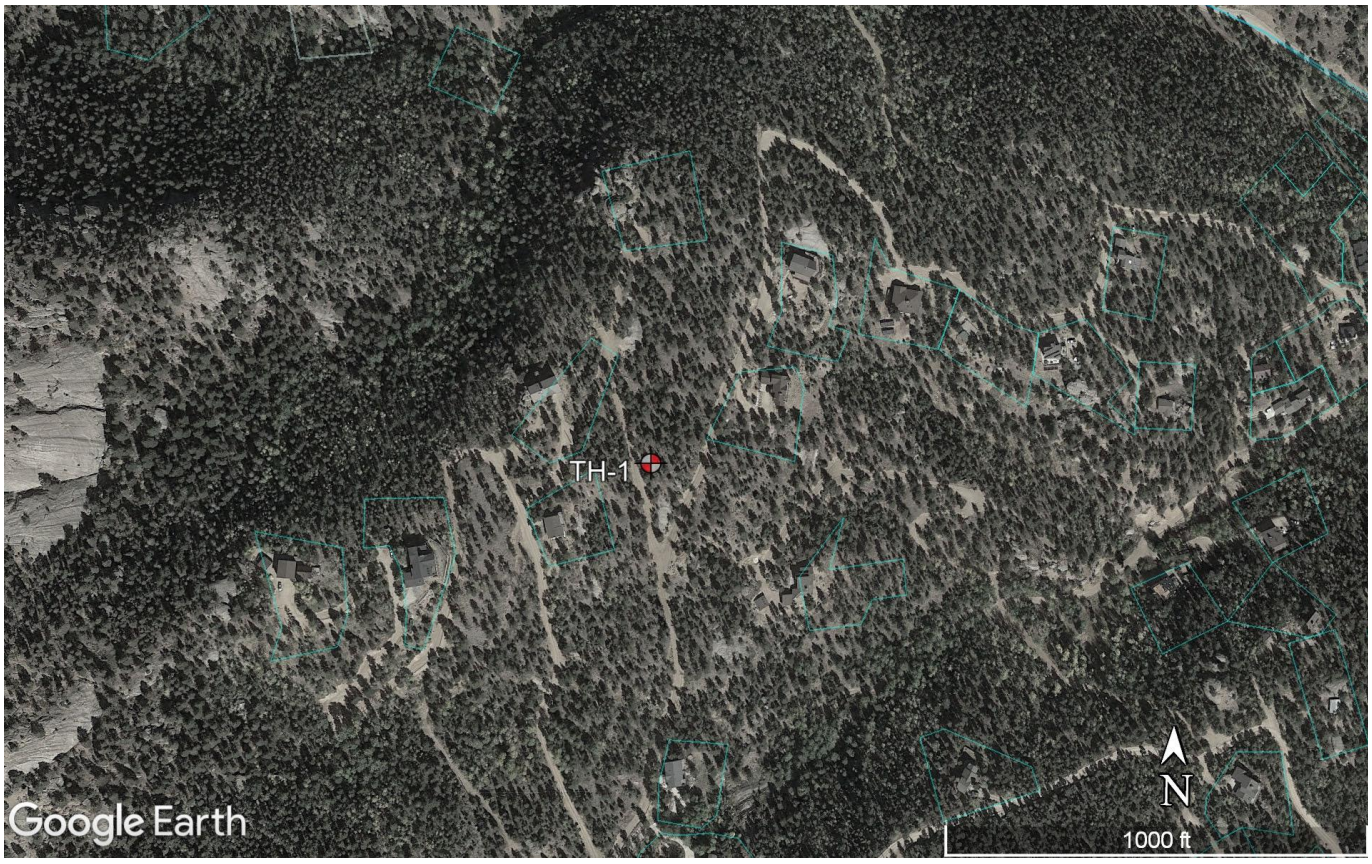
Sample Types
- ● Disturbed
- + Undisturbed
- ☐ Shelby / U4
- ■ Core Cutter
- SPT Sample
- Water Sample
- ▽ Groundwater Level

Abbreviations
- LL : Liquid Limit
- PL : Plastic Limit
- PI : Plastic Index
- NPI : None PI
- w : Moisture Content

Site Map

Project:	0 Spruce Rd
Client:	Palace Homes
Job No.:	23-0406
Location:	Manitou Springs, CO

A Better Soil Solution



Coordinates

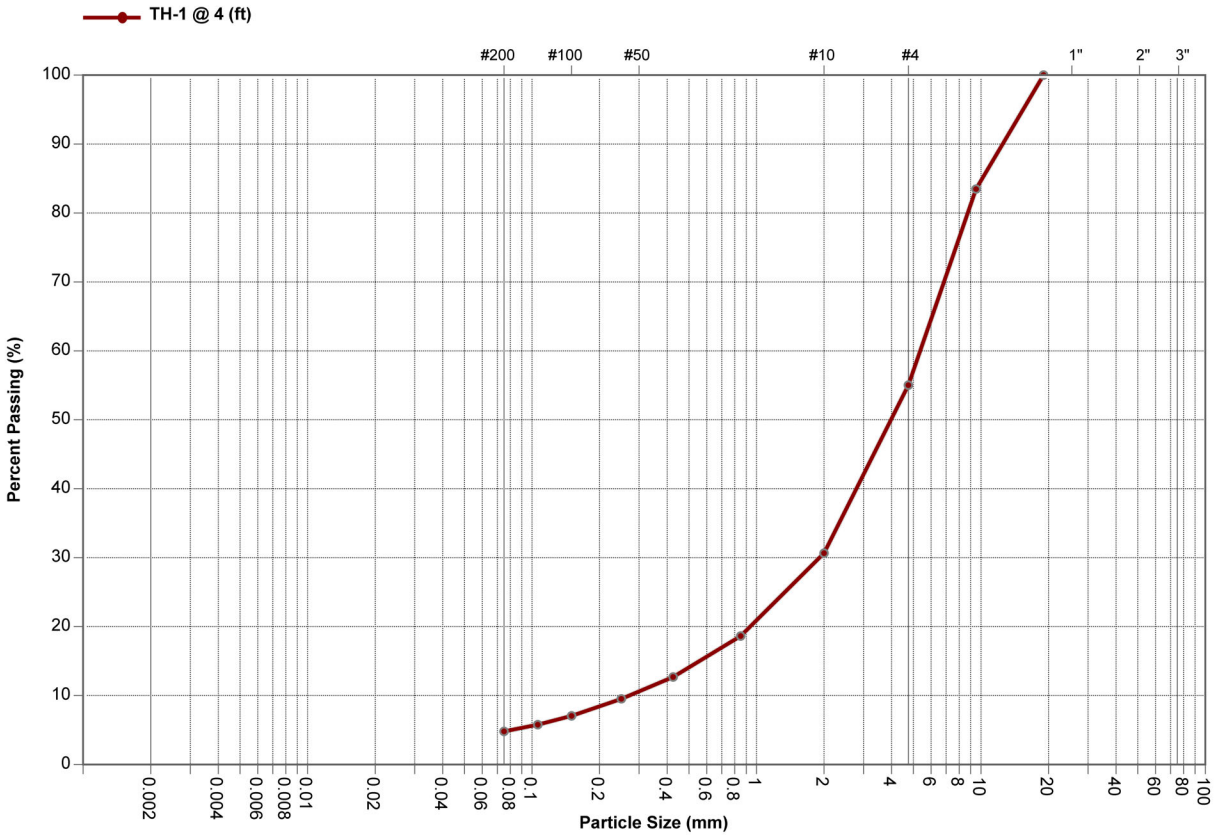
Bore Hole	Latitude	Longitude
TH-1	38.829858	-104.938769

Particle Analysis Test

Project : 0 Spruce Rd
Client : Palace Homes
Job No.: 23-0406
Location : Manitou Springs, CO

A Better Soil Solution

ASTM D6913



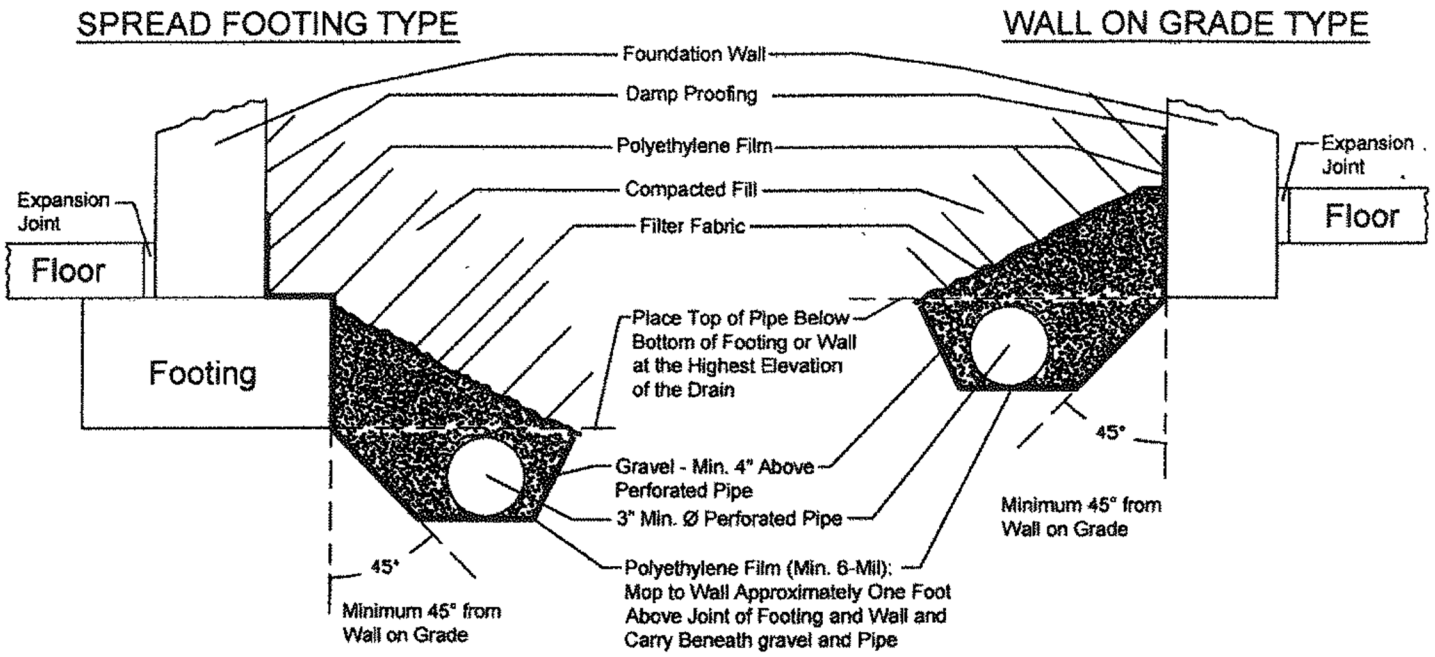
Particle Distribution (%)

Clay	Silt	Sand	Gravel	Cobbl
	4.8	50.2	45	-

Classification

Borehole	Sample Depth (ft)	D10 (mm)	D30 (mm)	D50 (mm)	D60 (mm)	Cc	Cu	LL (%)	PI (%)	Disp. (%)	USCS	AASHTO
TH-1	4	0.271	1.91	3.975	5.364	2.51	19.793	-	-	N/A	SW	A-1-b(0)

Exterior Drain Detail



1. Gravel to be Not More Than 1-1/2" and Not Less Than 1/2" Diameter.

2. Perforated Pipe Diameter Varies With Expected Seepage. 3"Ø and 4"Ø are Most Common. ABS and PVC are Most Common Materials for Pipe. We approve the use of an "EZ Flow Drainage System" by Infiltrator. All specifications in this drain detail are still applicable.

3. Pipe to be Laid out in a Minimum Slope of 1" in 10'.

4. Gravity Outfall is Desired if Possible. Portion of Pipe in Area Not Drained Shall be Non-Perforated. Daylight Must be Maintained Clear of Debris in Order to Function Properly.

5. If Gravity Outfall is Not Possible, Provide a Sump With Operational Pump. Pump May Not Connect to Any Sanitary or Storm Sewer.

6. Soil Backfill Should be Compacted to at Least 80% of the Modified Proctor Denisty in the Upper Three Feet of Fill.

7. Filter Fabric to be Mirafi 140s or Approved Equivalent. Roofing Felt and Sheet Plastic are Not Acceptable.

8. Drain Pipe Shall be Laid Below Protected Area, as Shown in The Detail Above.

9. Mop Polyethylene Film to Wall Approximately One Foot Above Joint of Footing and Wall (Do Not Pull Plastic Tight) and Carry Beneath Gravel and Pipe.

10. The Polyethylene Film Shall be Continued to the Edge of the Excavation.