# REPORT
# GEOTECHNICAL STUDY
# PROPOSED GRANTSVILLE SUBDIVISION
# NORTHEAST OF
# 4792 WEST UTAH STATE ROAD 112
# GRANTSVILLE, UTAH

Submitted To:

The Romney Group
2265 East Murray Holladay Road
Holladay, Utah 84117

Submitted By:

GSH Geotechnical, Inc.
473 West 4800 South
Salt Lake City, Utah 84123

December 21, 2020

Job No. 3203-001-20

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Mr. Anthon Stauffer
The Romney Group
2265 East Murray Holladay Road
Holladay, Utah 84117

Mr. Stauffer:

Re: Report
Geotechnical Study
Proposed Grantsville Subdivision
Northeast of 4792 West Utah State Road 112
Grantsville, Utah

## 1. INTRODUCTION

### 1.1 GENERAL

This report presents the results of our geotechnical study performed at the site of the proposed Grantsville subdivision to be located northeast of 4792 West Utah State Road 112 in Grantsville, Utah. The general location of the site with respect to existing roadways, as of 2020, is presented on Figure 1, Vicinity Map. A more detailed layout of the site showing existing roadways, and the test pits excavated in conjunction with this study is presented on Figure 2, Site Plan.

### 1.2 OBJECTIVES AND SCOPE

The objectives and scope of the study were planned in discussions between Mr. Anthon Stauffer of The Romney Group and Mr. Alan Spilker of GSH Geotechnical, Inc. (GSH).

In general, the objectives of this study were to:

1. Define and evaluate the subsurface soil and groundwater conditions across the site.

2. Provide appropriate foundation, earthwork, pavement, and geoseismic recommendations to be utilized in the design and construction of the proposed facilities.

GSH Geotechnical, Inc.
473 West 4800 South
Salt Lake City, Utah 84123
Tel: 801.685.9190 Fax: 801.685.2990
www.gshgeo.com

In accomplishing these objectives, our scope has included the following:

1. A field program consisting of the excavating, logging, and sampling of 10 exploration test pits.

2. A laboratory testing program.

3. An office program consisting of the correlation of available data, engineering analysis, and the preparation of this summary report.

## 1.3 AUTHORIZATION

Authorization was provided by returning a signed copy of the Professional Services Agreement No. 20-1142 dated November 12, 2020.

## 1.4 PROFESSIONAL STATEMENTS

Supporting data upon which our recommendations are based are presented in subsequent sections of this report. Recommendations presented herein are governed by the physical properties of the soils encountered in the exploration test pits, projected groundwater conditions, and the layout and design data discussed in Section 2, Proposed Construction. If subsurface conditions other than those described in this report are encountered and/or if design and layout changes are implemented, GSH must be informed so that our recommendations can be reviewed and amended, if necessary.

Our professional services have been performed, our findings developed, and our recommendations prepared in accordance with generally accepted engineering principles and practices in this area at this time.

# 2. PROPOSED CONSTRUCTION

This project is to consist of the development of a 30-acre parcel for single-family residential structures. The structures are to be of wood frame construction with partial- or full-depth basements if conditions allow and supported over conventional spread and continuous wall foundations.

Maximum real column and wall loads are anticipated to be on the order of 60 kips and 1 to 2 kips per lineal foot, respectively. Real loads are defined as the total of all dead plus frequently applied (reduced) live loads.

Residential roadways may be planned to service the subdivision. Proposed traffic in the residential roadways is anticipated to consist of a moderate volume of automobiles and light trucks, a light volume of medium-weight trucks, and occasional heavy-weight trucks.

Site development will require some earthwork in the form of minor cutting and filling. At this time, we anticipate that maximum site grading cuts and fills, excluding utilities, will be on the order of 5 to 6 feet.

## 3. SITE INVESTIGATIONS

### 3.1 GENERAL

Subsurface conditions in unexplored locations or at other times may vary from those encountered at specific test pit locations. If such variations are noted during construction or if project development plans are changed, GSH must review the changes and amend our recommendations, if necessary.

Test pit locations were established by estimating distances and angles from site landmarks. If increased accuracy is desired by the client, we recommend that the test pit locations and elevations be surveyed.

### 3.2 FIELD PROGRAM

To define and evaluate the subsurface soil and groundwater conditions across the site, 10 test pits were excavated within the accessible areas. These test pits were completed to depths ranging from 10.0 to 13.5 feet with a moderate-sized rubber tire-mounted excavator. The approximate locations of the test pits are presented on Figure 2.

The field portion of our study was under the direct control and continual supervision of an experienced member of our geotechnical staff. During the course of the excavation operations, a continuous log of the subsurface conditions encountered was maintained. In addition, samples of the typical soils encountered were obtained for subsequent laboratory testing and examination. The soils were classified in the field based upon visual and textural examination. These classifications were supplemented by subsequent inspection and testing in our laboratory. Graphical representation of the subsurface conditions encountered is presented on Figures 3A through 3J, Test Pit Logs. Soils were classified in accordance with the nomenclature described on Figure 4, Key to Test Pit Log (USCS).

A 2.42-inch inside diameter thin-wall drive sampler was utilized at select locations and depths within the test pit excavations to collect soil samples for further examination and laboratory testing.

Following completion of excavation operations, 1.25-inch diameter slotted PVC pipe was installed in Test Pits TP-1, TP-4, and TP-8 to provide a means of monitoring the groundwater fluctuations. The test pits were then backfilled. Although an effort was made to compact the backfill with the excavator, backfill was not placed in uniform lifts and compacted to a specific density. Consequently, settlement of the backfill with time is likely to occur.

## 3.3 LABORATORY TESTING

### 3.3.1 General

To provide data necessary for our engineering analysis, a laboratory testing program was performed. This program included moisture, density, partial gradation, consolidation, and chemical tests. The following paragraphs describe the tests and summarize the test data.

### 3.3.2 Moisture and Density Tests

To provide index parameters and to correlate other test data, moisture and density tests were performed on selected samples. The results of these tests are presented on the test pit logs, Figures 3A through 3J.

### 3.3.3 Partial Gradation Tests

To aid in classifying the granular soils, partial gradation tests were performed. Results of the tests are tabulated below and presented on the test pit logs, Figures 3A through 3J.

| Test Pit No. | Depth (feet) | Percent Passing No. 200 Sieve | Moisture Content Percent | Soil Classification |
|---|---|---|---|---|
| TP-4 | 13.0 | 41.3 | 6.6 | SM |
| TP-5 | 13.0 | 21.4 | 5.5 | SM |

### 3.3.4 Consolidation Tests

To provide data necessary for our settlement analysis, consolidation testing was performed on 2 representative samples of the natural fine-grained clay soils encountered at the site. The results of these tests indicate that the samples tested were moderately over-consolidated and will exhibit moderate strength and compressibility characteristics under the anticipated loading. Detailed results of the tests are maintained within our files and can be transmitted to you, upon your request.

### 3.3.5 Chemical Tests

To determine if the site soils will react detrimentally with concrete, chemical tests were performed on a representative sample of the near-surface soil encountered at the site. The results of the chemical tests are tabulated below:

| Test Pit No. | Depth (feet) | Soil Classification | pH | Total Water Soluble Sulfate (mg/kg-dry) |
|---|---|---|---|---|
| TP-1 | 1.0 | CL | 8.87 | 26.1 |

# 4. SITE CONDITIONS

## 4.1 SURFACE

The site is located northeast of 4792 West Utah State Road 112 in Grantsville, Utah. The site is currently vacant/undeveloped land used for agricultural purposes. The topography of the site is slightly sloped, grading down to the north with a total relief of approximately 15 to 20 feet. Site vegetation consists of agricultural grass fields.

The site is bounded to the north, east, south, and west by similar vacant/undeveloped agricultural land and to the southeast by a single-family residential structure with Utah State Road 112 beyond.

## 4.2 SUBSURFACE SOIL

The following paragraphs provide generalized descriptions of the subsurface profiles and soil conditions encountered within the test pits conducted during this study. As previously noted, soil conditions may vary in unexplored locations.

The test pits were excavated to depths ranging from 10.0 to 13.5 feet. The soil conditions encountered in each of the test pits, to the depths explored, were generally similar across the test pit locations.

- Approximately 4 inches of topsoil was encountered in each test pit. Topsoil thickness is frequently erratic and thicker zones of topsoil should be anticipated.

- Natural soils were encountered below the ground surface in each test pit. The natural soils consisted primarily of clay with varying silt and sand content, silt with varying sand and clay content, and sand with varying silt and gravel content.

The natural clay and silt soils were medium stiff to hard, dry to slightly moist, gray and tan in color, and moderately over-consolidated. The natural clay and silt soils are anticipated to exhibit moderate strength and compressibility characteristics under the anticipated loading.

The natural sand soils were medium dense, dry, and tan in color. The natural sand soils are anticipated to exhibit moderately high strength and moderately low compressibility characteristics under the anticipated load range.

For a more descriptive interpretation of subsurface conditions, please refer to Figures 3A through 3J, Test Pit Logs. The lines designating the interface between soil types on the test pit logs generally represent approximate boundaries. In situ, the transition between soil types may be gradual.

## 4.3 GROUNDWATER

Groundwater was not encountered to the depths explored in the excavations completed at the site.

Groundwater levels vary with changes in season and rainfall, construction activity, irrigation, snow melt, surface water run-off, and other site-specific factors.

# 5. DISCUSSIONS AND RECOMMENDATIONS

## 5.1 SUMMARY OF FINDINGS

The proposed structures may be supported upon conventional spread and continuous wall foundations supported upon suitable natural soils and/or structural fill extending to suitable natural soils.

The most significant geotechnical aspects at the site are:

1. The potential to encounter non-engineered fill at the site.

2. The potential to encounter loose/plow disturbed topsoil from agricultural activities.

Prior to proceeding with construction, removal of the surface vegetation, root systems, topsoil, loose/plow disturbed soils, non-engineered fill (if encountered), and any deleterious materials from beneath an area extending out at least 5 feet from the perimeter of the proposed structure footprint and 3 feet beyond rigid pavements and exterior flatwork areas will be required. All existing utility locations should be reviewed to assess their impact on the proposed construction and abandoned and/or relocated as appropriate.

Due to the developed nature of this site and the surrounding area, non-engineered fills may exist in unexplored areas of the site. Based on our experience, non-engineered fills are frequently erratic in composition and consistency. All surficial loose/disturbed soils and non-engineered fills must be removed below all footings, floor slabs, and rigid pavements. The in situ, non-engineered fills may remain below flexible pavements if free of any deleterious materials, of limited thickness, and if properly prepared, as discussed later in this report.

To reduce disturbance of the natural soils during excavation, it is recommended that low-impact, track-mounted equipment with smooth edge buckets/blades be utilized.

Detailed discussions pertaining to earthwork, foundations, pavements, and the geoseismic setting of the site are presented in the following sections.

## 5.2 EARTHWORK

### 5.2.1 Site Preparation

Initial site preparation will consist of the removal of the non-engineered fills (if encountered), loose/disturbed soil, surface vegetation, root systems, topsoil, and any deleterious materials from beneath an area extending out at least 5 feet from the perimeter of the proposed structure footprint and 3 feet beyond rigid pavements and exterior flatwork areas. All existing utility locations should be reviewed to assess their impact on the proposed construction and abandoned and/or relocated as appropriate.

In situ, non-engineered fills (if encountered) may remain below flexible pavements if free of debris and deleterious materials, less than 3 feet in thickness, and if properly prepared. Proper preparation below pavements will consist of the scarification of the upper 12 inches below the asphalt pavement sequence, followed by moisture preparation and re-compaction to the requirements of structural fill. Even with proper preparation, pavements established overlying non-engineered fills may encounter some long-term movements unless the non-engineered fills are completely removed.

It must be noted that from a handling and compaction standpoint, soils containing high amounts of fines (silts and clays) are inherently more difficult to rework and are very sensitive to changes in moisture content, requiring very close moisture control during placement and compaction. This will be very difficult, if not impossible, during wet and cold periods of the year. Additionally, the on-site soils are likely above optimum moisture content for compacting at present and would require some drying prior to re-compacting.

Subsequent to stripping and prior to the placement of floor slabs, foundations, structural site grading fills, exterior flatwork, and pavements, the exposed subgrade must be proof rolled by passing moderate-weight rubber tire-mounted construction equipment over the surface at least twice. If excessively soft or otherwise unsuitable soils are encountered beneath footings, they must be completely removed. If removal depth required is greater than 2 feet below footings, GSH must be notified to provide further recommendations. In pavement, floor slab, and outside flatwork areas, unsuitable natural soils should be removed to a maximum depth of 2 feet and replaced with compacted granular structural fill.

Subgrade preparation as described must be completed prior to placing overlying structural site grading fills.

To reduce disturbance of the natural soils during excavation, it is recommended that low-impact, track-mounted equipment with smooth edge buckets/blades be utilized.

GSH must be notified prior to the placement of structural site grading fills, floor slabs, footings, and pavements to verify that all loose/disturbed soils and non-engineered fills (if encountered) have been completely removed and/or properly prepared.

### 5.2.2 Temporary Excavations

Temporary excavations up to 8 feet deep in fine-grained cohesive soils, above or below the water table, may be constructed with sideslopes no steeper than one-half horizontal to one vertical (0.5H:1.0V). Excavations deeper than 8 feet are not anticipated at the site.

To reduce disturbance of the natural soils during excavation, it is recommended that low-impact, track-mounted equipment with smooth edge buckets/blades be utilized.

All excavations must be inspected periodically by qualified personnel. If any signs of instability or excessive sloughing are noted, immediate remedial action must be initiated.

### 5.2.3 Structural Fill

Structural fill is defined as all fill which will ultimately be subjected to structural loadings, such as imposed by footings, floor slabs, pavements, etc. Structural fill will be required as backfill over foundations and utilities, as site grading fill, and as replacement fill below footings. All structural fill must be free of surface vegetation, root systems, rubbish, topsoil, frozen soil, and other deleterious materials.

Structural site grading fill is defined as structural fill placed over relatively large open areas to raise the overall grade. For structural site grading fill, the maximum particle size shall not exceed 4 inches; although, occasional larger particles, not exceeding 8 inches in diameter, may be incorporated if placed randomly in a manner such that "honeycombing" does not occur and the desired degree of compaction can be achieved. The maximum particle size within structural fill placed within confined areas shall be restricted to 2 inches.

Imported structural fill below foundations and floor slabs shall consist of a well graded sand and gravel mixture with less than 30 percent retained on the three-quarter-inch sieve and less than 20 percent passing the No. 200 Sieve (clays and silts).

To stabilize soft subgrade conditions (if encountered) or where structural fill is required to be placed closer than 2.0 feet above the water table at the time of construction, a mixture of coarse angular gravels and cobbles and/or 1.5- to 2.0-inch gravel (stabilizing fill) should be utilized. It may also help to utilize a stabilization fabric, such as Mirafi 600X or equivalent, placed on the natural ground if 1.5- to 2.0-inch gravel is used as stabilizing fill.

### 5.2.4 Fill Placement and Compaction

All structural fill shall be placed in lifts not exceeding 8 inches in loose thickness. Structural fills shall be compacted in accordance with the percent of the maximum dry density as determined by the AASHTO[1] T180 (ASTM[2] D1557) compaction criteria in accordance with the following table:

[1] American Association of State Highway and Transportation Officials
[2] American Society for Testing and Materials

| Location | Total Fill Thickness (feet) | Minimum Percentage of Maximum Dry Density |
|---|---|---|
| Beneath an area extending at least 5 feet beyond the perimeter of the structure | 0 to 10 | 95 |
| Site grading fills outside area defined above | 0 to 5 | 90 |
| Site grading fills outside area defined above | 5 to 10 | 95 |
| Utility trenches within structural areas | -- | 96 |
| Road base | -- | 96 |

Structural fills greater than 10 feet thick are not anticipated at the site.

Subsequent to stripping and prior to the placement of structural site grading fill, the subgrade shall be prepared as discussed in Section 5.2.1, Site Preparation, of this report. In confined areas, subgrade preparation should consist of the removal of all loose or disturbed soils.

Coarse angular gravel and cobble mixtures (stabilizing fill), if utilized, shall be end dumped, spread to a maximum loose lift thickness of 15 inches, and compacted by dropping a backhoe bucket onto the surface continuously at least twice. As an alternative, the stabilizing fill may be compacted by passing moderately heavy construction equipment or large self-propelled compaction equipment over the surface at least twice. Subsequent fill material placed over the coarse gravels and cobbles shall be adequately compacted so that the "fines" are "worked into" the voids in the underlying coarser gravels and cobbles. Where soil fill materials are to be placed directly over more than about 18 inches of clean gravel, a separation geofabric, such as Mirafi 140N or equivalent, is recommended to be placed between the gravel and subsequent soil fills.

Non-structural fill may be placed in lifts not exceeding 12 inches in loose thickness and compacted by passing construction, spreading, or hauling equipment over the surface at least twice.

### 5.2.5 Utility Trenches

All utility trench backfill material below structurally loaded facilities (footings, floor slabs, flatwork, pavements, etc.) shall be placed at the same density requirements established for structural fill. If the surface of the backfill becomes disturbed during the course of construction, the backfill shall be proof rolled and/or properly compacted prior to the construction of any exterior flatwork over a backfilled trench. Proof rolling shall be performed by passing moderately loaded rubber tire-mounted construction equipment uniformly over the surface at least twice. If excessively loose or soft areas are encountered during proof rolling, they shall be removed to a maximum depth of 2 feet below design finish grade and replaced with structural fill.

Many utility companies and City-County governments are now requiring that Type A-1a or A-1b (AASHTO Designation – granular soils with limited fines) soils be used as backfill over utilities. These organizations are also requiring that in public roadways, the backfill over major utilities be compacted over the full depth of fill to at least 96 percent of the maximum dry density as determined by the AASHTO T180 (ASTM D1557) method of compaction. GSH recommends that as the major utilities continue onto the site that these compaction specifications are followed.

Fine-grained soils, such as silts and clays, are not recommended for utility trench backfill in structural areas.

To reduce disturbance of the natural soils during excavation, it is recommended that low-impact, track-mounted equipment with smooth edge buckets/blades be utilized.

## 5.3 GROUNDWATER

Groundwater was not encountered to the depths explored in the excavations completed at the site.

The groundwater measurements presented are conditions at the time of the field exploration and may not be representative of other times or locations. Groundwater levels may vary seasonally and with precipitation, as well as other factors including irrigation. Evaluation of these factors is beyond the scope of this study. Groundwater levels may, therefore, be at shallower or deeper depths than those measured during this study, including during construction and over the life of the structure.

The extent and nature of any dewatering required during construction will be dependent on the actual groundwater conditions prevalent at the time of construction and the effectiveness of construction drainage to prevent run-off into open excavations.

## 5.4 SPREAD AND CONTINUOUS WALL FOUNDATIONS

### 5.4.1 Design Data

The results of our analysis indicate that the proposed structures may be supported upon conventional spread and continuous wall foundations established upon suitable natural soils and/or structural fill extending to suitable natural soils. Under no circumstances shall foundations be established over non-engineered fills, loose or disturbed soils, topsoil, surface vegetation, root systems, rubbish, construction debris, other deleterious materials, frozen soils, or within ponded water. For design, the following parameters are provided:

| | |
|---|---|
| Minimum Recommended Depth of Embedment for Frost Protection | - 30 inches |
| Minimum Recommended Depth of Embedment for Non-frost Conditions | - 15 inches |
| Recommended Minimum Width for Continuous Wall Footings | - 18 inches |
| Minimum Recommended Width for Isolated Spread Footings | - 24 inches |
| Recommended Net Bearing Capacity for Real Load Conditions | - 2,500 pounds per square foot |
| Bearing Capacity Increase for Seismic Loading | - 50 percent |

The term "net bearing capacity" refers to the allowable pressure imposed by the portion of the structure located above lowest adjacent final grade. Therefore, the weight of the footing and backfill to lowest adjacent final grade need not be considered. Real loads are defined as the total of all dead plus frequently applied live loads. Total load includes all dead and live loads, including seismic and wind.

### 5.4.2 Installation

Under no circumstances shall the footings be installed upon, non-engineered fills, loose or disturbed soils, topsoil, surface vegetation, root systems, rubbish, construction debris, or other deleterious materials. If unsuitable soils are encountered, they must be removed and replaced with compacted granular fill. If granular soils become loose or disturbed, they must be recompacted prior to pouring the concrete.

The width of structural replacement fill below footings should be equal to the width of the footing plus one foot for each foot of fill thickness.

### 5.4.3 Settlements

Based on column loadings, soil bearing capacities, and the foundation recommendations as discussed above, we expect primary total settlement beneath individual foundations to be less than one inch.

The amount of differential settlement is difficult to predict because the subsurface and foundation loading conditions can vary considerably across the site. However, we anticipate differential

settlement between adjacent foundations could vary from 0.5 to 0.75 inch. The final deflected shape of the structure will be dependent on actual foundation locations and loading.

## 5.5 LATERAL RESISTANCE

Lateral loads imposed upon foundations due to wind or seismic forces may be resisted by the development of passive earth pressures and friction between the base of the footings and the supporting soils. In determining frictional resistance, a coefficient of friction of 0.30 may be utilized for the footing interface with in situ natural clay soils and 0.40 for footing interface with granular structural fill. Passive resistance provided by properly placed and compacted granular structural fill above the water table may be considered equivalent to a fluid with a density of 300 pounds per cubic foot. Below the water table, this granular soil should be considered equivalent to a fluid with a density of 150 pounds per cubic foot.

A combination of passive earth resistance and friction may be utilized provided that the friction component of the total is divided by 1.5.

## 5.6 LATERAL PRESSURES

Parameters, as presented within this section, are for backfills which will consist of drained soil placed and compacted in accordance with the recommendations presented herein.

The lateral pressures imposed upon subgrade facilities will, therefore, be basically dependent upon the relative rigidity and movement of the backfilled structure. For active walls, such as retaining walls which can move outward (away from the backfill), drained backfill may be considered equivalent to a fluid with a density of 40 pounds per cubic foot in computing lateral pressures. For more rigid subgrade walls that are not more than 10 inches thick, granular backfill may be considered equivalent to a fluid with a density of 50 pounds per cubic foot. For very rigid non-yielding walls, granular backfill should be considered equivalent to a fluid with a density of at least 60 pounds per cubic foot. The above values assume that the surface of the soils slope behind the wall is horizontal and that the granular fill within 3 feet of the wall will be compacted with hand-operated compacting equipment.

For seismic loading of below-grade walls, the uniform lateral pressures below, in pounds per square foot (psf), should be added based on wall depth and wall case:

| Uniform Lateral Pressures | | | |
|---|---|---|---|
| **Wall Height (Feet)** | **Active Pressure Case (psf)** | **Moderately Yielding Case (psf)** | **At Rest/Non-Yielding Case (psf)** |
| 4 | 12 | 31 | 50 |
| 6 | 18 | 48 | 78 |
| 8 | 25 | 65 | 105 |
| 10 | 31 | 81 | 131 |

## 5.7 FLOOR SLABS

Floor slabs may be established upon suitable natural subgrade soils or structural fill extending to suitable natural soils. Under no circumstances shall floor slabs be established directly over non-engineered fills, loose or disturbed soils, sod, rubbish, construction debris, other deleterious materials, frozen soils, or within ponded water.

To facilitate curing of the concrete and to provide a capillary moisture break, it is recommended that floor slabs be directly underlain by at least 4 inches of "free-draining" fill, such as "pea" gravel or three-quarters to one inch minus clean gap-graded gravel.

Settlement of lightly loaded floor slabs designed according to previous recommendations (average uniform pressure of 200 pounds per square foot or less) is anticipated to be less than one-quarter of an inch.

## 5.8 PAVEMENTS

The natural clay soils will exhibit poor pavement support characteristics when saturated. All pavement areas must be prepared as previously discussed (see Section 5.2.1, Site Preparation). Under no circumstances shall pavements be established over loose or disturbed soils, topsoil, surface vegetation, root systems, rubbish, construction debris, other deleterious materials, frozen soils, or within ponded water. With the subgrade soils and the projected traffic as discussed in Section 2, Proposed Construction, the following pavement sections are recommended:

Residential Roadways

(Moderate Volume of Automobiles and Light Trucks,
Light Volume of Medium-Weight Trucks,
and Occasional Heavy-Weight Trucks)
[6 equivalent 18-kip axle loads per day]

Flexible Pavements:
(Asphalt Concrete)

| | |
|---|---|
| 3.0 inches | Asphalt concrete |
| 9.0 inches | Aggregate base |
| Over | Properly prepared natural subgrade soils and/or structural site grading fill extending to properly prepared natural subgrade soils |

Rigid Pavements:
(Non-reinforced Concrete)

| | |
|---|---|
| 5.0 inches | Portland cement concrete (non-reinforced) |
| 5.0 inches | Aggregate base |
| Over | Properly prepared natural subgrade soils, and/or structural site grading fill extending to properly prepared natural subgrade soils |

These above rigid pavement sections are for non-reinforced Portland cement concrete. Concrete should be designed in accordance with the American Concrete Institute (ACI) and joint details should conform to the Portland Cement Association (PCA) guidelines. The concrete should have a minimum 28-day unconfined compressive strength of 4,000 pounds per square inch and contain 6 percent ±1 percent air-entrainment.

The crushed stone should conform to applicable sections of the current Utah Department of Transportation (UDOT) Standard Specifications. All asphalt material and paving operations should meet applicable specifications of the Asphalt Institute and UDOT. A GSH technician shall observe placement and perform density testing of the base course material and asphalt.

Please note that the recommended pavement section is based on estimated post-construction traffic loading. If the pavement is to be constructed and utilized by construction traffic, the above pavement section may prove insufficient for heavy truck traffic, such as concrete trucks or tractor-trailers used for construction delivery. Unexpected distress, reduced pavement life, and/or premature failure of

the pavement section could result if subjected to heavy construction traffic and the owner should be made aware of this risk. If the estimated traffic loading stated herein is not correct, GSH must review actual pavement loading conditions to determine if revisions to these recommendations are warranted.

## 5.9 CEMENT TYPES

The laboratory tests indicate that the natural soils tested contain a negligible amount of sulfates. Based on our test results, concrete in contact with the on-site soil will have a low potential for sulfate reaction (ACI 318, Table 4.3.1). Therefore, all concrete which will be in contact with the site soils may be prepared using Type I or IA cement.

## 5.10 GEOSEISMIC SETTING

### 5.10.1 General

Utah municipalities have adopted the International Building Code (IBC) 2018. The IBC 2018 code refers to ASCE 7-16 Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE 7-16) determines the seismic hazard for a site based upon mapping of bedrock accelerations prepared by the United States Geologic Survey (USGS) and the soil site class. The USGS values are presented on maps incorporated into the IBC code and are also available based on latitude and longitude coordinates (grid points).

### 5.10.2 Faulting

Based on our review of available literature, no active faults pass through or immediately adjacent to the site. The nearest active mapped fault consists of the Oquirrh fault zone, located about 8.8 miles to the east of the site.

### 5.10.3 Site Class

For dynamic structural analysis, the site class design category $D_1$ – as defined by the International Residential Code can be utilized.

### 5.10.4 Liquefaction

The site is located in an area that has been identified by the Utah Geological Survey (UGS) as being a “very low” liquefaction potential zone. Liquefaction is defined as the condition when saturated, loose, granular soils lose their support capabilities because of excessive pore water pressure, which develops during a seismic event. Clayey soils, even if saturated, will generally not liquefy during a major seismic event.

Due to the clayey nature of the soils and lack of shallow groundwater, liquefaction is not anticipated to occur within the soils encountered at this site.

## 5.11 SITE VISITS

GSH must verify that all topsoil/disturbed soils and any other unsuitable soils have been removed, that non-engineered fills (if encountered) have been removed and/or properly prepared, and that suitable soils have been encountered prior to placing site grading fills, footings, slabs, and pavements. Additionally, GSH must observe fill placement and verify in-place moisture content and density of fill materials placed at the site.

## 5.12 CLOSURE

If you have any questions or would like to discuss these items further, please feel free to contact us at (801) 685-9190.

Respectfully submitted,

**GSH Geotechnical, Inc.**

Dion A Obermeyer
Staff Geologist

Reviewed by:

Alan D. Spilker, P.E.
State of Utah No. 334228
President/Senior Geotechnical Engineer

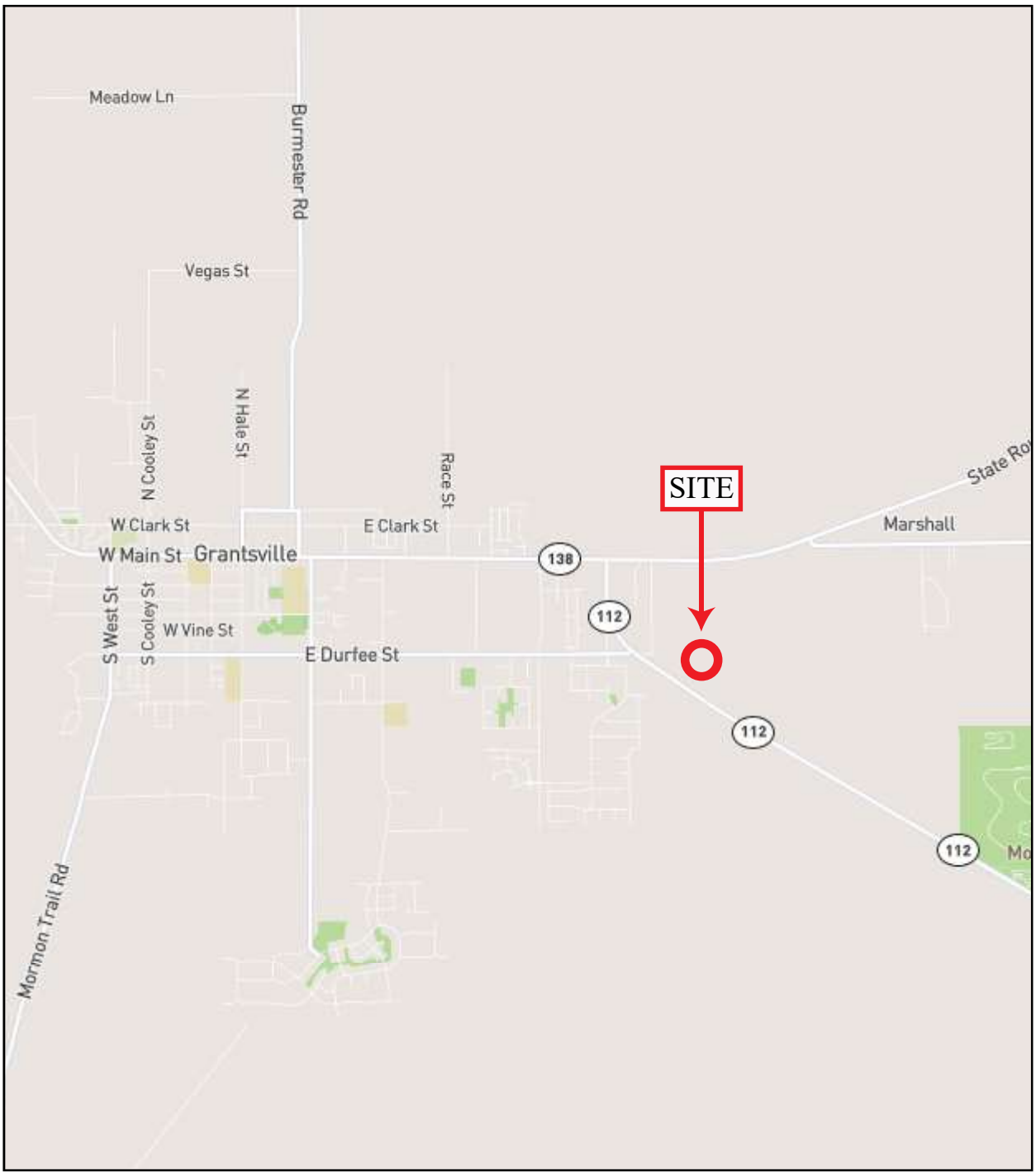
REGISTERED PROFESSIONAL ENGINEER
No. 334228
ALAN D. SPILKER
STATE OF UTAH

DAO/ADS:sp

Encl. Figure 1, Vicinity Map
Figure 2, Site Plan
Figures 3A through 3J, Test Pit Logs
Figure 4, Key to Test Pit Log (USCS)

Addressee (email)

THE ROMNEY GROUP
JOB NO. 3203-001-20




1 0 1 2 KM 3

0.5 0 0.5 1 1.5 MI 2

# FIGURE 1
# VICINITY MAP

REFERENCE:
ALL TRAILS - NATIONAL GEOGRAPHIC TERRAIN
DATED 2020

GSH

THE ROMNEY GROUP
JOB NO. 3203-001-20


FIGURE 2
SITE PLAN

REFERENCE:
ADAPTED FROM AERIAL IMAGERY
DOWNLOADED FROM GOOGLE EARTH
DATED 23 JUNE 2017

GSH

# TEST PIT LOG

Page: 1 of 1

## TEST PIT: TP-1

CLIENT: The Romney Group | PROJECT NUMBER: 3203-001-20

PROJECT: Grantsville Subdivision | DATE STARTED: 11/18/20 | DATE FINISHED: 11/18/20

LOCATION: Northeast of 4792 West SR-112, Grantsville, Utah | GSH FIELD REP.: NWU

EXCAVATING METHOD/EQUIPMENT: 6-ton Kubota

GROUNDWATER DEPTH: Not Encountered (11/18/20) | ELEVATION: ---

| WATER LEVEL | USCS | DESCRIPTION | DEPTH (FT.) | SAMPLE SYMBOL | MOISTURE (%) | DRY DENSITY (PCF) | % PASSING 200 | LIQUID LIMIT (%) | PLASTICITY INDEX | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **Ground Surface** | 0 | | | | | | | |
| | CL | FINE TO MEDIUM SANDY CLAY<br>with silt; major roots (topsoil) to 4"; brown | | | | | | | | dry<br>stiff |
| | | grades silty clay with trace fine sand; gray | 5 | | | | | | | hard |
| | | grades tan | 10 | | | | | | | |
| | | End of exploration at 12.5'.<br>No significant sidewall caving.<br>No groundwater encountered at time of excavation.<br>Installed 1.25" diameter slotted PVC pipe to 10'. | 15<br>20<br>25 | | | | | | | |

See Subsurface Conditions section in the report for additional information.

FIGURE 3A

# TEST PIT LOG

Page: 1 of 1

## TEST PIT: TP-2

CLIENT: The Romney Group | PROJECT NUMBER: 3203-001-20

PROJECT: Grantsville Subdivision | DATE STARTED: 11/18/20 | DATE FINISHED: 11/18/20

LOCATION: Northeast of 4792 West SR-112, Grantsville, Utah | GSH FIELD REP.: NWU

EXCAVATING METHOD/EQUIPMENT: 6-ton Kubota

GROUNDWATER DEPTH: Not Encountered (11/18/20) | ELEVATION: ---

| WATER LEVEL | USCS | DESCRIPTION | DEPTH (FT.) | SAMPLE SYMBOL | MOISTURE (%) | DRY DENSITY (PCF) | % PASSING 200 | LIQUID LIMIT (%) | PLASTICITY INDEX | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **Ground Surface** | 0 | | | | | | | |
| | CL | SILTY CLAY<br>with trace fine sand; major roots (topsoil) to 4"; gray | | | | | | | | slightly moist<br>very stiff |
| | | | 5 | | 20.1 | 99 | | | | |
| | | grades tan | | | | | | | | dry |
| | | | 10 | | | | | | | |
| | | End of exploration at 11.0'.<br>No significant sidewall caving.<br>No groundwater encountered at time of excavation. | | | | | | | | |
| | | | 15 | | | | | | | |
| | | | 20 | | | | | | | |
| | | | 25 | | | | | | | |

See Subsurface Conditions section in the report for additional information.

FIGURE 3B

# TEST PIT LOG

Page: 1 of 1

## TEST PIT: TP-3

CLIENT: The Romney Group | PROJECT NUMBER: 3203-001-20

PROJECT: Grantsville Subdivision | DATE STARTED: 11/18/20 | DATE FINISHED: 11/18/20

LOCATION: Northeast of 4792 West SR-112, Grantsville, Utah | GSH FIELD REP.: NWU

EXCAVATING METHOD/EQUIPMENT: 6-ton Kubota

GROUNDWATER DEPTH: Not Encountered (11/18/20) | ELEVATION: ---

| WATER LEVEL | USCS | DESCRIPTION | DEPTH (FT.) | SAMPLE SYMBOL | MOISTURE (%) | DRY DENSITY (PCF) | % PASSING 200 | LIQUID LIMIT (%) | PLASTICITY INDEX | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **Ground Surface** | 0 | | | | | | | |
| | ML | CLAYEY SILT<br>with some fine sand; major roots (topsoil) to 4"; tan | | | | | | | | dry<br>medium stiff |
| | | | | | 18.4 | 88 | | | | |
| | CL | SILTY CLAY<br>with some fine sand; gray | | | | | | | | slightly moist<br>very stiff |
| | | | 5 | | | | | | | |
| | | grades with trace gravel; tan | | | | | | | | dry |
| | | | 10 | | | | | | | |
| | | End of exploration at 12.5'.<br>No significant sidewall caving.<br>No groundwater encountered at time of excavation. | | | | | | | | |
| | | | 15 | | | | | | | |
| | | | 20 | | | | | | | |
| | | | 25 | | | | | | | |

See Subsurface Conditions section in the report for additional information.

FIGURE 3C

# TEST PIT LOG

Page: 1 of 1

## TEST PIT: TP-4

CLIENT: The Romney Group | PROJECT NUMBER: 3203-001-20

PROJECT: Grantsville Subdivision | DATE STARTED: 11/18/20 | DATE FINISHED: 11/18/20

LOCATION: Northeast of 4792 West SR-112, Grantsville, Utah | GSH FIELD REP.: NWU

EXCAVATING METHOD/EQUIPMENT: 6-ton Kubota

GROUNDWATER DEPTH: Not Encountered (11/18/20) | ELEVATION: ---

| WATER LEVEL | USCS | DESCRIPTION | DEPTH (FT.) | SAMPLE SYMBOL | MOISTURE (%) | DRY DENSITY (PCF) | % PASSING 200 | LIQUID LIMIT (%) | PLASTICITY INDEX | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **Ground Surface** | 0 | | | | | | | |
| | CL | SILTY CLAY<br>with some fine sand; major roots (topsoil) to 4"; tan | | | | | | | | dry<br>stiff |
| | | grades with trace fine sand; gray | 5 | | | | | | | slightly moist<br>very stiff |
| | | | | | | | | | | dry |
| | | | 10 | | | | | | | |
| | SM | SILTY FINE TO MEDIUM SAND<br>with some fine and coarse gravel; tan | | | 6.6 | | 41.3 | | | dry<br>medium dense |
| | | End of exploration at 13.0'.<br>No significant sidewall caving.<br>No groundwater encountered at time of excavation.<br>Installed 1.25” diameter slotted PVC pipe to 13.0’. | 15 | | | | | | | |
| | | | 20 | | | | | | | |
| | | | 25 | | | | | | | |

See Subsurface Conditions section in the report for additional information.

FIGURE 3D

# TEST PIT LOG

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## TEST PIT: TP-5

CLIENT: The Romney Group | PROJECT NUMBER: 3203-001-20

PROJECT: Grantsville Subdivision | DATE STARTED: 11/18/20 | DATE FINISHED: 11/18/20

LOCATION: Northeast of 4792 West SR-112, Grantsville, Utah | GSH FIELD REP.: NWU

EXCAVATING METHOD/EQUIPMENT: 6-ton Kubota

GROUNDWATER DEPTH: Not Encountered (11/18/20) | ELEVATION: ---

| WATER LEVEL | USCS | DESCRIPTION | DEPTH (FT.) | SAMPLE SYMBOL | MOISTURE (%) | DRY DENSITY (PCF) | % PASSING 200 | LIQUID LIMIT (%) | PLASTICITY INDEX | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **Ground Surface** | 0 | | | | | | | |
| | ML | CLAYEY SILT<br>with some fine sand; major roots (topsoil) to 4"; tan | | | | | | | | dry<br>medium stiff |
| | CL | SILTY CLAY<br>with trace fine sand; gray | | | | | | | | slightly moist<br>stiff |
| | | | | | 14.6 | 83 | | | | |
| | | | 5 | | | | | | | |
| | | grades with trace fine gravel | 10 | | | | | | | medium stiff |
| | SM | SILTY FINE TO MEDIUM SAND<br>with fine and coarse gravel; tan | | | | | | | | dry<br>dense |
| | | | | | 5.5 | | 21.4 | | | |
| | | End of exploration at 13.5'.<br>No significant sidewall caving.<br>No groundwater encountered at time of excavation. | 15 | | | | | | | |
| | | | 20 | | | | | | | |
| | | | 25 | | | | | | | |

See Subsurface Conditions section in the report for additional information.

FIGURE 3E

# TEST PIT LOG

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## TEST PIT: TP-6

CLIENT: The Romney Group | PROJECT NUMBER: 3203-001-20

PROJECT: Grantsville Subdivision | DATE STARTED: 11/18/20 | DATE FINISHED: 11/18/20

LOCATION: Northeast of 4792 West SR-112, Grantsville, Utah | GSH FIELD REP.: NWU

EXCAVATING METHOD/EQUIPMENT: 6-ton Kubota

GROUNDWATER DEPTH: Not Encountered (11/18/20) | ELEVATION: ---

| WATER LEVEL | USCS | DESCRIPTION | DEPTH (FT.) | SAMPLE SYMBOL | MOISTURE (%) | DRY DENSITY (PCF) | % PASSING 200 | LIQUID LIMIT (%) | PLASTICITY INDEX | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **Ground Surface** | 0 | | | | | | | |
| | CL | SILTY CLAY<br>with some fine sand; major roots (topsoil) to 4"; tan | | | | | | | | slightly moist<br>medium stiff |
| | | | | | 14.3 | 60 | | | | |
| | | grades with trace fine sand | 5 | | | | | | | stiff |
| | | | 10 | | | | | | | |
| | | End of exploration at 10.5'.<br>No significant sidewall caving.<br>No groundwater encountered at time of excavation. | 15 | | | | | | | |
| | | | 20 | | | | | | | |
| | | | 25 | | | | | | | |

See Subsurface Conditions section in the report for additional information.

FIGURE 3F

# TEST PIT LOG

Page: 1 of 1

## TEST PIT: TP-7

CLIENT: The Romney Group | PROJECT NUMBER: 3203-001-20

PROJECT: Grantsville Subdivision | DATE STARTED: 11/18/20 | DATE FINISHED: 11/18/20

LOCATION: Northeast of 4792 West SR-112, Grantsville, Utah | GSH FIELD REP.: NWU

EXCAVATING METHOD/EQUIPMENT: 6-ton Kubota

GROUNDWATER DEPTH: Not Encountered (11/18/20) | ELEVATION: ---

| WATER LEVEL | USCS | DESCRIPTION | DEPTH (FT.) | SAMPLE SYMBOL | MOISTURE (%) | DRY DENSITY (PCF) | % PASSING 200 | LIQUID LIMIT (%) | PLASTICITY INDEX | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **Ground Surface** | 0 | | | | | | | |
| | CL | SILTY CLAY<br>with some fine sand; major roots (topsoil) to 4"; gray | | | | | | | | dry<br>medium stiff |
| | | grades with trace fine sand | 5 | | | | | | | slightly moist<br>stiff |
| | | | 10 | | | | | | | |
| | | End of exploration at 10.5'.<br>No significant sidewall caving.<br>No groundwater encountered at time of excavation. | 15 | | | | | | | |
| | | | 20 | | | | | | | |
| | | | 25 | | | | | | | |

See Subsurface Conditions section in the report for additional information.

FIGURE 3G

# TEST PIT LOG

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## TEST PIT: TP-8

CLIENT: The Romney Group | PROJECT NUMBER: 3203-001-20

PROJECT: Grantsville Subdivision | DATE STARTED: 11/18/20 | DATE FINISHED: 11/18/20

LOCATION: Northeast of 4792 West SR-112, Grantsville, Utah | GSH FIELD REP.: NWU

EXCAVATING METHOD/EQUIPMENT: 6-ton Kubota

GROUNDWATER DEPTH: Not Encountered (11/18/20) | ELEVATION: ---

| WATER LEVEL | USCS | DESCRIPTION | DEPTH (FT.) | SAMPLE SYMBOL | MOISTURE (%) | DRY DENSITY (PCF) | % PASSING 200 | LIQUID LIMIT (%) | PLASTICITY INDEX | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **Ground Surface** | 0 | | | | | | | |
| | CL | SILTY CLAY<br>with trace fine sand; major roots (topsoil) to 4"; tan | | | | | | | | dry<br>stiff |
| | | grades gray | 5 | | | | | | | slightly moist |
| | | | 10 | | | | | | | |
| | | End of exploration at 13.0'.<br>No significant sidewall caving.<br>No groundwater encountered at time of excavation.<br>Installed 1.25” diameter slotted PVC pipe to 13.0’. | 15 | | | | | | | |
| | | | 20 | | | | | | | |
| | | | 25 | | | | | | | |

See Subsurface Conditions section in the report for additional information.

FIGURE 3H

# TEST PIT LOG

Page: 1 of 1

## TEST PIT: TP-9

CLIENT: The Romney Group | PROJECT NUMBER: 3203-001-20

PROJECT: Grantsville Subdivision | DATE STARTED: 11/18/20 | DATE FINISHED: 11/18/20

LOCATION: Northeast of 4792 West SR-112, Grantsville, Utah | GSH FIELD REP.: NWU

EXCAVATING METHOD/EQUIPMENT: 6-ton Kubota

GROUNDWATER DEPTH: Not Encountered (11/18/20) | ELEVATION: ---

| WATER LEVEL | USCS | DESCRIPTION | DEPTH (FT.) | SAMPLE SYMBOL | MOISTURE (%) | DRY DENSITY (PCF) | % PASSING 200 | LIQUID LIMIT (%) | PLASTICITY INDEX | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **Ground Surface** | 0 | | | | | | | |
| | CL | SILTY CLAY<br>with some fine sand and organics; major roots (topsoil) to 4"; tan | | | | | | | | dry<br>medium stiff |
| | | grades with trace fine sand; gray | 5 | | 19.9 | 81 | | | | slightly moist<br>stiff |
| | | End of exploration at 10.0'.<br>No significant sidewall caving.<br>No groundwater encountered at time of excavation. | 10 | | | | | | | |
| | | | 15 | | | | | | | |
| | | | 20 | | | | | | | |
| | | | 25 | | | | | | | |

See Subsurface Conditions section in the report for additional information.

FIGURE 3I

# TEST PIT LOG

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## TEST PIT: TP-10

CLIENT: The Romney Group | PROJECT NUMBER: 3203-001-20

PROJECT: Grantsville Subdivision | DATE STARTED: 11/18/20 | DATE FINISHED: 11/18/20

LOCATION: Northeast of 4792 West SR-112, Grantsville, Utah | GSH FIELD REP.: NWU

EXCAVATING METHOD/EQUIPMENT: 6-ton Kubota

GROUNDWATER DEPTH: Not Encountered (11/18/20) | ELEVATION: ---

| WATER LEVEL | USCS | DESCRIPTION | DEPTH (FT.) | SAMPLE SYMBOL | MOISTURE (%) | DRY DENSITY (PCF) | % PASSING 200 | LIQUID LIMIT (%) | PLASTICITY INDEX | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **Ground Surface** | 0 | | | | | | | |
| | CL | SILTY CLAY<br>with trace fine sand; major roots (topsoil) to 4"; tan | | | | | | | | dry<br>medium stiff |
| | | grades gray | 5 | | | | | | | slightly moist<br>stiff |
| | | End of exploration at 10.5'.<br>No significant sidewall caving.<br>No groundwater encountered at time of excavation. | 10 | | | | | | | |
| | | | 15 | | | | | | | |
| | | | 20 | | | | | | | |
| | | | 25 | | | | | | | |

See Subsurface Conditions section in the report for additional information.

FIGURE 3J

CLIENT: The Romney Group
PROJECT: Grantsville Subdivision
PROJECT NUMBER: 3203-001-20

# KEY TO TEST PIT LOG

| WATER LEVEL | USCS | DESCRIPTION | DEPTH (FT.) | SAMPLE SYMBOL | MOISTURE (%) | DRY DENSITY (PCF) | % PASSING 200 | LIQUID LIMIT (%) | PLASTICITY INDEX | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | ⑧ | ⑨ | ⑩ | ⑪ |

## COLUMN DESCRIPTIONS

① **Water Level:** Depth to measured groundwater table. See symbol below.

② **USCS:** (Unified Soil Classification System) Description of soils encountered; typical symbols are explained below.

③ **Description:** Description of material encountered; may include color, moisture, grain size, density/consistency,

④ **Depth (ft.):** Depth in feet below the ground surface.

⑤ **Sample Symbol:** Type of soil sample collected at depth interval shown; sampler symbols are explained below.

⑥ **Moisture (%):** Water content of soil sample measured in laboratory; expressed as percentage of dryweight of

⑦ **Dry Density (pcf):** The density of a soil measured in laboratory; expressed in pounds per cubic foot.

⑧ **% Passing 200:** Fines content of soils sample passing a No. 200 sieve; expressed as a percentage.

⑨ **Liquid Limit (%):** Water content at which a soil changes from plastic to liquid behavior.

⑩ **Plasticity Index (%):** Range of water content at which a soil exhibits plastic properties.

⑪ **Remarks:** Comments and observations regarding drilling or sampling made by driller or field personnel. May include other field and laboratory test results using the following abbreviations:

| CEMENTATION: | MODIFIERS: | MOISTURE CONTENT (FIELD TEST): |
|---|---|---|
| **Weakly:** Crumbles or breaks with handling or slight finger pressure. | **Trace** <5% | **Dry:** Absence of moisture, dusty, dry to the touch. |
| **Moderately:** Crumbles or breaks with considerable finger pressure. | **Some** 5-12% | **Moist:** Damp but no visible water. |
| **Strongly:** Will not crumble or break with finger pressure. | **With** > 12% | **Saturated:** Visible water, usually soil below water table. |

Descriptions and stratum lines are interpretive; field descriptions may have been modified to reflect lab test results. Descriptions on the logs apply only at the specific boring locations and at the time the borings were advanced; they are not warranted to be representative of subsurface conditions at other locations or times.

## UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

| MAJOR DIVISIONS | | | USCS SYMBOLS | TYPICAL DESCRIPTIONS |
|---|---|---|---|---|
| COARSE-GRAINED SOILS More than 50% of material is larger than No. 200 sieve size. | GRAVELS More than 50% of coarse fraction retained on No. 4 sieve. | CLEAN GRAVELS (little or no fines) | GW | Well-Graded Gravels, Gravel-Sand Mixtures, Little or No Fines |
| | | | GP | Poorly-Graded Gravels, Gravel-Sand Mixtures, Little or No Fines |
| | | GRAVELS WITH FINES (appreciable amount of fines) | GM | Silty Gravels, Gravel-Sand-Silt Mixtures |
| | | | GC | Clayey Gravels, Gravel-Sand-Clay Mixtures |
| | SANDS More than 50% of coarse fraction passing through No. 4 sieve. | CLEAN SANDS (little or no fines) | SW | Well-Graded Sands, Gravelly Sands, Little or No Fines |
| | | | SP | Poorly-Graded Sands, Gravelly Sands, Little or No Fines |
| | | SANDS WITH FINES (appreciable amount of fines) | SM | Silty Sands, Sand-Silt Mixtures |
| | | | SC | Clayey Sands, Sand-Clay Mixtures |
| FINE-GRAINED SOILS More than 50% of material is smaller than No. 200 sieve size. | SILTS AND CLAYS Liquid Limit less than 50% | | ML | Inorganic Silts and Very Fine Sands, Rock Flour, Silty or Clayey Fine Sands or Clayey Silts with Slight Plasticity |
| | | | CL | Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays |
| | | | OL | Organic Silts and Organic Silty Clays o f Low Plasticity |
| | SILTS AND CLAYS Liquid Limit greater than 50% | | MH | Inorganic Silts, Micacious or Diatomacious Fine Sand or Silty Soils |
| | | | CH | Inorganic Clays of High Plasticity, Fat Clays |
| | | | OH | Organic Silts and Organic Clays of Medium to High Plasticity |
| HIGHLY ORGANIC SOILS | | | PT | Peat, Humus, Swamp Soils with High Organic Contents |

Note: Dual Symbols are used to indicate borderline soil classifications.

**STRATIFICATION:**

| DESCRIPTION | THICKNESS |
|---|---|
| Seam | up to 1/8" |
| Layer | 1/8" to 12" |
| **Occasional:** One or less per 6" of thickness | |
| **Numerous;** More than one per 6" of thickness | |

**TYPICAL SAMPLER GRAPHIC SYMBOLS**

- Bulk/Bag Sample
- Standard Penetration Split Spoon Sampler
- Rock Core
- No Recovery
- 3.25" OD, 2.42" ID D&M Sampler
- 3.0" OD, 2.42" ID D&M Sampler
- California Sampler
- Thin Wall

**WATER SYMBOL**

Water Level

FIGURE 4

GSH