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ROCKY MOUNTAIN GROUP
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SOILS AND GEOLOGY STUDY

Cornerstone Estates
Northwest of the Intersection of Goodson Rd and Rex Rd
El Paso County, Colorado

PREPARED FOR:

William Guman & Associates, Ltd
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Colorado Springs, CO 80903

JOB NO. 184228

November 5, 2021

Respectfully Submitted,
RMG – Rocky Mountain Group

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Reviewed by,
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1.0 GENERAL SITE AND PROJECT DESCRIPTION

1.1 Project Location

The project lies in the NE¼ of Section 23, Township 12 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado, and is generally located northwest of the intersection of Rex Road and Goodson Road. The approximate location of the site is shown on the Site Vicinity Map, Figure 1.

1.2 Existing Land Use

The site consists of one parcel. It is approximately 58.77 acres and is partially developed. The parcel included is:

- Schedule No. 5223000003

The current zoning is *"PUD" – Planned Unit Development.* The parcel is currently partially developed.

1.3 Project Description

The site consists of approximately 58.77 acres and is partially developed. An existing modular home is located on the northwest corner of the property. A horse stable and corral were located south of the modular home. The proposed development is to consist of 16 lots, each comprising 2.5 acres to 3.64 acres, and a tract of approximately 5.98 acres for open space and drainage. The proposed lot layout is presented in Figure 11, Engineering and Geology Map.

Each lot is to be served by an onsite wastewater treatment system (OWTS) and an individual water supply well. Based upon our review of the proposed site grading (Reference 1), site grading activities is to be limited to the extent necessary to facilitate construction of individual homes, drainage, utilities and roadway construction. The site is to be accessed from Goodson Road.

All streets within the subdivision are to be Rural Local with a 60' R.O.W and constructed to El Paso County standards. The streets are to be maintained by El Paso County.

2.0 QUALIFICATIONS OF PREPARERS

This Soil, Geology, and Wastewater 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 as defined by State Statute (C.R.S 34-1-201) with over 21 years of experience in the geological and geotechnical engineering field. Ms. Kelli Zigler holds a B.S. in Geology from the University of Tulsa. Ms. Zigler has supervised and performed numerous geological and geotechnical field investigations throughout Colorado.

Tony Munger, P.E. is a licensed professional engineer with over 21 years of experience in the construction engineering (residential) field. Mr. Munger holds a B.S. in Architectural Engineering from the University of Wyoming

3.0 STUDY OVERVIEW

The purpose of this investigation is to characterize the general geotechnical, geologic site conditions, and onsite wastewater treatment system (OWTS) feasibility and present our opinions of the potential effect of these conditions on the proposed residential development within El Paso County, Colorado. As such, our services exclude evaluation of the environmental and/or human, health related work products or recommendations previously prepared, by others, for this project.

Revisions to the conclusions presented in this report may be issued based upon submission of the Development Plan. This study has been prepared in accordance with the requirements outlined in the El Paso County Land Development Code (LDC) specifically Chapter 8, last updated August 27, 2019. Applicable sections include 8.4.8 and 8.4.9, and the El Paso County Engineering Criteria Manual (ECM), specifically Appendix C last updated July 9, 2019.

3.1 Scope and Objective

The scope of this study is to include a physical reconnaissance of the site and a review of pertinent, publically available documents including, but not limited to, previous geologic and geotechnical reports, overhead and remote sensing imagery, published geology and/or hazard maps, design documents, etc.

The objectives of our study are to:

- Identify geologic conditions present on the site
- Analyze potential negative impacts of these conditions on the proposed site development
- Analyze potential negative impacts to surrounding properties and/or public services resulting from the proposed site development as it relates to existing geologic conditions
- Provide our opinion of suitable techniques that may be utilized to mitigate any potential negative impacts identified herein

This report presents the findings of the study performed by RMG relating to the geologic conditions of the above-referenced site. Revisions and modifications to 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
- Review of pertinent documents (development plans, plat maps, drainage reports/plans, etc.) not available at the time of this study
- Comments received from the governing jurisdiction and/or their consultants subsequent to submission of this document

3.2 Site Evaluation Techniques

The information included in this report has been compiled from several sources, including:

- Field reconnaissance
- Geologic and topographic maps
- Review of selected publicly available, pertinent engineering reports
- Available aerial photographs
- Subsurface exploration
- Laboratory testing of representative site soil and rock samples
- Geologic research and analysis
- Site development plans prepared by others

Geophysical investigations were not considered necessary for characterization of the site geology. Monitoring programs, which typically include instrumentation and/or observations for changes in groundwater, surface water flows, slope stability, subsidence, and similar conditions, are not known to exist and were not considered applicable for the scope of this report.

3.3 Previous Studies and Field Investigation

Reports of previous geotechnical engineering/geologic investigations for nearby sites were available for our review and are listed below:

1. *Geologic Hazards Study, Preliminary Subsurface Soil Investigation, Preliminary Onsite Wastewater System Report, Cornerstone Estates, Northwest of the Intersection of Goodson and Rex Roads, El Paso County, Colorado*, prepared by RMG Engineers, Job No. 117523, last revised May 5, 2008.

3.4 Additional Documents

Additional documents reviewed during the performance of this study are included in Appendix A.

4.0 SITE CONDITIONS

4.1 Existing Site Conditions

The site is partially developed. The property is generally located northwest of the intersection of Rex and Goodson Roads in northern El Paso County, Colorado and comprises approximately 58.77 acres. The site is zoned PUD, Planned Unit Development. Adjacent properties to the north, west and east are zoned RR-5, rural residential. Adjacent properties to the south are zoned RR-2.5, rural residential.

4.2 Topography

Based on our site reconnaissance on July 13, 2021 and USGS 2016 topographic map of the Falcon NW Quadrangle, the site generally slopes down from the northwest to southeast with an elevation difference of approximately 68 feet. Two drainage features traverse the site from northwest to southeast and are shown in Figure 11. The water levels in the drainage are anticipated to vary dependent upon local precipitation events.

4.3 Vegetation

Site vegetation primarily consists of native grasses and other prairie-type vegetation. Deciduous trees are scattered sparsely across the southeastern portion of the site. Dense stands of deciduous trees occur near the center and the northwest boundary of the site and in defined drainage features. Willows, cattails and similar vegetation were present near and surrounding the defined drainage features. Landscaping around the modular home consisted of shrubs, flowers and trees.

4.4 Aerial photographs and remote-sensing imagery

Personnel of RMG reviewed aerial photos available through Google Earth Pro dating back to 1999, CGS surficial geologic mapping, and historical photos by historicaerials.com dating back to 1947. Historically, the site has remained partially developed land since the 1960s.

5.0 FIELD INVESTIGATION AND LABORATORY TESTING

The current subsurface conditions within the property were explored by drilling four (4) exploratory test borings to depths of 20-feet below the existing ground surface. RMG's previous investigation conducted in May of 2008, Job No. 117523, explored subsurface conditions within the property by drilling eight (8) exploratory test borings to depths of 20-feet below the existing ground surface. The total number of borings exceeds the minimum criteria of one test boring per 10 acres of development up to 100 acres and one additional boring for every 25 acres of development above 100 acres as stipulated in the ECM, Section C.3.3. Additionally, three (3) test pits were excavated for on-site wastewater treatment system (OWTS) purposes.

The test borings were drilled with a power-driven, continuous-flight auger drill rig. Samples were obtained during drilling of the test boring in general accordance with ASTM D-1586 and D-3550, utilizing a 2-inch O.D. Split Barrel Sampler and a 2½-inch O.D. California sampler, respectively. Results of penetration tests are shown on the drilling logs. The test boring locations are presented in the Test Boring and Test Pit Location Map, Figure 13. An Explanation of Test Boring Logs is presented in Figure 3, the Test Boring Logs are presented in Figures 4 and 5. The Test Pit Logs are presented in Figures 6 and 7.

5.1 Laboratory Testing

Soil laboratory testing was performed as part of this investigation. Laboratory testing included moisture content, grain-size analysis and Atterberg Limits. A Summary of Laboratory Test Results is presented in Figure 8. Soil Classification Data is presented in Figure 9.

5.2 Shallow Groundwater

Groundwater was not encountered in the test borings during the field exploration for the current investigation. However, in the 2008 report by RMG, groundwater was encountered in five of the eight borings at depths ranging from approximately 1 to 15 feet below the existing ground surface. Groundwater was not encountered in the remaining three test borings.

Our previous investigation states that the groundwater appeared to be perched on the bedrock underlying the site. The test borings were drilled prior to the part of the year when El Paso County typically receives

the most precipitation. Therefore, the groundwater levels encountered previously are not considered to represent seasonally high groundwater levels.

Fluctuations in groundwater and subsurface moisture conditions may occur due to variations in precipitation, landscape irrigation, and modifications in land use in the area. Development of adjacent properties may also affect groundwater levels.

6.0 SOIL, GEOLOGY, AND ENGINEERING GEOLOGY

The site is located within the central portion of the Great Plains Physiographic Province. A major structural feature known as the Rampart Range Fault is located approximately 15 miles west of the site. Rampart Range Fault marks the boundary between the Great Plains Physiographic Province and the Southern Rocky Mountain Province. The site exists within the southern edge of a large structural feature known as the Denver Basin. In general, the geology at the site consists of colluvium and alluvium overlying the bedrock of the Upper part of the Dawson Formation. The colluvium and alluvium generally consist of slightly silty to silty sands. The upper part of the Dawson Formation is generally comprised of the arkosic sandstone, claystone, mudstone, and conglomerate and localized coal beds.

6.1 Subsurface Soil Conditions

The subsurface materials encountered in the test borings were classified within the laboratory using the Unified Soil Classification System (USCS). The materials classify primarily as clayey sand (SC) overlying sandstone and claystone bedrock.

Additional descriptions and the interpreted distribution (approximate depths) of the subsurface materials are presented on the Test Boring Logs. The classifications shown on the logs are based upon the engineer's description of the samples at the depths indicated. Stratification lines shown on the logs represent the approximate boundaries between material types and the actual transitions may be gradual and vary with location.

6.2 Bedrock Conditions

Bedrock was encountered in the test borings performed for this study. In general, the bedrock (as mapped by Colorado Geologic Survey - CGS) is considered part of the Dawson formation and consists of silty sandstone with interbedded layers of claystone. The Dawson formation is thick-bedded to massive, generally light colored arkose, pebbly, and pebble conglomerate. The sandstone is generally poorly sorted with various amounts of clay content. The sandstone is generally permeable, well drained, and has good foundation characteristics. The claystone is generally well sorted with high sand content. The claystone is less permeable than the sandstone and is generally not suitable for direct bearing of shallow foundations. Bedrock is anticipated in the excavations and utility trenches for the proposed development.

6.3 U.S. Soil Conservation Service

The U.S. Soil Conservation Service along with United States Department of Agriculture (USDA) identifies the site soils as:

- 71 – Pring Coarse Sandy Loam, 3 to 8 percent slopes. The Pring coarse sandy loam was mapped by the USDA to encompass the majority of the property. Properties of the sandy loam include,

some-what excessively drained soils, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be low, frequency of flooding and ponding is none, and landforms include hills.

- 40 – Kettle Gravelly Loamy Sand, 3 to 8 percent slopes. The Kettle Gravelly Loamy Sand was mapped by the USDA to encompass is very small portion of the northwest property corner. Properties of the loamy sand include somewhat excessively drained soils, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be low, frequency of flooding and ponding is none, and landforms include hills.

The USDA Soil Survey Map is presented in Figure 10.

6.4 General Geologic Conditions

Based on our field observations and review of relevant geologic maps, a geologic map was prepared which identifies the geologic conditions affecting the development. The identified geologic conditions affecting the development are presented in the Engineering and Geology Map, Figure 11.

The site generally consists of eolian deposits overlying sandstone bedrock. Four geologic units were mapped at the site as:

- *TKda3 – Dawson formation, facies unit three* – white to light-gray, cross-bedded or massive, very coarse arkosic sandstone or pebbly conglomerate. Occasional interbedded thin to very thinly bedded sandy claystone. Estimate thickness varies from 25 to 200 feet. The Dawson formation was encountered in all the test borings.
- *Psw* – Potentially Seasonal Wet Area
- *sw* – Seasonal Wet Area
- *af* – Artificial fill Area

6.5 Engineering Geology

Charles Robinson and Associates (1977) have mapped two environmental engineering units at the site as:

- *1A* – Stable alluvium, colluvium and bedrock on flat to gentle slopes (0-5%).
- *7A* – Physiographic floodplain where erosion and deposition presently occur and is generally subject to recurrent flooding. Includes 100-year floodplain along major streams where floodplain studies have been conducted.

6.6 Structural Features

Structural features such as schistocity, folds, zones of contortion or crushing, joints, shear zones or faults were not observed on the site, in the surrounding area, or in the soil samples collected for laboratory testing.

6.7 Surficial (Unconsolidated) Deposits

Lake and pond sediments, swamp accumulations, sand dunes, marine terrace deposits, talus accumulations, creep, or slope wash were not observed on the site. Slump and slide debris were also not observed on the site.

6.8 Features of Special Significance

Features of special significance such as accelerated erosion, (advancing gully head, badlands, or cliff reentrants) were not observed on the property. Features indicating settlement or subsidence such as fissures, scarplets, and offset reference features were not observed on the study site or surrounding areas. Features indicating creep, slump, or slide masses in bedrock and surficial deposits were not observed on the property.

6.9 Drainage of Surface Water and Groundwater

The overall topography of the site slopes down from the northwest to the southeast. It is anticipated the direction of surface water and groundwater is to flow in the same direction. Groundwater was not encountered in the test borings performed for this current study. However, in our 2008 report, groundwater was encountered at depths ranging from approximately 1 to 18 feet below the existing ground surface. Two drainage features traverse the site from northwest to southeast.

7.0 ECONOMIC MINERAL RESOURCES

Under the provision of House Bill 1529, it was made a policy by the State of Colorado to preserve for extraction commercial mineral resources located in a populous county. Review of the *El Paso Aggregate Resource Evaluation Map, Master Plan for Mineral Extraction*, *Map 2* indicates the site is identified as Upland Deposits. The overburden upland deposits consist of sand and gravel with silt and clay deposited by older stream deposits on topographic highs or beach like features. Extraction of the sand and gravel more than likely would not be considered to be economical compared to materials available elsewhere within the county.

According to the *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands*, the site is mapped within the southern part of the Denver Basin Coal Region. However, the area of the site has been mapped “Somewhat Poor" for coal resources, no active or inactive mines have been mapped in the area of the site. No metallic mineral resources have been mapped on the site. No oil and gas wells are drilled on this tract, or within two miles of it. The nearest historic coal mine sites are located five miles southwest of the tract in the Colorado Springs coal field. In this part of the Denver coal region, coal resources are locally present within the lower part of the Laramie Formation of Upper Cretaceous age.

The alluvium on this tract may contain sand or gravel. However, the Piney Creek Alluvium is often silty or clayey in this area. It often does not contain useable sand and gravel resources. Eolian sand, which is also present on this tract, has been mined locally for silica sand. Silica sand is mined in an area about three to four miles west-northwest of this tract.

8.0 IDENTIFICATION AND MITIGATION OF POTENTIAL GEOLOGIC CONDITIONS

The El Paso County Engineering Criteria Manual recognizes and delineates the difference between geologic hazards and constraints. A *geologic hazard* is one of several types of adverse geologic conditions capable of causing significant damage or loss of property and life. Geologic hazards are defined in Section C.2.2 Sub-section E.1 of the ECM. A *geologic constraint* is one of several types of adverse geologic

conditions capable of limiting or restricting construction on a particular site. Geologic constraints are defined in Section C.2.2 Sub-section E.2 of the ECM (1.15 Definitions of Specific Terms and Phrases). The following geologic constraints were considered in the preparation of this report. They are not are not anticipated to pose a significant risk to the proposed development:

- Avalanches
- Debris Flow-Fans/Mudslides
- Floodplains
- Ground Subsidence
- Landslides
- Rockfall
- Ponding water
- Steeply Dipping Bedrock
- Unstable or Potentially Unstable Slopes
- Scour, Erosion, accelerated erosion along creek banks and drainage ways
- Corrosive Minerals

The following sections present geologic constraints that have been identified on the property:

8.1 Expansive Soils and Bedrock

Based on the test borings performed by RMG for this investigation and our experience with similar materials in this area, the silty to clayey sand generally possesses nil to low swell potential and the sandy clay and claystone generally possess low to moderate swell potential. The Dawson formation is known to have moderate to high swell potential in some locations. It is anticipated that expansive soil/bedrock may be encountered at depths anticipated to affect residential foundations. These materials are readily mitigated with typical construction practices common to this region of El Paso County, Colorado.

<u>Mitigation</u>
Foundation design and construction are typically adjusted for expansive soils. Mitigation of expansive soils may include overexcavation and replacement with non-expansive structural fill. Drilled piers are not anticipated. Floor slabs bearing directly on expansive soils are expected to experience movement. Overexcavation and replacement with compacted non-expansive soils can be successful in reducing this slab movement.

If expansive soils or bedrock are encountered during construction, mitigation of these expansive materials should follow the recommendations presented in a lot-specific subsurface soil investigation performed for each proposed structure.

8.2 Compressible Soils

The site contains colluvial deposits consisting of sandy clay with clayey sand seams and gravel with occasional boulders. Materials similar to those encountered can experience settlement when saturated and simultaneously exposed to superimposed loads from foundations.

It is unknown at this time whether the proposed single-family residences will have crawlspaces, basements, or a combination of both.

Mitigation
Foundation design and construction are typically adjusted for loose soils. Mitigation of loose soils may include overexcavation and replacement with non-expansive structural fill. Drilled piers are not anticipated. Floor slabs bearing directly on loose soils are expected to experience movement. Overexcavation and replacement with compacted non-expansive soils can be successful in reducing this slab movement.

If loose soils are encountered during construction, mitigation of these loose materials should follow the recommendations presented in a lot-specific subsurface soil investigation performed for each proposed structure.

8.3 Surface Drainage

Based on our review of the Federal Emergency Management Agency (FEMA) Community Panel No. 08041C0535G and the online ArcGIS El Paso County Risk Map, the entire site lies outside the 100- and 500-year floodplains of both Black Squirrel Creek and Sand Creek. The site currently lies in the Zone X. Zone X is defined by FEMA as an area of minimal flood hazard that is determined to be outside the Special Flood Hazard Area and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. The FEMA Map is presented in Figure 12.

A natural drainage transverses from northeast to southwest on the property site. The drainage is to remain, and the residences and OWTS should be located outside the drainage pathway. It is anticipated that the area is potentially seasonally wet. Ponds located near the southernmost drainage way, proposed lot 11, proposed lot 7, and in the southeast corner near the utility easement are also anticipated to be seasonally wet.

Mitigation
Based on the proposed site plan provided by the client, the drainages in the southwest corner of the site cross both Mercy Court and individual-lot driveways. A combination of swales and culverts can be used to divert surface drainage water away from the proposed structures and around or below paved areas.

8.4 Springs and High Groundwater

Based on our site observations and review of the Black Forest Quadrangle and Google Earth images dating back to September 1999, springs do not appear to originate on the subject site. Groundwater was not encountered at the time of drilling for this investigation. However, areas of shallow groundwater were encountered in our 2008 investigation. In these areas, we would anticipate the potential for periodically high subsurface moisture conditions and frost heave potential. Depths of groundwater for the 2008 investigation are presented in Figure 13, Test Boring and Test Pit Location Map.

Fluctuations in groundwater and subsurface moisture conditions may occur due to variations in rainfall and other factors not readily apparent at this time. Development of the property and adjacent properties may also affect groundwater levels. Groundwater information obtained for the 2008 investigation or the current investigation performed prior to the land development phase may or may not be representative of the conditions present at the time of construction. Furthermore, the development processes (reshaping of the ground surface, installation of buried utilities, installation of an underdrain below the roadways, etc.) can significantly alter the depth and flow paths of the subsurface water. The construction of surrounding lots can also alter the amount and depth of subsurface groundwater below a given lot. The potential exists

for high groundwater levels during high moisture periods and should structures encroach on these areas the following mitigations should be followed.

Mitigation:
Foundations must have a minimum 30-inch depth for frost protection. Perimeter drains are recommended around portions of the structures which will have habitable or storage space located below the finished ground surface. This includes crawlspace areas but not the walkout trench, if applicable. Perimeter drains are recommended for portions of the structures which will have below-grade spaces to help reduce the intrusion of water into areas below grade. A typical perimeter drain detail is presented in Figure 14.

If groundwater is encountered at the time of the site-specific subsurface soil investigations within 4 to 6 feet of the proposed basement slab elevation, an underslab drain would be considered in conjunction with the perimeter drain. It must be understood that subsurface drains are designed to intercept some types of subsurface moisture and not others. Therefore, the drain(s) could operate properly and not mitigate all moisture problems relating to foundation performance or moisture intrusion into the basement areas.

Groundwater was not indicated in readings from the current investigation, but was reported in the previous investigation referenced above. Test borings with groundwater from the referenced report were located within or immediately adjacent to identified drainages. It's possible that surface runoff water contributed to the water encountered in the original test borings, resulting in a false reading.

In areas where basements are proposed, an underdrain placed at the bottom of sanitary sewer trenches within drive lanes may help reduce the impact of groundwater on basement feasibility. Underdrains placed in sanitary sewer trenches in areas where groundwater is anticipated will likely be the “active” type, which uses a perforated drain pipe. In areas where groundwater is not anticipated, “passive” type underdrains may be used. Typical underdrain details are presented in Figures 16 and 17

8.5 Faults and Seismicity

Based on review of the Earthquake and Late Cenozoic Fault and Fold Map Server provided by CGS located at http://dnrwebmapgdev.state.co.us/CGSOnline/ and the recorded information dating back to November of 1900, Colorado Springs has not experienced a recorded earthquake with a magnitude greater than 1.6 during that period. The nearest recorded earthquakes over 1.6 occurred in December of 1995 in Manitou Springs, which experienced magnitudes ranging between 2.8 to 3.5. Additional earthquakes over 1.6 occurred between 1926 and 2001 in Woodland Park, which experienced magnitudes ranging from 2.7 to 3.3. Both of these locations are located near the Ute Pass Fault, which is greater than 10 miles from the subject site.

Earthquakes felt at this site will most likely result from minor shifting of the granite mass within the Pikes Peak Batholith, which includes pull from minor movements along faults found in the Denver basin. It is our opinion that ground motions resulting from minor earthquakes may affect structures (and the surrounding area) at this site if minor shifting were to occur.

Mitigation
The Pikes Peak Regional Building Code, 2017 Edition, indicates maximum considered earthquake spectral response accelerations of 0.185g for a short period (S_s) and 0.059g 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 feet per second for the materials in the upper 100 feet.

8.6 Radon

"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".*

Northern El Paso County and the 80908/80831 zip code in which the site is located, has an EPA assigned Radon Zone of *1*. A radon Zone of *1* predicts an average indoor radon screening level greater than 0.4 pCi/L (picocuries per liter), which is above the recommended levels assigned by the EPA. *The EPA recommends corrective measures to reduce exposure to radon gas.*

All of the State of Colorado is considered EPA Zone 1 based on the information provided at https://county-radon.info/CO/El_Paso.html. Elevated hazardous levels of radon from naturally occurring sources are not anticipated at this site.

Mitigation
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.

8.7 Undocumented Fill

Artificial fill is assumed to be located in the vicinity of the current structures and in the man-made berm located north of lot 11, near the western boundary.

The fill soils are currently considered undocumented fill, and as such are not suitable for development for the following reasons: the degree of consolidation is unknown, material densities will vary, pockets and seams of soft and loose material may be encountered, and uneven and differential settlement potential can exist. It is our opinion that undocumented fill soils can be mitigated with typical construction practices common to the Colorado Springs area.

Mitigation
If unsuitable fill soils are encountered during the Open Excavation Observation, they will require removal (overexcavation) and replacement with compacted structural fill. The zone of overexcavation shall extend to the bottom of the unsuitable fill zone and shall extend at least that same distance beyond the building perimeter (or lateral extent of the fill, if encountered first).

8.8 Proposed Grading, Erosion Control, Cuts and Masses of Fill

A preliminary grading plan was available for this site. It is our understanding that site grading will alter the existing topography only to the extent necessary to accommodate the proposed development. Based

on the test borings for this investigation, excavations are anticipated to encounter silty to clayey sand, sandy clay and sandstone with interbedded claystone seams.

Mitigation

The on-site soils can be used as site grading fill, though the clay and claystone should be avoided in areas where the proposed foundations are not anticipated to penetrate through the grading fill.

The on-site soils are mildly susceptible to wind and water erosion. Minor wind erosion and dust may be an issue for a short time during and immediately after construction. Should the problem be considered severe during construction, watering of the cut areas may be required. Once construction is complete, vegetation should be re-established.

Prior to placement of overlot fill or removal and recompaction of the existing materials, topsoil, low-density native soil, all uncontrolled or undocumented fill, and organic matter should be removed from the proposed fill area. The subgrade should be scarified, moisture conditioned to facilitate compaction (usually within 2% of the optimum moisture content), and recompacted to the same degree as the overlying fill to be placed. The placement and compaction of fill should be periodically observed and tested by a representative of RMG during construction.

Guideline Site Grading Specifications are included in the Appendix C.

9.0 On-site Wastewater Treatment Systems

It is our understanding that On-site Wastewater Treatment Systems (OWTS) are proposed for the subdivision. Individual wells and septic systems are proposed for each new residence. The site was evaluated in general accordance with the El Paso Land Development Code, specifically sections 8.4.8. Three test pits ranging in depth from 5 to 8 feet were performed across the site to obtain a general understanding of the soil and bedrock conditions. The Test Pit Logs are presented in Figures 6 and 7.

The United States Department of Agriculture (USDA) as discussed in section 6.3 consisted of sandy loam and loamy sand. Limiting layers were encountered in two test pits at 5 feet and 7 feet. The long term acceptance rates (LTAR) associated with the soils observed in the test pits range from 0.35 to 0.80 gallons per day per square foot (soil types 1 to 3). Signs of seasonal groundwater were not observed in the test pits.

Contamination of surface and subsurface water resources should not occur provided the OWTS sites are evaluated and installed according to the El Paso County Board of Health Guidelines and property maintained.

Treatment areas at a minimum, must achieve the following:

- Treatment areas must be 4 feet above groundwater or bedrock as defined by the Definitions 8.3.4 of the Regulations of the El Paso County Board of Health, Chapter 8 OWTS Regulations, most recently amended May 23, 2018;
- Each lot (after purchase but prior to construction of an OWTS) will require an OWTS site evaluation report prepared per *the Regulations of the El Paso County Board of Health, Chapter 8 OWTS Regulations*. During the site reconnaissance, a minimum of two 8-foot deep test pits will need to be excavated in the vicinity of the proposed treatment area;

- Comply with any physical setback requirements of Table 7-1 of the El Paso County Department of Health and Environment (EPCHDE);
- Treatment areas are to be located a minimum 100 feet from any well (existing or proposed), including those located on adjacent properties per Table 7-2 per the EPCHDE;
- Each lot shall be designed to insure that a minimum of 2 sites are appropriate for a OWTS and do not fall within the restricted areas identified on the Engineering and Geology Map, Figure 11, (e.g. existing ponds, existing septic fields that may remain);
- It is not recommended that the existing septic systems be utilized for new construction. The existing systems were constructed between 1964 and 1994. The average life span of systems constructed between those dates was approximately 20 to 30 years. It is unlikely the existing septic systems will meet the current criteria for a Transfer of Title Inspection per 8.4 (O).6 per EPCHDE;
- If an existing system is to be removed (e.g. tank, components and/or soil) they should be disposed of in an approved off-site location;
- New treatment areas are not to be located within the existing septic field areas unless the existing system has been properly abandoned or removed.

It is our opinion that if the EPCHDE physical setback requirements are met for each lot, there are no restrictions on the placement of the individual On-site Wastewater Treatment Systems.

Soil and groundwater conditions at the site are suitable for individual treatment systems. It should be noted that the LTAR values stated above are for the test pit locations performed for this report only. The LTAR values may change throughout the site. If an LTAR value of less than 0.35 (or soil types 3A to 5) are encountered at the time of the site specific OWTS evaluation an "engineered system" will be required.

10.0 BEARING OF GEOLOGIC CONDITIONS UPON PROPOSED DEVELOPMENT WITHOUT CONTROL

Geologic hazards (as described in Section 8.0 of this report) found to be present at this site include seismicity and radon. The most significant geologic constraints to development recognized at this site are expansive/compressible soils and shallow groundwater. The geologic conditions encountered at this site are relatively common to the immediate area and mitigation can be accomplished by implementing common engineering and construction practices. None of these conditions are anticipated to preclude the proposed development.

11.0 BURIED UTILITIES

Based upon the conditions encountered in the test borings, we anticipate that the soils encountered in individual utility trench excavations will consist mostly of native silty to clayey sand, sandy clay and sandstone with interbedded claystone. It is anticipated the sands will be encountered at loose to medium dense relative densities. Sandstone and claystone bedrock are anticipated within the utility trenches and to be encountered at hard to very hard densities. If groundwater is encountered during construction, dewatering using sump-and-pump dewatering techniques and/or diversion ditches and berms may be required.

We believe the sand will classify as Type C materials and the sandstone perhaps as Type B materials as defined by OSHA in 29 CFR Part 1926. OSHA requires that temporary excavations made in Type B and C materials be laid back at ratios no steeper than 1:1 (horizontal to vertical) and 1½:1 (horizontal to

vertical), respectively, unless the excavation is shored and braced. Excavations deeper than 20 feet, or when water is present, should always be braced or the slope designed by a professional engineer.

Utility mains such as water and sanitary sewer lines are typically placed beneath paved roadways. The settlement of the utility trench backfill can have a detrimental effect on pavements and roadway surfaces. We recommend that utility trench backfill be placed in thin loose lifts, moisture conditioned as required and compacted to the recommendation outlined in the **Exterior Backfill** section of this report. The placement and compaction of utility trench backfill should be observed and tested by RMG during construction.

It is a common local practice for underdrains to be placed at the bottom of sanitary sewer trenches within drive lanes. Underdrains placed in the sanitary sewer trenches in areas where groundwater is anticipated will likely be the "active" type, which uses a perforated drain pipe. In areas where groundwater is not anticipated, “passive” type underdrains may be used. The outfall for the sanitary sewer trench underdrain was not known at the time of this investigation because the development plan and grading plan were not available for our review. Typical underdrain details are presented in Figures 16 and 17.

12.0 PAVEMENTS

The proposed pavement areas within the development according to the Cornerstone Estates Site Plan, as provided by William Guman & Associates, Ltd., are to be classified as “Rural Local” with a 60-foot right-of-way. The rural local roads are to connect with Goodson Road which is classified as a “Major Collector” with a 60-foot right-of-way. As such, they will require a site-specific pavement design prepared in accordance with the El Paso County Engineering Criteria Manual. All pavement designs, however, should consider the criteria presented in the Engineering Criteria Manual.

For purposes of this report, we anticipate the subgrade soils will have American Association of State Highway and Transportation Officials (AASHTO) Soil Classifications primarily of A-1 and A-2 soils, which are considered “excellent to good” for use as subgrade material. The clay and claystone are anticipated to classify as A-6 and A-7 soils, which is considered “poor” for use as subgrade material.

The ECM notes that mitigation measures may be required for expansive soils/bedrock, shallow groundwater, subgrade instability, etc. Based on the AASHTO classification of the soils in the subdivision and laboratory swell testing, the majority of the subgrade soils are expected to encounter nil to low expansive potential. Therefore, special mitigation measures are not anticipated for subgrade preparation.

Pavement materials should be selected, prepared, and placed in accordance with the El Paso County specification and the Pikes Peak Region Asphalt Paving Specifications. Tests should be performed in accordance with the applicable procedures presented in the final design.

13.0 ANTICIPATED FOUNDATION SYSTEMS

Based on the information presented previously, conventional shallow foundation systems consisting of standard spread footings/stemwalls or conventionally-reinforced stiffened (ribbed) slabs-on-grade are anticipated to be suitable for the proposed residential structures. It is assumed that the deepest excavation cuts will be approximately 7 to 10 feet below the final ground surface, not including overexcavation which may be required on a lot-by-lot basis.

Due to the swell potential, the sandy clay and claystone are generally not suitable for support of spread footing foundations or floor slabs. Where expansive soils are encountered near spread footing foundation or floor slab levels, they should be removed. In general, the exposed surface soils should be scarified and moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 92 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557).

After compaction of the in-situ soil, the foundation construction should then be backfilled in compacted lifts to bottom of footing elevation with approved native soil or structural fill consisting of well-graded non-cohesive granular material. The material should not be excessively wet, should be free of organic matter and construction debris, and contain no rock fragments greater than 2-inches in any dimension. Structural fill material should be placed in 8-inch loose lifts with moisture content within 2 percent of optimum as determined by ASTM D-1557. Each loose lift should be compacted to a minimum of 92 percent of Modified Proctor maximum dry density as determined by ASTM D-1557. The structural fill should be density tested to verify compaction meets these requirements.

The foundation design should be prepared by a qualified Colorado Registered Professional Engineer using the recommendations presented in this report. This foundation system should be designed to span a minimum of 10 feet under the design loads. The bottoms of exterior foundations should be at least 30 inches below finished grade for frost protection. When prepared and properly compacted, total settlement of 1-inch or less with differential settlement of ½ inch or less is estimated. Settlement in granular material generally occurs relatively rapidly with construction loads. Long-term consolidation settlement should not be an issue if the fill materials are prepared as recommended above.

The foundation system for each lot should be designed and constructed based upon recommendations developed in a detailed Subsurface Soil Investigation completed after site development activities are complete. The recommendations presented in the Subsurface Soil Investigations should be verified by an Open Excavation Observation following the excavation on each lot.

13.1 Structural Fill - General

The native sands and processed sandstone (maximum particle size of 3 inches) are suitable for use as structural fill. Claystone is not considered suitable for use as structural fill. Except as described above for foundations, areas to receive structural fill should have topsoil, organic material, and debris removed. The upper 6-inches of the exposed surface soils should be scarified and moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 92 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557).

Structural fill should be placed in thin lifts not to exceed 6 inches and moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 92 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557).

Structural fill placed on slopes should be benched into the slope. Maximum bench heights should not exceed 4 feet, and bench widths should be wide enough to accommodate compaction equipment. Structural fill should not be placed on frozen subgrade or allowed to freeze during moisture conditioning and placement. To verify the condition of the compacted soils, density tests should be performed during placement.

13.2 Exterior Backfill

Backfill should be placed in loose lifts not exceeding 8 to 12 inches, moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to 85 percent of the maximum dry density as determined by the Modified Proctor test, ASTM D-1557 on exterior sides of walls in landscaped areas. In areas where backfill supports pavement and/or concrete flatwork, the materials should be compacted to 90 percent of the maximum dry density.

Fill placed on slopes should be benched into the slope. Maximum bench heights should not exceed 4 feet, and bench widths should be wide enough to accommodate compaction equipment.

The appropriate government/utility specifications should be used for fill placed in utility trenches. If material is imported for backfill, the material should be approved by the Geotechnical Engineer prior to hauling it to the site.

The backfill should not be placed on frozen subgrade or allowed to freeze during moisture conditioning and placement. Backfill should be compacted by mechanical means, and foundation walls should be braced during backfilling and compaction.

13.3 Surface Detention and Drainage

The ground surface should be sloped from structures with a minimum gradient of 10 percent for the first 10 feet. This is equivalent to 12 inches of fall across this 10-foot zone. 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 5 feet from the foundation and sloped parallel with the wall with a minimum slope of 2 percent to intercept the surface water and transport it around and away from the structure. Roof drains should extend across backfill zones and landscaped areas to a region that is graded to direct flow away from the structure. Water should be kept from 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. Excess surface water may increase the likelihood of slab and foundation movements.

13.4 Foundation Drains

A subsurface perimeter drain is required around portions of the structure which will have habitable or storage space located below the finished ground surface. This includes crawlspace areas but not the walkout trench, if applicable.

Groundwater conditions were encountered in the test borings at the time of the 2008 investigation. Depending on the conditions encountered during the lot-specific Subsurface Soil Investigation and the conditions observed at the time of the Open Excavation Observation, additional subsurface drainage systems may be recommended.

One such system is an underslab drainage layer to help intercept groundwater before it enters the slab area should the groundwater levels rise. In general, if groundwater was encountered within 4 to 6 feet of the proposed basement slab elevation, an underslab drain should be anticipated. An Underslab Drain detail is presented in Figure 15. Another such system would consist of a subsurface drain and/or vertical drain board placed around the perimeter of the overexcavation to help intercept groundwater and allow for proper placement and compaction of the replacement structural fill. Careful attention should be paid to grade and discharge of the drain pipes of these systems.

13.5 Design Parameters

The allowable bearing pressure of the subsurface soils should be determined by a detailed site specific Subsurface Soil Investigation and verified by and Open Excavation Observation, as noted above.

14.0 DETENTION STORAGE CRITERIA

This section has been prepared in accordance with the requirements outlined in the El Paso County Land Development Code (LDC), the Engineering Criteria Manual (ECM) Section 2.2.6 and Appendix C.3.2.B, and the El Paso County (EPC) Drainage Criteria Manual, Volume 1 Section 11.3.3.

14.1 Soil and Rock Design Parameters

A detention pond is proposed to be located near the southeast corner near the utility easement and is to be located in a drainage/open space area. It is our understanding that the proposed detention pond is to be built-up. RMG has performed laboratory tests of soil from across the proposed development. Based upon field and laboratory testing, the following soil and rock parameters are typical for the soils likely to be encountered, and are recommended for use in detention pond embankment design.

Soil Description	Unit Weight (lb/ft^3)	Friction Angle (degree)	Active Earth Pressure, Ka	Passive Earth Pressure, Kp	At Rest Earth Pressure, Ko
Clayey Sand (SC)	115	28	0.36	2.77	0.53
Clayey Sandstone	125	30	0.33	3.0	0.50
Sandy Claystone	115	20	0.49	2.04	0.66

14.2 Embankment Recommendations

Existing and Proposed Drainage Maps have been reviewed for Cornerstone Estates, prepared by J. R Engineering, last dated May 6, 2008. Based on the review of the Existing and Proposed Drainage Map Plans and Preliminary Plans, the proposed ground surface elevation of the embankments in the proposed detention ponds is approximately 1 to 7.5 feet lower in elevation than the existing ground surface. Embankments are to be constructed with a maximum 4:1 slope. Embankments should be constructed in accordance with applicable sections of the El Paso County Engineering Criteria Manual, the El Paso County Drainage Criteria Manual, and the El Paso County Land Development Code. The following recommendations are in accordance with the El Paso county DCM Volume 2, Extended Detention Basin (EDB), Design Procedure and Criteria, paragraph 8.

The ground area to receive embankments should be cleared and grubbed to a minimum depth of two-feet to remove grass, shrubs, trees, roots, stumps, and other organic material. The exposed soil should be moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 95 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557). The prepared surface should present a firm and stable condition.

Embankment should be constructed as structural fill on a prepared stable base. On-site native soil when screened of all deleterious material and cobbles greater than 6-inches in any dimension is suitable for embankment construction. Embankment fill should be placed in 10-inch loose lifts and moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 95 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557).

Embankment fill placed on slopes should be benched into the slope. Maximum bench heights should not exceed 4 feet, and bench widths should be wide enough to accommodate compaction equipment. Embankment fill should not be placed on frozen subgrade or allowed to freeze during moisture conditioning and placement. To verify the condition of the compacted soils, density tests should be performed during placement. The first density tests should be conducted when 24 inches of fill have been placed

15.0 ADDITIONAL STUDIES

The findings, conclusions and recommendations presented in this report were provided to evaluate the suitability of the site for future development. Unless indicated otherwise, the test borings, laboratory test results, conclusions and recommendations presented in this report are not intended for use for design and construction of individual OWTS or foundations. ***A site-specific subsurface soil investigation will be required for all proposed structures including (but not limited to) residences, retaining walls and pumphouses, etc.***

To develop recommendations for construction of the proposed roadways, a pavement design investigation should be performed. This investigation should consist of additional test borings, soil laboratory testing and specific recommendations for the design and construction of roadway pavement sections.

16.0 CONCLUSIONS

Based upon our evaluation of the geologic conditions, it is our opinion that the proposed development is feasible. The geologic conditions identified are considered typical for the Front Range region of Colorado. Mitigation of geologic conditions is most effectively accomplished by avoidance. However, where avoidance is not a practical or acceptable alternative, geologic conditions should be mitigated by implementing appropriate planning, engineering, and suitable construction practices.

In addition to the previously identified mitigation alternatives, surface and subsurface drainage systems should be considered. Exterior, perimeter foundation drains should be installed around below-grade habitable or storage spaces. Surface water should be efficiently removed from the building area to prevent ponding and infiltration into the subsurface soil. Due to past shallow groundwater conditions and proximity to the drainage way, additional subsurface drainage systems may also be required

The foundation and floor slabs of the structures should be designed using the recommendations provided in the site-specific Subsurface Soil Investigation performed for each lot. In addition, appropriate surface drainage should be established during construction and maintained by the homeowner.

The recommendations in this and the referenced report 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.

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.

17.0 CLOSING

This report is for the exclusive purpose of providing geologic hazards information and preliminary geotechnical engineering recommendations. The scope of services did not include, either specifically or by implication, evaluation of wild fire hazards, 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 owner is concerned about the potential for such contamination or conditions, other studies should be undertaken.

This report has been prepared for **William Guman & Associates, Ltd** in accordance with generally accepted geotechnical engineering and engineering geology practices. The conclusions and recommendations in this report are based in part upon data obtained from review of available topographic and geologic maps, review of available reports of previous studies conducted in the site vicinity, a site reconnaissance, and research of available published information, soil test borings, soil laboratory testing, and engineering analyses. The nature and extent of variations may not become evident until construction activities begin. If variations then become evident, RMG should be retained to re-evaluate the recommendations of this report, if necessary.

Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by geotechnical engineers and engineering geologists 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.

FIGURES

APPENDIX A
Additional Reference Documents

1. *Preliminary Plan, Cornerstone Estates, El Paso County, Colorado*, prepared by J.R Engineering., Job No. 29992.00, last dated May 6, 2008.
2. *Preliminary Drainage Report, Cornerstone Estates,* prepared by J.R Engineering, Job No. 29992.00, last dated June 12, 2008.
3. *Flood Insurance Rate Map, El Paso County, Colorado and Unincorporated Areas, Community Panel No. 08041C0535G,* Federal Emergency Management Agency (FEMA), effective December 7, 2018.
4. *Geologic Map of the Black Forest Quadrangle, El Paso County, Colorado*, Madole, R.F., 2003, Colorado Geological Survey Open-File Report OF03-08.
5. *Black Forest Quadrangle, Environmental and Engineering Geologic Map for Land Use*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
6. *Black Forest Quadrangle, Map of Potential Geologic Hazards and Surficial Deposits*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
7. *Pikes Peak Regional Building Department:* https://www.pprbd.org/.
8. https://property.spatialest.com/co/elpaso/#/property/5223000003
   Schedule No. 5223000003
9. *Colorado Geological Survey, USGS Geologic Map Viewer*:
   http://coloradogeologicalsurvey.org/geologic-mapping/6347-2/.
10. *Historical Aerials:* https://www.historicaerials.com/viewer, Images dated 1947, 1952, 1955, 1960, 1969, 1983, 1999, 2005, 2009, 2011, 2013, 2015, and 2017.
11. *USGS Historical Topographic Map Explorer:* http://historicalmaps.arcgis.com/usgs/ Colorado Springs, Black Forest Quadrangle dated 1898, 1909, 1948, 1969, 1981 and 1989.
12. *Google Earth Pro*, Imagery dated 1999, 2004, 2005, 2006, 2011, 2013, 2015, 2017, 2019 and 2020.

APPENDIX B

Test Boring Logs and Summary of Laboratory Results, RMG Job No. 117523, last dated May 5, 2008.

APPENDIX C
GUIDELINE SITE GRADING SPECIFICATIONS

Description: Unless specified otherwise by local or state regulatory agencies, these guideline specifications are for the excavation, placement and compaction of material from locations indicated on the plans, or staked by the Engineer, as necessary to achieve the required elevations. These specifications shall also apply to compaction of materials that may be placed outside of the project.

General: The Geotechnical Engineer shall approve fill materials, method of placement, moisture contents and percent compactions, and shall give written approval of the compacted fill.

Clearing Site: The Contractor shall remove trees, brush, rubbish, vegetation, topsoil and existing structures before excavation or fill placement is commenced. The Contractor shall dispose of the cleared material to provide the Owner with a clean job site. Cleared material shall not be placed in areas to receive fill or where the material will support structures. Clearing shall also include removal of existing fills that do not meet the requirements of this specification and existing structures.

Preparation of Slopes or Drainage Areas to Receive Fill: Natural slopes or slopes of drainage gullies where grades are 20 percent (5:1, horizontal to vertical) or steeper shall be benched prior to fill placement. Benches shall be at least 10 feet wide. Benches may require additional width to accommodate excavation or compaction equipment. At least one bench shall be provided for each 5 feet or less of vertical elevation difference. The bench surface shall be essentially horizontal perpendicular to the slope or at a slight incline into the slope.

Scarifying: Topsoil and vegetation shall be removed from the ground surface in areas to receive fill. The surface shall be plowed or scarified a minimum of 12 inches until the surface is free from ruts, hummocks or other uneven features which would prevent uniform compaction by the equipment to be used.

Compacting Area to Receive Fill: After the area to receive fill has been cleared and scarified, it shall be disked or bladed until it is free from large clods, moisture conditioned to a proper moisture content and compacted to the maximum density as specified for the overlying fill. Areas to receive fill shall be worked, stabilized, or removed and replaced, if necessary, in accordance with the Geotechnical Engineer's recommendations in preparation for fill.

Fill Materials: Fill material shall be free from organic material or other deleterious substances, and shall not contain rocks or lumps having a diameter greater than six inches. Fill materials shall be obtained from cut areas shown on the plans or staked in the field by the Engineer or imported to the site and shall be approved by the Geotechnical Engineer prior to placement. It is recommended that the fill materials have nil to low expansion potential, i.e., consist of silty to slightly clayey sand.

Moisture Content: Fill materials shall be moisture conditioned to within limits of optimum moisture content specified. Sufficient laboratory compaction tests shall be made to determine the optimum moisture content for the various soils encountered in borrow areas or imported to the site.

The contractor may be required to add moisture to the excavation materials in the borrow area if, in the opinion of the Geotechnical Engineer, it is not possible to obtain uniform moisture content by adding water to the fill material during placement. The Contractor may be required to rake or disk the fill soils to provide uniform moisture content through the soils.

The application of water to embankment materials shall be made with watering equipment, approved by the Geotechnical Engineer, which will give the desired results. Water jets from the spreader shall not be directed at the embankment with such force that fill materials are eroded.

Should too much water be added to the fill, such that the material is too wet to permit the desired compaction to be obtained, compacting and work on that section of the fill shall be delayed until the material has been allowed to dry to the required moisture content. The Contractor will be permitted to rework the wet material in an approved manner to hasten its drying.

Compaction of Fill Areas: Selected fill material shall be placed and mixed in evenly spread layers. After each fill layer has been placed, it shall be uniformly compacted to not less than the specified percentage of maximum density. Fill materials shall be placed such that the thickness of loose material does not exceed 12 inches and the compacted lift thickness does not exceed 6 inches.

Compaction, as specified above, shall be obtained by the use of sheepsfoot rollers, multiple-wheel pneumatic-tired rollers, or other equipment approved by the Geotechnical Engineer. Granular fill shall be compacted using vibratory equipment or other equipment approved by the Geotechnical Engineer. Compaction shall be accomplished while the fill material is at the specified moisture content. Compaction of each layer shall be continuous over the entire area.

Density Criteria:

A. For on-site fills supporting utilities, roadways and landscaping, 95% of the Standard Proctor dry density.

B. For structural fill soils supporting buildings, 92% of the Modified Proctor dry density or 95% of the Standard Proctor dry density.

C. For general grading fills, 90% of the Standard Proctor dry density.

Compaction of Slopes: Fill slopes shall be compacted by means of sheepsfoot rollers or other suitable equipment. Compaction operations shall be continued until slopes are stable, but not too dense for planting, and such that there is no appreciable amount of loose soil on the slopes. Compaction of slopes may be done progressively in increments of three to five feet in height or after the fill is brought to its total height. Permanent fill slopes shall not exceed 3:1 (horizontal to vertical).

Density Testing: Field density testing shall be performed by the Geotechnical Engineer at locations and depths of his choosing. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density tests shall be taken in compacted material below the disturbed surface. When density tests indicate the density or moisture content of any layer of fill or portion thereof is below that required, the particular layer or portion shall be reworked until the required density or moisture content has been achieved.

Observation and Testing of Fill: Observation by the Geotechnical Engineer shall be sufficient during the placement of fill and compaction operations so that he can declare the fill was placed in general conformance with Specifications. All observations necessary to test the placement of fill and observe compaction operations will be at the expense of the Owner.

Seasonal Limits: No fill material shall be placed, spread or rolled while it is frozen, thawing, or during unfavorable weather conditions. When work is interrupted by heavy precipitation, fill operations shall not be resumed until the Geotechnical Engineer indicates the moisture content and density of previously placed materials are as specified.

Reporting of Field Density Tests: Density tests made by the Geotechnical Engineer shall be submitted progressively to the Owner. Dry density, moisture content, percent compaction, and approximate location shall be reported for each test taken.

NOT TO SCALE

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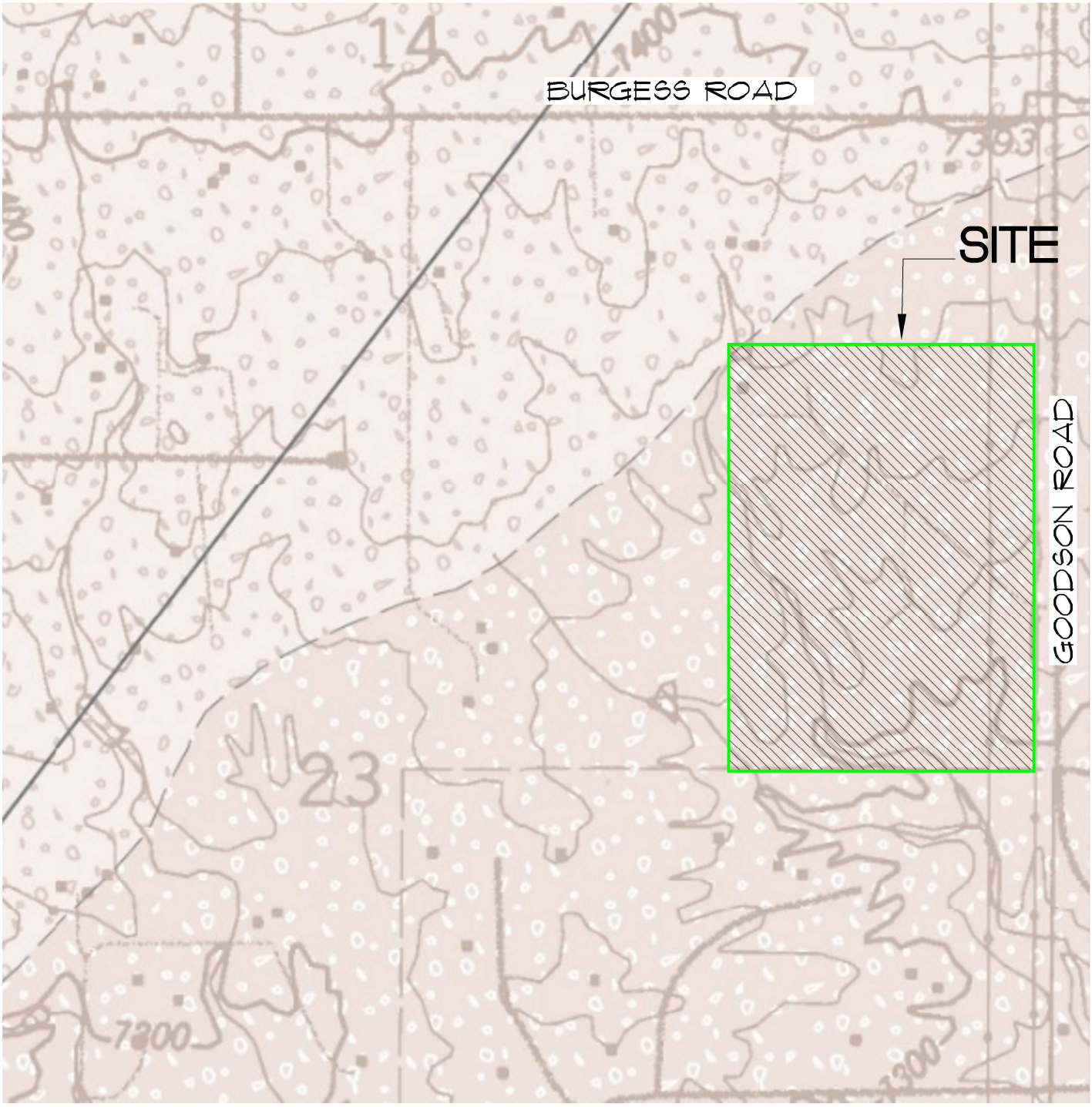
SITE VICINITY MAP

CORNERSTONE ESTATES
GOODSON ROAD
EL PASO COUNTY, COLORADO
WILLIAM GUMAN AND ASSOCIATES, LTD

JOB No. 184228

FIG No. 1

DATE 11-5-2021



NOT TO SCALE

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USGS TOPO MAP

CORNERSTONE ESTATES
GOODSON ROAD
EL PASO COUNTY, COLORADO
WILLIAM GUMAN AND ASSOCIATES, LTD

JOB No. 184228

FIG No. 2

DATE 11-5-2021

SOILS DESCRIPTION

CLAYEY SAND

CLAYSTONE

SANDSTONE

UNLESS NOTED OTHERWISE, ALL LABORATORY
TESTS PRESENTED HEREIN WERE PERFORMED BY:
RMG - ROCKY MOUNTAIN GROUP
2910 AUSTIN BLUFFS PARKWAY
COLORADO SPRINGS, COLORADO

SYMBOLS AND NOTES

XX — STANDARD PENETRATION TEST - MADE BY DRIVING A SPLIT-BARREL SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-1586. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).

XX — UNDISTURBED CALIFORNIA SAMPLE - MADE BY DRIVING A RING-LINED SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-3550. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).

FREE WATER TABLE

DEPTH AT WHICH BORING CAVED

BULK — DISTURBED BULK SAMPLE

AUG — AUGER "CUTTINGS"

4.5 — WATER CONTENT (%)

ROCKY MOUNTAIN GROUP

Architectural
Structural
Forensics

ARCHITECTS
RMG
ENGINEERS

Geotechnical
Materials Testing
Civil, Planning

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SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

EXPLANATION OF TEST BORING LOGS

JOB No. 184228

FIGURE No. 3

DATE 11/5/2021

TEST BORING: **3**

DATE DRILLED:
7/8/21
NO GROUNDWATER ON
7/8/21

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, CLAYEY, with gravel, tan to olive, moist			
5	SANDSTONE, CLAYEY, with gravel, tan, medium hard to hard, moist	■	48	7.4
10		■	50/8"	6.3
15	CLAYSTONE, SANDY, brown to olive, hard, moist	■	50/9"	13.0
	SANDSTONE, CLAYEY, with gravel, tan, very hard, moist	■	50/6"	--
20				

TEST BORING: **7**

DATE DRILLED:
7/8/21
NO GROUNDWATER ON
7/8/21

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, CLAYEY, with gravel, tan, medium dense, moist			
5		■	13	16.2
	SANDSTONE, CLAYEY, with gravel, tan, very hard, moist			
10		■	50/3"	6.4
15		■	50/5"	8.9
20		■	50/5"	8.5

ROCKY MOUNTAIN GROUP

Architectural
Structural
Forensics

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SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

TEST BORING LOG

JOB No. 184228

FIGURE No. 4

DATE 11/5/2021

TEST BORING: **12** DATE DRILLED: 7/8/21 NO GROUNDWATER ON 7/8/21	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, CLAYEY, with gravel, light brown to olive, medium dense, moist	5			18	9.0
SANDSTONE, CLAYEY, gray to olive, medium hard to hard, moist	10			50	9.8
	15			46	15.2
	20			50/7"	12.1

TEST BORING: **15** DATE DRILLED: 7/8/21 NO GROUNDWATER ON 7/8/21	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, CLAYEY, with gravel, tan to olive, medium dense, moist	5			22	8.0
SANDSTONE, CLAYEY, with gravel, tan to olive, hard to very hard, moist	10			50/8"	9.6
	15			50/5"	8.6
	20			50/6"	9.3

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TEST BORING LOG

JOB No. 184228

FIGURE No. 5

DATE 11/5/2021

TEST PIT TP-1

DATE OBSERVED: 7/15/21

SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 1.0 FT LOAM (WEAK)			2A
1.0 - 2.0 FT SILTY CLAY LOAM (MODERATE)	2ft		3
2.0 - 3.5 FT SILTY LOAM (MODERATE)			2
3.5 - 5.0 FT BEDROCK (LIMITING LAYER)	4ft		
	6ft		
	8ft		

TEST PIT TP-2

DATE OBSERVED: 7/15/21

SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 1.0 FT SANDY LOAM (WEAK)			2A
1.0 - 2.5 FT SANDY CLAY LOAM (MODERATE)	2ft		3
2.5 - 5.0 FT SANDY LOAM (MODERATE)	4ft		2
5.0 - 8 FT SAND (STRUCTURELESS)	6ft		1
	8ft		

SOIL DESCRIPTIONS

- LOAM
- SILTY CLAY LOAM
- SILTY LOAM
- BEDROCK
- SANDY LOAM (WEAK)
- SANDY CLAY LOAM
- SANDY LOAM (MODERATE)
- SAND

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TEST PIT LOGS

CORNERSTONE ESTATES
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EL PASO COUNTY, COLORADO
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JOB No. 184228

FIGURE No. 6

DATE 11-5-2021

TEST PIT TP-3

DATE OBSERVED: 7/15/21

SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 2.0 FT SANDY LOAM (WEAK)			2A
	2ft		
2.0 - 4.0 FT SANDY LOAM (MODERATE)			2
	4ft		
4.0 FT - 7.0 FT SAND (STRUCTURELESS)	6ft		1
7.0 - 8.0 FT BEDROCK (LIMITING LAYER)	8ft		

SOIL DESCRIPTIONS

SANDY LOAM (WEAK)

SANDY LOAM (MODERATE)

SAND

BEDROCK

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PROFILE PIT LOGS

CORNERSTONE ESTATES
GOODSON ROAD
EL PASO COUNTY, COLORADO
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JOB No. 184228

FIGURE No. 7

DATE 11-5-2021

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	Load at Saturation (psf)	% Swell/ Collapse	USCS Classification
3	4.0	7.4								
3	9.0	6.3				17.0	12.3			
3	14.0	13.0								
7	4.0	16.2		32	17	0.5	41.6			SC
7	9.0	6.4								
7	14.0	8.9								
7	19.0	8.5								
12	4.0	9.0								
12	9.0	9.8		36	21	8.3	15.9			SC
12	14.0	15.2								
12	19.0	12.1								
15	4.0	8.0		27	9	4.7	23.8			SC
15	9.0	9.6								
15	14.0	8.6								
15	19.0	9.3								

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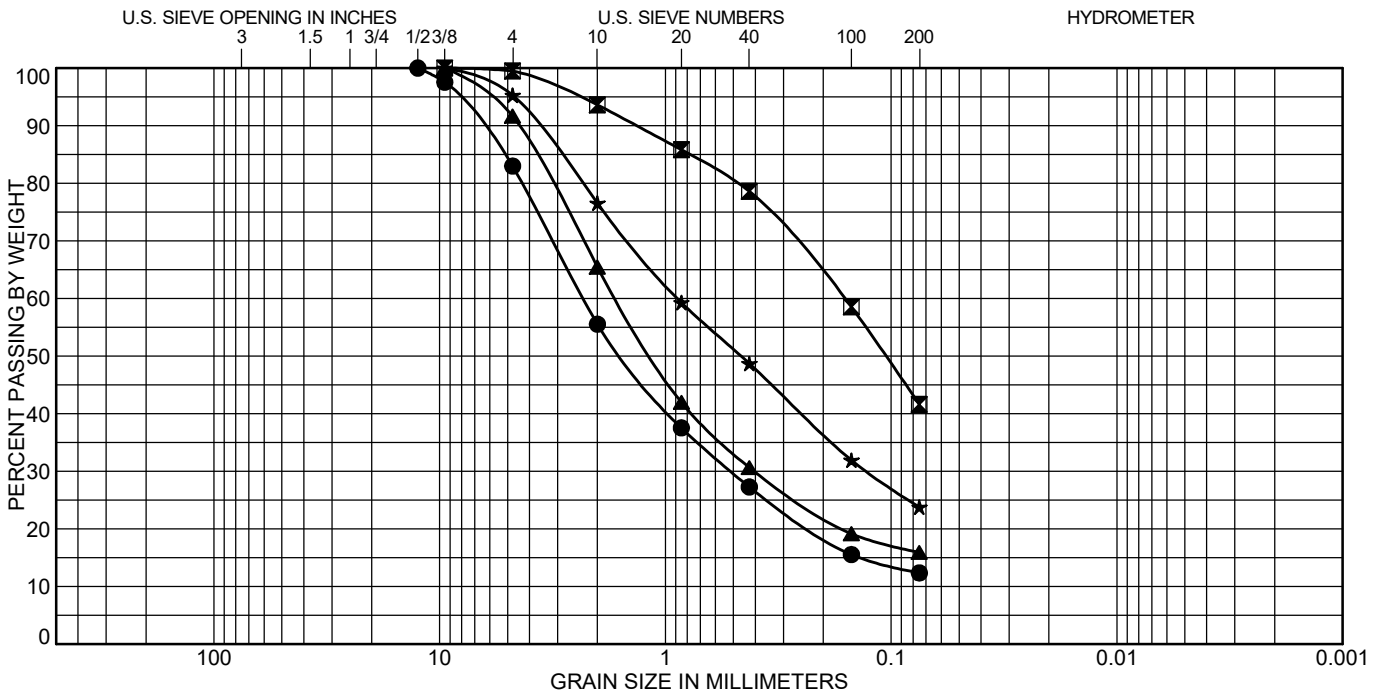
SUMMARY OF LABORATORY TEST RESULTS

JOB No. 184228
FIGURE No. 8
PAGE 1 OF 1
DATE 11/5/2021



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	3	9.0				
⊠	7	4.0	**CLAYEY SAND(SC)**	32	15	17
▲	12	9.0	**CLAYEY SAND(SC)**	36	15	21
★	15	4.0	**CLAYEY SAND(SC)**	27	18	9

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	3	9.0	17.0	70.6	12.3	
⊠	7	4.0	0.5	57.9	41.6	
▲	12	9.0	8.3	75.7	15.9	
★	15	4.0	4.7	71.5	23.8	

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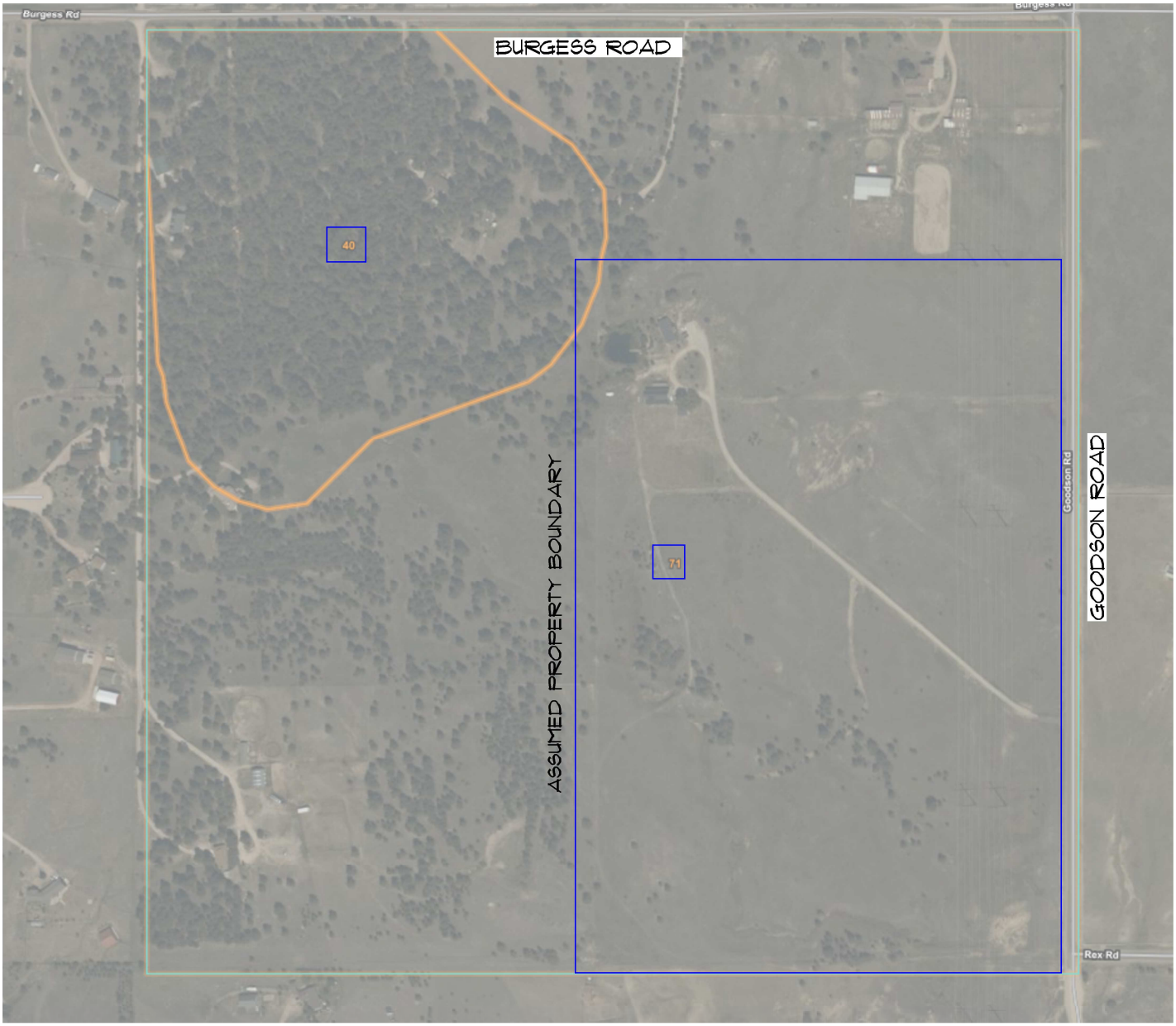
SOIL CLASSIFICATION DATA

JOB No. 184228

FIGURE No. 9

DATE 11/5/2021



NOT TO SCALE

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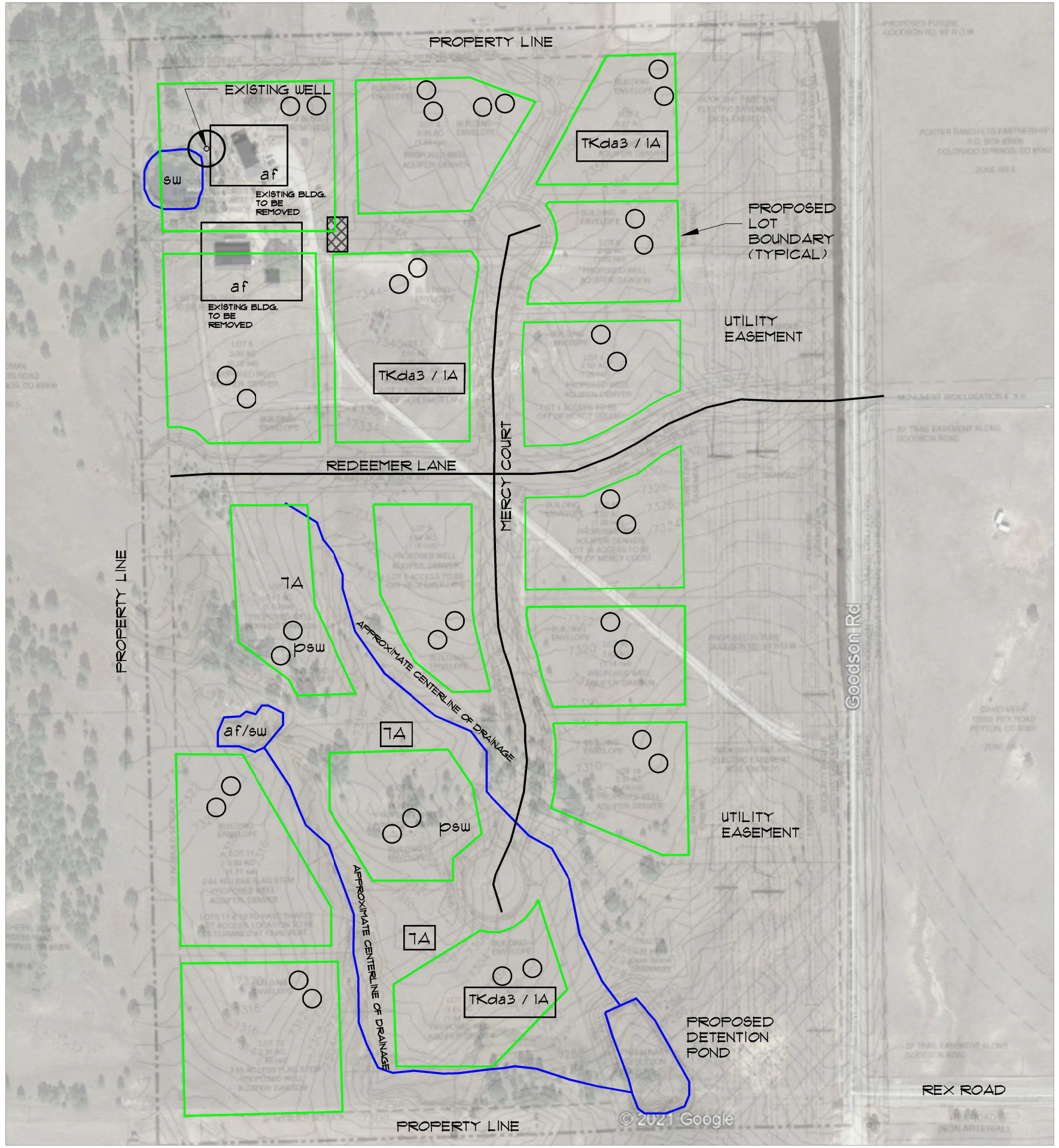
USDA SOIL SURVEY MAP

CORNERSTONE ESTATES
GOODSON ROAD
EL PASO COUNTY, COLORADO
WILLIAM GUMAN AND ASSOCIATES, LTD

JOB No. 184228

FIG No. 10

DATE 11-5-2021



REFERENCE
NOT TO SCALE

Disclaimer: The chosen On-site Wastewater Treatment System (OWTS) locations are for illustration only. If the El Paso County Health Department physical setback requirements are met for each lot, there are no restrictions on the placement of the individual OWTS

Geologic Conditions

TKda3 - Dawson Formation

Psw - Potentially Seasonally Wet Area

sw - Seasonal Wet Area

af - Areas of potential and/or known fill

Engineering Geology

1A - Stable Alluvium, colluvium and bedrock on flat to gentle slopes (0-5%)

7A - Physiographic floodplain

100 foot minimum required from any well to an OWTS

Area of potential and/or known septic fields (areas to be avoided, unless approved for reuse)

JOB No. 184228

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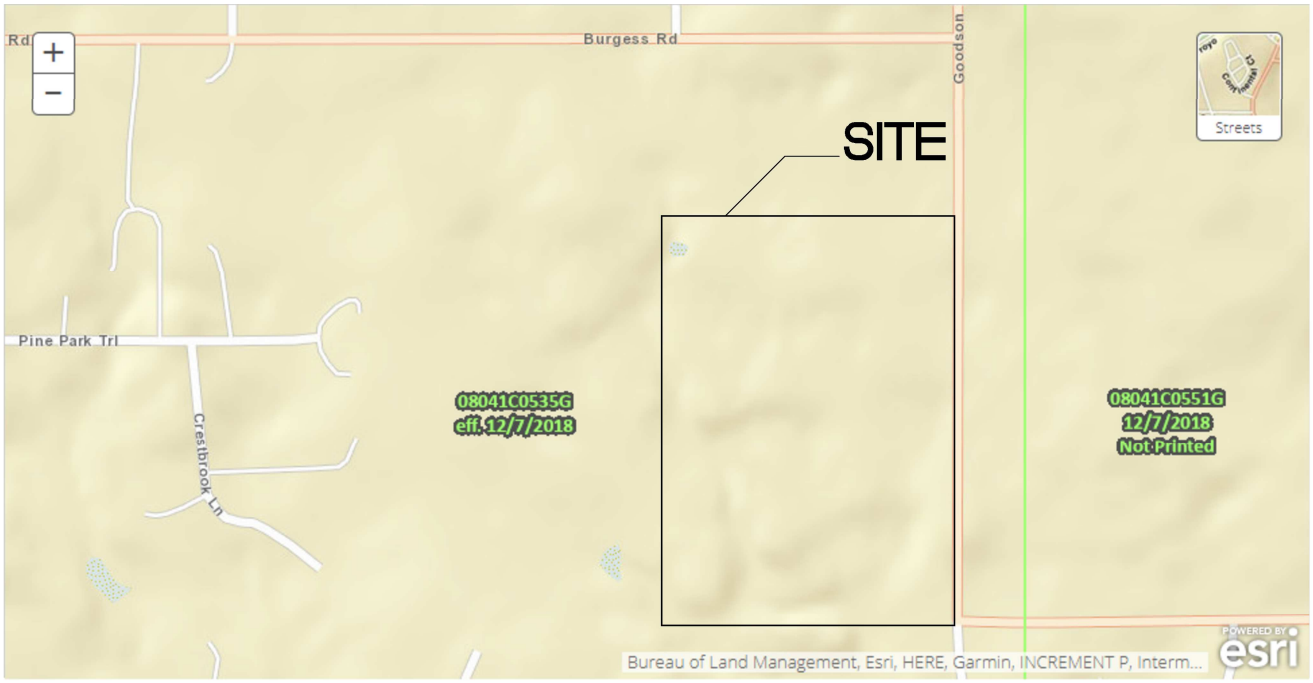
CORNERSTONE ESTATES GOODSON ROAD

EL PASO COUNTY, COLORADO
WILLIAM GUMAN AND ASSOCIATES, LTD

ENGINEER:	TPM
DRAWN BY:	KCR
CHECKED BY:	TPM
ISSUED:	11-5-2021

ENGINEERING AND GEOLOGY MAP

SHEET No.
FIG-11



PIN
- Approximate location based on user input and does not represent an authoritative property location

MAP PANELS
- Selected FloodMap Boundary
- Digital Data Available
- No Digital Data Available
- Unmapped

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard Zone X
- Effective LOMRs
- Area of Undetermined Flood Hazard Zone D
- Otherwise Protected Area
- Coastal Barrier Resource System Area

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) Zone A, V, A99
- With BFE or Depth
- Regulatory Floodway Zone AE, AO, AH, VE, AR

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
- Future Conditions 1% Annual Chance Flood Hazard Zone X
- Area with Reduced Flood Risk due to Levee. See Notes. Zone X
- Area with Flood Risk due to Levee Zone D

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

NOT TO SCALE

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FEMA MAP

CORNERSTONE ESTATES
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EL PASO COUNTY, COLORADO
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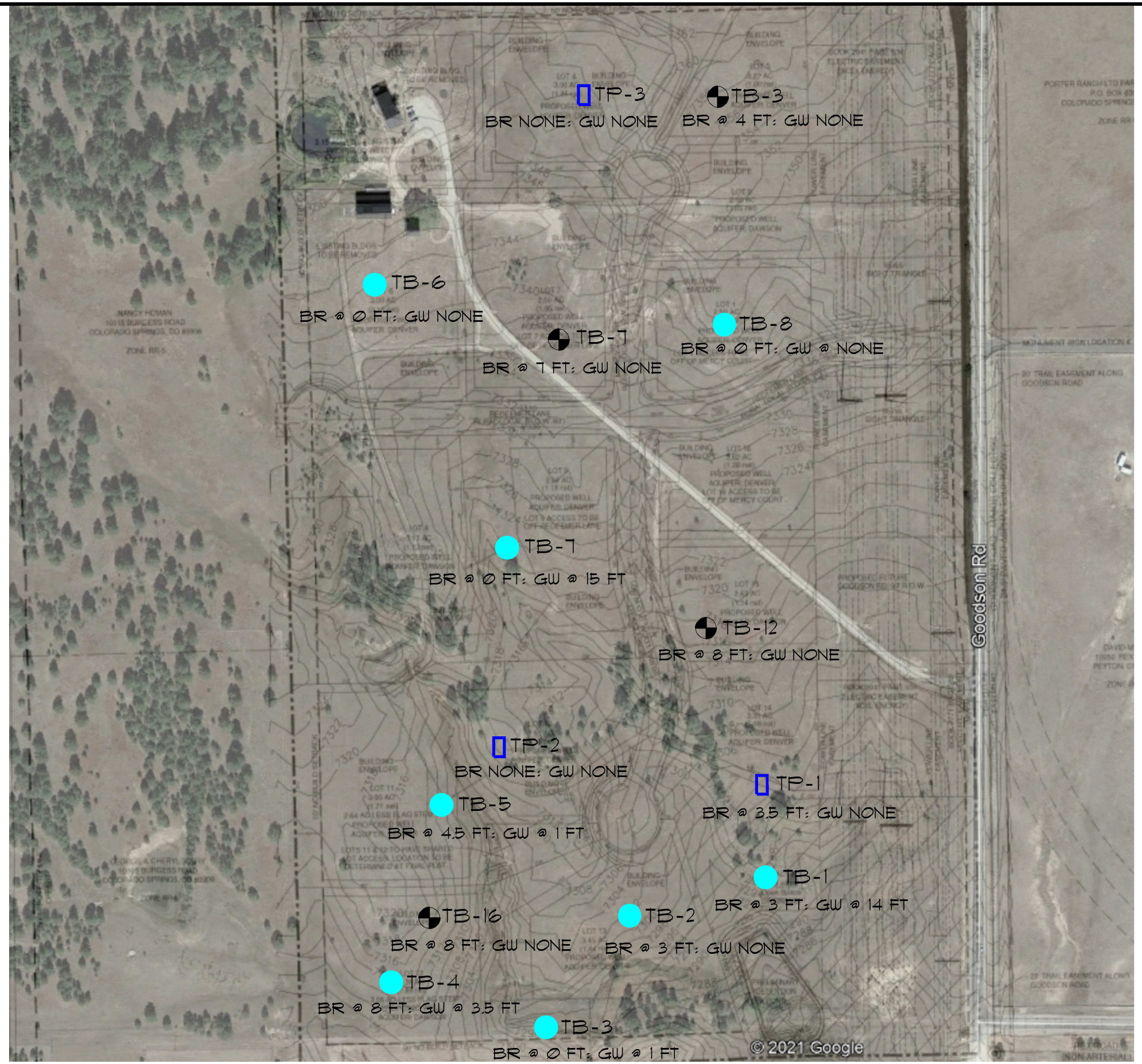
JOB No. 184228

FIG No. 12

DATE 11-5-2021



REFERENCE
NOT TO SCALE

DENOTES APPROXIMATE LOCATION OF TEST PITS PREFORMED FOR THIS INVESTIGATION

DENOTES APPROXIMATE LOCATION OF TEST BORINGS PREFORMED FOR PREVIOUS RMG INVESTIGATION JOB No. 117523

DENOTES APPROXIMATE LOCATION OF TEST BORINGS PREFORMED FOR THIS INVESTIGATION

JOB No. 184228

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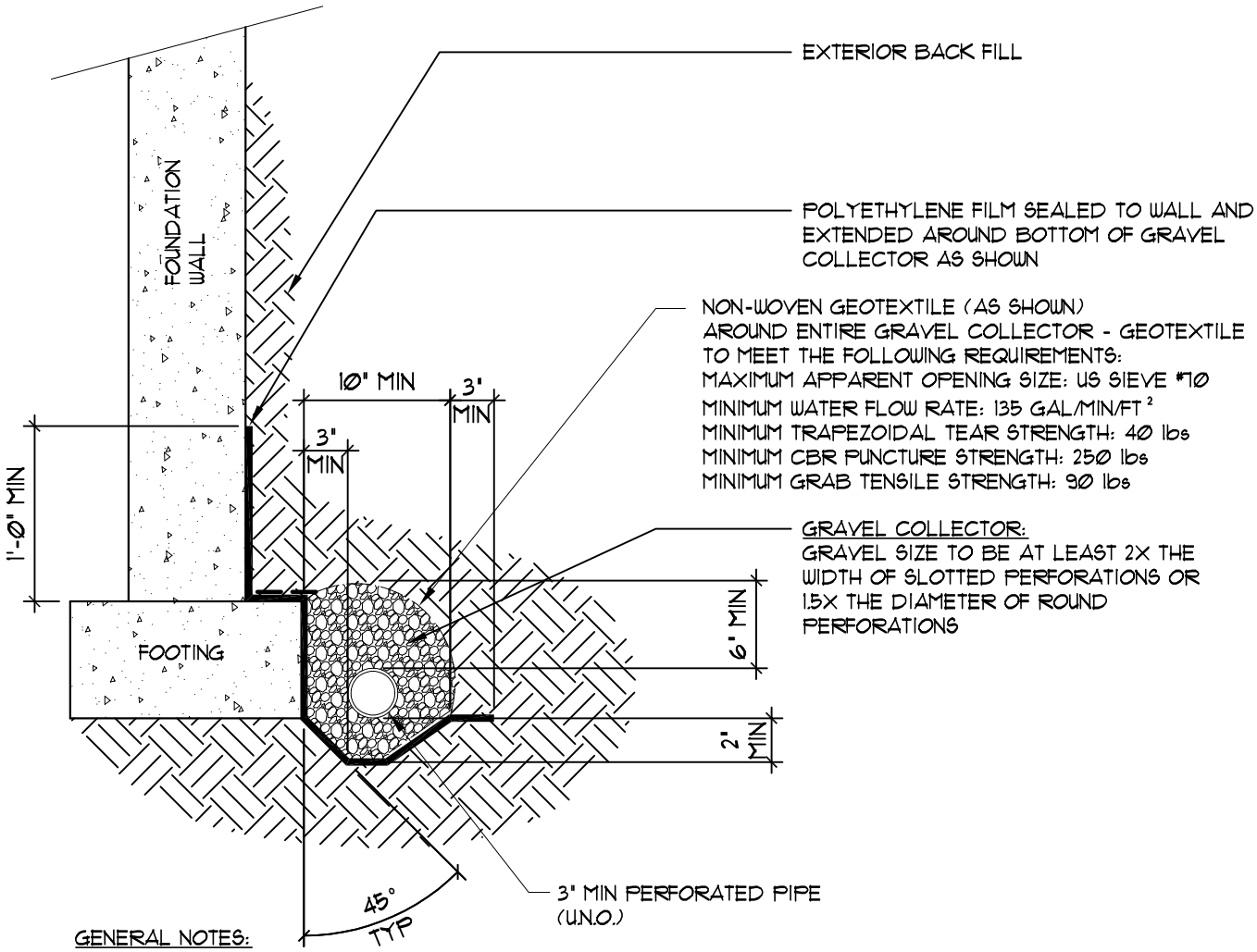
EL PASO COUNTY, COLORADO
WILLIAM GUMAN AND ASSOCIATES, LTD

ENGINEER:	TPM
DRAWN BY:	KCR
CHECKED BY:	TPM
ISSUED:	11-5-2021

TEST BORING AND TEST PIT LOCATION MAP

SHEET No.
FIG-13



GENERAL NOTES:

1. BOTTOM OF DRAIN PIPE SHALL BE AT OR BELOW BOTTOM OF FOOTING AT ALL LOCATIONS
2. ALL DRAIN PIPE SHALL BE PERFORATED PLASTIC, WITH THE EXCEPTION OF THE DISCHARGE PORTION WHICH SHALL BE SOLID, NON-PERFORATED PIPE.
3. DRAIN PIPE SHALL HAVE POSITIVE FALL THROUGHOUT.
4. DRAIN PIPE SHALL BE PROVIDED WITH A FREE GRAVITY OUTFALL, IF POSSIBLE. IF A GRAVITY OUTFALL CANNOT BE ACHIEVED, THEN A SUMP PIT AND PUMP SHALL BE USED. THE OUTFALL SHOULD EXTEND PAST BACKFILL ZONES AND DISCHARGE TO A LOCATION THAT IS GRADED TO DIRECT WATER OFF-SITE.
5. ALL DRAIN COMPONENTS SHALL BE RATED/APPROVED BY THE MANUFACTURER FOR THE INSTALLED DEPTH AND APPLICATION
6. DRAIN SYSTEM, INCLUDING THE OUTFALL OF THE DRAIN, SHALL BE OBSERVED BY QUALIFIED PERSONNEL PRIOR TO BACKFILLING TO VERIFY INSTALLATION.
7. A VERTICAL SEGMENT OF PERFORATED DRAIN PIPE, CAPPED AT THE TOP, SHALL EXTEND TO FINISH GRADE WITHIN ALL WINDOW WELLS.

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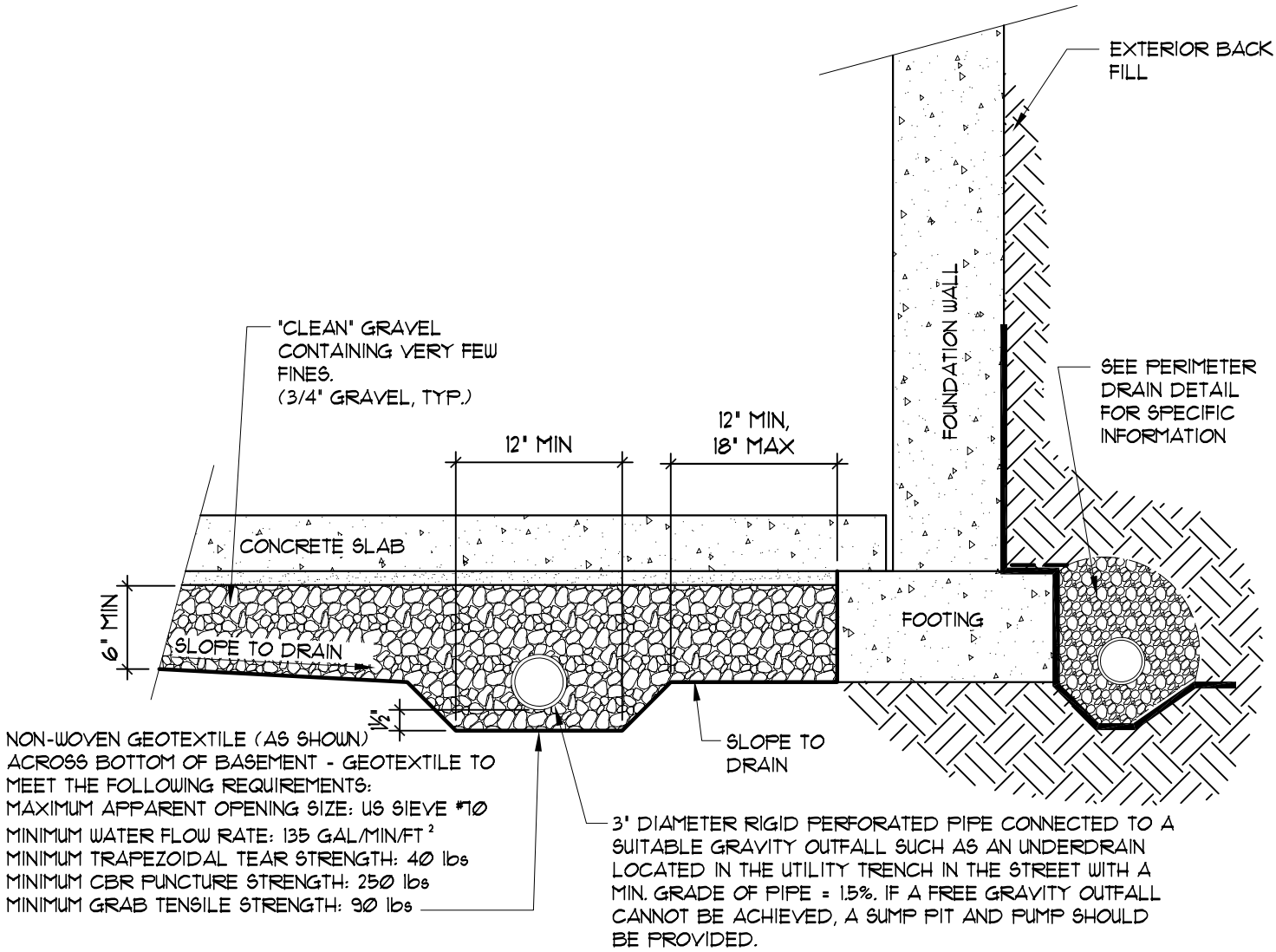
PERIMETER DRAIN

FIG No. 14



GENERAL NOTES:

1. ALL DRAIN PIPE SHALL BE PERFORATED PLASTIC, WITH THE EXCEPTION OF THE DISCHARGE PORTION WHICH SHALL BE SOLID, NON-PERFORATED PIPE.

2. DRAIN PIPE SHALL HAVE POSITIVE FALL THROUGHOUT.

3. DRAIN PIPE SHALL BE PROVIDED WITH A FREE GRAVITY OUTFALL, IF POSSIBLE. IF A GRAVITY OUTFALL CANNOT BE ACHIEVED, THEN A SUMP PIT AND PUMP SHALL BE USED. THE OUTFALL SHOULD EXTEND PAST BACKFILL ZONES AND DISCHARGE TO A LOCATION THAT IS GRADED TO DIRECT WATER OFF-SITE.

4. ALL DRAIN COMPONENTS SHALL BE RATED/APPROVED BY THE MANUFACTURER FOR THE INSTALLED DEPTH AND APPLICATION

5. DRAIN SYSTEM, INCLUDING THE OUTFALL OF THE DRAIN, SHALL BE OBSERVED BY QUALIFIED PERSONNEL PRIOR TO BACKFILLING TO VERIFY INSTALLATION.

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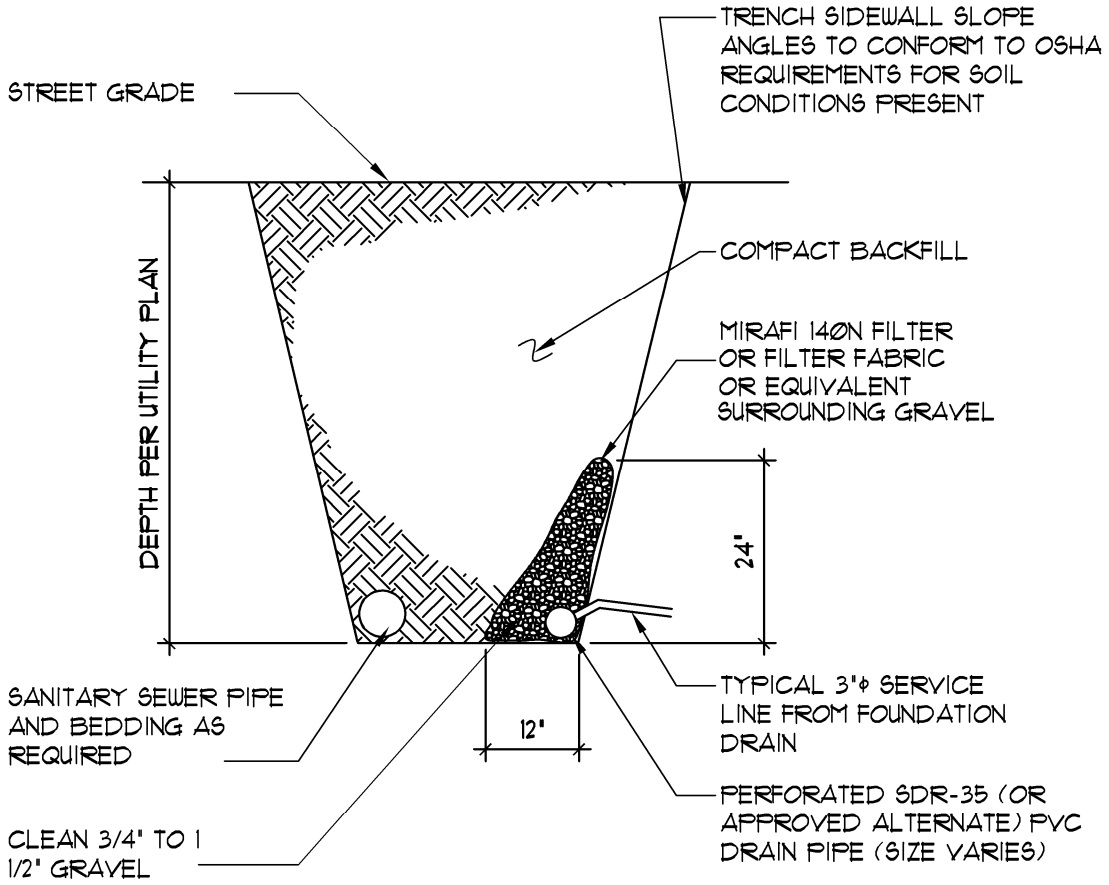
UNDERSLAB DRAIN

FIG No. 15

NOTE: TO BE USED IN CASES WHERE GROUNDWATER IS FOUND DURING TRENCHING OR WHERE SHALLOW GROUNDWATER IS KNOWN TO EXIST



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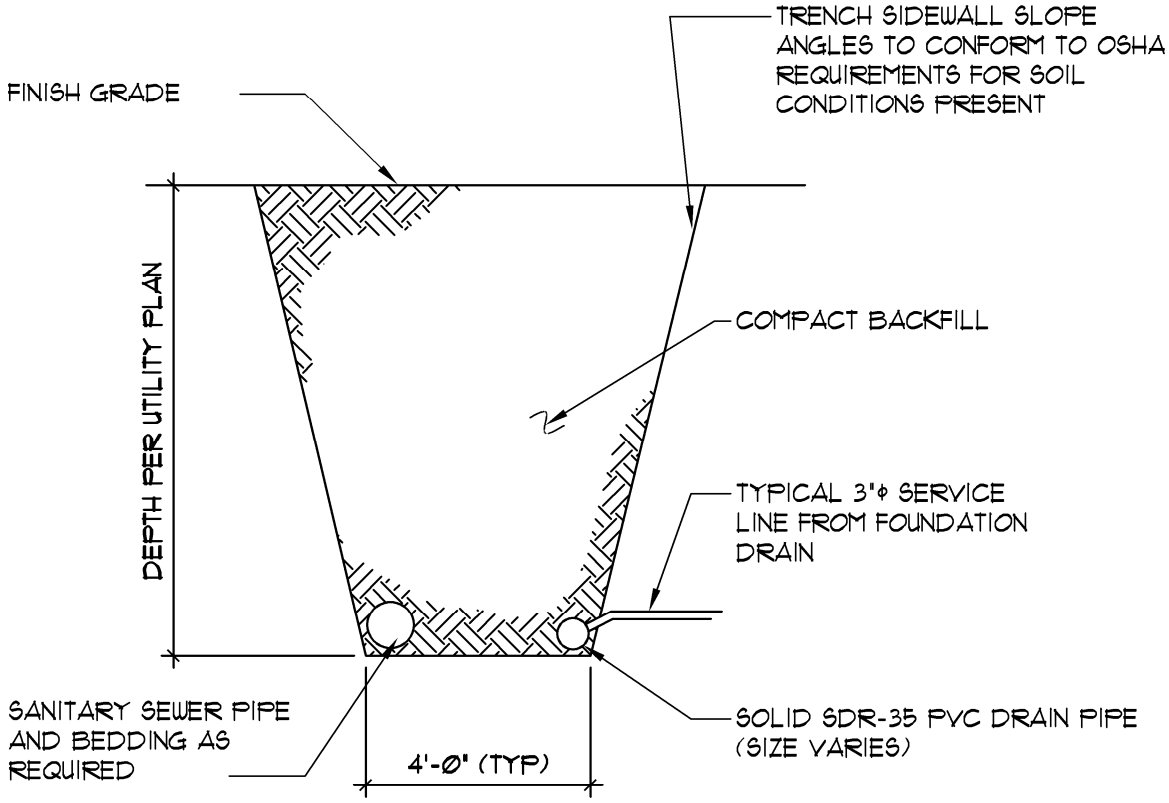
ACTIVE UNDERDRAIN IN SANITARY SEWER TRENCH

FIG No. 16

NOTE: TO BE USED WHERE NO SHALLOW GROUNDWATER IS KNOWN TO EXIST



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PASSIVE UNDERDRAIN IN SANITARY SEWER TRENCH

FIG No. 17

SOILS DESCRIPTION

SILTY SAND

SANDSTONE

SYMBOLS AND NOTES

XX — STANDARD PENETRATION TEST - OBTAINED BY DRIVING A SPLIT-BARREL SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-1586. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).

WATER LEVEL MEASURED IN TEST BORING

BULK — DISTURBED BULK SAMPLE

XX — CALIFORNIA SAMPLE - OBTAINED BY DRIVING A RING-LINED SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-3550. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).

1 — RMG SOIL TYPE - SEE REPORT TEXT FOR DESCRIPTION

4.5 — WATER CONTENT (%)

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EXPLANATION OF TEST BORING LOGS

JOB No. 117523

FIGURE No. 3

DATE 5/5/08

TEST BORING NO.: 1 DATE DRILLED: 5/16/07 REMARKS: GROUNDWATER @ 14.0 ' 5/17/07	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
SAND, SILTY, REDDISH BROWN, DENSE, MOIST						1
WEATHERED SANDSTONE, SILTY, WITH INTERMITTENT CLAYSTONE SEAMS, REDDISH BROWN, HARD TO VERY HARD, MOIST TO WET	5			50/6"	9.5	2
	10			50/7"	5.6	2
	15			50/7"	12.2	2
	20			50/5"	20.1	2

TEST BORING NO.: 2 DATE DRILLED: 5/16/07 REMARKS: NO GROUNDWATER ON 5/17/07	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
SAND, SILTY, REDDISH BROWN, DENSE, MOIST						1
WEATHERED SANDSTONE, SILTY, WITH INTERMITTENT CLAYSTONE SEAMS, REDDISH TO OLIVE BROWN, VERY HARD, MOIST	5			50/5"	11.6	2
	10			50/5"	10.2	2
	15			50/5"	9.2	2
	20			50/4"	9.3	2

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TEST BORING LOGS

JOB No. 117523

FIGURE No. 4

DATE 5/5/08

TEST BORING NO.: 3 DATE DRILLED: 5/16/07 REMARKS: GROUNDWATER @ 1.0 ' 5/23/07	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
WEATHERED SANDSTONE, SILTY TO SLIGHTLY CLAYEY, HARD WITH INTERMITTENT CLAYSTONE SEAMS, OLIVE BROWN TO GRAY, HARD TO VERY, MOIST TO WET	5			50/7"	11.5	2
	10			50/4"	19.7	2
	15			50/3"	22.6	2
	20			50/2"	14.4	2

TEST BORING NO.: 4 DATE DRILLED: 5/16/07 REMARKS: GROUNDWATER @ 3.4 ' 5/17/07	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
SAND, SILTY, BROWN, MEDIUM DENSE, MOIST TO WET	5			19	16.4	1
WEATHERED SANDSTONE, SILTY, BROWN TO DARK BROWN, WITH INTERMITTENT CLAYSTONE SEAMS, HARD, MOIST TO WET	10			50/6"	11.4	2
	15			50/6"	14.7	2
	20			50/6"	13.8	2

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TEST BORING LOGS

JOB No. 117523

FIGURE No. 5

DATE 5/5/08

TEST BORING NO.: 5
DATE DRILLED:
5/16/07
REMARKS:
GROUNDWATER @ 1.0'
5/23/07

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
5			30	18.2	1
10			50/6"	13.5	2
15			50/2"	9.7	2
20			10/0"	17.1	2

SAND, SLIGHTLY SILTY, BROWN, DENSE, WET

WEATHERED SANDSTONE, SILTY, WITH INTERMITTENT CLAYSTONE SEAMS, BROWN, VERY HARD, WET

TEST BORING NO.: 6
DATE DRILLED:
5/16/07
REMARKS:
NO GROUNDWATER ON
5/17/07

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
5			50/5"	8.7	2
10			50/5"	7.4	2
15			50/4"	11.6	2
20			50/5"	12.5	2

WEATHERED SANDSTONE, SILTY, LIGHT BROWN TO GRAY, WITH INTERMITTENT CLAYSTONE SEAMS, VERY HARD, MOIST

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TEST BORING LOGS

JOB No. 117523

FIGURE No. 6

DATE 5/5/08

TEST BORING NO.: 7
DATE DRILLED:
5/16/07
REMARKS:
GROUNDWATER @ 15.0 '
5/17/07

WEATHERED SANDSTONE, SILTY, GRAY TO BROWN, WITH INTERMITTENT CLAYSTONE SEAMS, HARD TO VERY HARD, MOIST TO WET

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
5			50/6"	7.5	2
10			50/4"	10.6	2
15 ▽			50/4"	10.1	2
20			50/5"	12.1	2

TEST BORING NO.: 8
DATE DRILLED:
5/16/07
REMARKS:
NO GROUNDWATER ON
5/17/07

WEATHERED SANDSTONE, SILTY, GRAY, WITH INTERMITTENT CLAYSTONE SEAMS, HARD TO VERY HARD, MOIST

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
5			50/6"	9.0	2
10			50/5"	8.1	2
15			50/7"	11.4	2
20			50/4"	9.5	2

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TEST BORING LOGS

JOB No. 117523

FIGURE No. 7

DATE 5/5/08

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	FHA Expansion Pressure (psf)	% Swell	RMG Soil Type
1	4.0	9.5	105.5						- 0.1	2
1	9.0	5.6								2
1	14.0	12.2		NP	NP		15.8			2
1	19.0	20.1								2
2	4.0	11.6								2
2	9.0	10.2	102.3						- 0.6	2
2	14.0	9.2								2
2	19.0	9.3								2
3	4.0	11.5		35	20		22.8			2
3	9.0	19.7								2
3	14.0	22.6		NP	NP		15.4			2
3	19.0	14.4								2
4	4.0	16.4								1
4	9.0	11.4								2
4	14.0	14.7		36	19		43.8			2
4	19.0	13.8								2
5	4.0	18.2	108.1						0.0	1
5	9.0	13.5								2
5	14.0	9.7		NP	NP		10.8			2
5	19.0	17.1								2
6	4.0	8.7		NP	NP		13.2			2
6	9.0	7.4	96.3						- 0.3	2
6	14.0	11.6								2
6	19.0	12.5								2
7	4.0	7.5	110.6						0.0	2
7	9.0	10.6								2
7	14.0	10.1		31	15		19.8			2
7	19.0	12.1								2
8	4.0	9.0								2
8	9.0	8.1	104.5						- 0.6	2
8	14.0	11.4		39	22		55.1			2
8	19.0	9.5								2

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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 117523
FIGURE No. 8
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DATE 5/5/08