REPORT
GEOTECHNICAL STUDY
PROPOSED GOLDENWEST CREDIT UNION
2461 NORTH HIGHWAY 162
EDEN, UTAH

Submitted To:

Goldenwest Credit Union
5025 South Adams Avenue
Ogden, Utah 84403

Submitted By:

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

February 1, 2019

Job No. 2545-003-19

February 1, 2019
Job No. 2545-003-19

Mr. Curtis Campbell
Goldenwest Credit Union
5025 South Adams Avenue
Ogden, Utah 84403

Mr. Campbell:

Re: Report
Geotechnical Study
Proposed Goldenwest Credit Union
2461 North Highway 162
Eden, Utah

1. INTRODUCTION

1.1 GENERAL

This report presents the results of our geotechnical study performed at the site of the proposed Goldenwest Credit Union Development located at 2461 North Highway 162 in Eden, Utah. The general location of the site with respect to existing roadways, as of 2019, is presented on Figure 1, Vicinity Map. A more detailed layout of the site showing the proposed development, nearby features, and streets is presented on Figure 2, Site Plan. The approximate locations of the test pits excavated in conjunction with this study, as well as the percolation test performed (P-1), are also presented on Figure 2.

1.2 OBJECTIVES AND SCOPE

The objectives and scope of our study were planned in discussions between Mr. Curtis Campbell of Goldenwest Credit Union and Mr. Mike Huber of GSH Geotechnical, Inc. (GSH).

In general, the objectives of this study were to:

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

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

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

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

1. A field program consisting of the excavation, logging, and sampling of 6 test pits, as well as performing a percolation test.

2. A laboratory testing program.

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

1.3 AUTHORIZATION

Authorization was provided by returning a signed copy of our Professional Services Agreement No. 19-0119.rev1 dated January 21, 2019.

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, of this report. 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

A 2,942 square-foot, 1-story credit union structure with an attached drive-thru canopy and associated pavements are proposed to be constructed at the site. The structure is anticipated to be of wood- or light steel-frame construction, placed slab on grade, and supported upon conventional spread and continuous wall footings. A septic system is also proposed to be constructed at the site; however, the details, including size of this system, were not available at the time of this report.

Maximum real column and wall loads are anticipated to be on the order of 40 to 50 kips and 2 to 3 kips per lineal foot, respectively. Real loads are defined as the total of all dead plus frequently

applied (reduced) live loads. Average uniform floor slabs are anticipated to be light and on the order of 100 to 150 pounds per square foot.

A roughly 8-foot by 8-foot vault will likely be supported upon a thickened reinforced concrete slab imposing uniform floor loads up to approximately 500 pounds per square foot.

Paved driveways and parking areas are also planned around the structure. Projected traffic in the parking areas is anticipated to consist of a light to moderate volume of automobiles and light trucks with occasional medium-weight trucks. In primary drive lanes, traffic is projected to consist of a moderate volume of automobiles and light trucks, a light to moderate volume of medium-weight trucks, and occasional heavyweight 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 1 to 3 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

In order to define and evaluate the subsurface soil and groundwater conditions at the proposed site, 6 test pits were excavated to depths of about 4.5 to 20.5 feet below existing grade using a moderate-sized trackhoe. 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 drilling 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 3F, 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-2, TP-3, and TP-4 to provide a means of monitoring the groundwater fluctuations. The test pits were then backfilled, excluding the shallow test pit in which the percolation test was performed. Although an effort was made to compact the backfill with the backhoe, 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

In order to provide data necessary for our engineering analyses, a laboratory testing program was completed. The 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 aid in classifying the soils and to help 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 3F.

3.3.3 Partial Gradation Tests

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

Test Pit No.	Depth (feet)	Percent Passing No. 200 Sieve	Moisture Content Percent	Soil Classification
TP-2	2.5	31.5	14.5	SC
TP-2	10.0	8.3	5.7	GP/GM
TP-3	15.0	1.4	3.8	GP
TP-4	10.0	1.2	3.7	GP

3.3.4 Consolidation Tests

To provide data necessary for our settlement analyses, a consolidation test was performed on a representative sample of the natural clayey soils obtained at a depth of 5 feet in Test Pit TP-3. The results indicate that the tested soils are moderately over-consolidated and will exhibit

moderate compressibility characteristics when loaded below the over-consolidation pressure. 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 representative samples of the on-site soils encountered. 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	2.5	SC	6.85	297

3.4 PERCOLATION TEST

A percolation test was performed at a depth of approximately 4.5 feet within the natural clayey sand soils encountered at Test Pit TP-1. Under the USDA classification required for septic systems, these soils are classified as silt loams. The measured percolation rate was 26 minutes per inch. This rate is typical for silt loam soils.

It is our understanding that the Health Department does not allow percolation tests to be verified through their office during the period between December 1 and March 1. Therefore, an additional test and associated test pit will likely be required by the Health Department outside of this restricted date range. Additionally, sizing of a leach field or other septic system components is outside the scope of this study, but is highly recommended to verify sufficient area is available on the lot for a septic system.

4. SITE CONDITIONS

4.1 SURFACE

The site is located at 2461 North Highway 162 in Eden, Utah. The site is currently vacant/undeveloped brush land with a dirt road bisecting the middle of the site running north to south. The topography of the site is relatively flat, grading down to the east, with a total relief of approximately 2 to 3 feet. Site vegetation consists of various weeds and brush/grass land throughout.

The site is bounded to the north by Wells Fargo Bank (permanently closed) followed a Maverik Gas Station; to the east by Highway 162 followed by vacant/undeveloped land with fill material stockpiled and an agricultural field beyond; to the south by commercial/retail structures and associated pavements with vacant/undeveloped land beyond; and to the west by similar vacant/undeveloped land.

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 4.5 to 20.5 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 to 6 inches of topsoil was encountered in each of the test pits.

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

The natural soils were medium dense to very dense, slightly moist to moist, and light brown and brown 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 3F, 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 levels vary with changes in season and rainfall, construction activity, surface water run-off, irrigation and other site-specific factors.

Groundwater was not encountered at the site at the time of the field exploration nor in the installed pipes on January 31, 2019. Seasonal and long-term groundwater fluctuations are projected with the highest seasonal levels generally occurring during the late spring and early summer months. Additional groundwater fluctuations could occur due to snowmelt and irrigation on this and surrounding sites.

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.

Prior to proceeding with construction, removal of the any debris, surface vegetation, root systems, topsoil, 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 pavements and exterior flatwork areas is 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 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 pavements.

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 any debris, non-engineered fills (if encountered), 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 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.

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.

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, non-engineered fills (if encountered), and any deleterious materials have been completely removed.

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.

For granular (cohesionless) soils, construction excavations above the water table, not exceeding 4 feet, should be no steeper than one-half horizontal to one vertical (0.5H:1.0V). For excavations up to 8 feet, in granular soils and above the water table, the slopes should be no steeper than one horizontal to one vertical (1H:1V). Excavations encountering saturated cohesionless soils will be very difficult and will require very flat sideslopes and/or shoring, bracing, and dewatering.

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.

On-site soils may be re-utilized as structural site grading fill if they do not contain construction debris or deleterious material and meet the requirements of structural fill. Fine-grained soils will require very close moisture control and may be very difficult, if not impossible, to properly place and compact during wet and cold periods of the year.

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 Uplift Loads

It is anticipated the drive-thru canopy will be "tied" to the soils with anchors. If the canopy is supported upon conventional spread foundations, uplift loads may be resisted by the weight of the foundation and the backfill within the limits defined by an imaginary line extending outward from the outside top edge of the footing 10 degrees from vertical up to finish grade. A unit weight of compacted backfill over the footings of 125 pounds per square foot may be used.

5.2.5 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] T-180 (ASTM[2] D1557) compaction criteria in accordance with the following table:

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 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

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

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.

5.2.6 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 T-180 (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.

5.3 SPREAD AND CONTINUOUS WALL FOUNDATIONS

5.3.1 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	- 3,000 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.

5.3.2 Installation

Under no circumstances shall the footings be installed 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.

5.3.3 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.

5.4 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 natural granular soils or 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.

5.5 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 over non-engineered fills, loose or disturbed soils, sod, rubbish, construction debris, other deleterious materials, frozen soils, or within ponded water.

In order 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 1-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.

5.6 PAVEMENTS

The natural sand soils will exhibit moderate 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 non-engineered fills, 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 pavement sections on the following pages are recommended.

Parking Areas

(Light to Moderate Volume of Automobiles and Light Trucks,
Occasional Medium-Weight Trucks,
and No Heavyweight Trucks)
[2 equivalent 18-kip axle loads per day]

Flexible:

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

Rigid:

5.5 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

Drive Lanes

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

Flexible:

4.0 inches	Asphalt concrete
9.0 inches	Aggregate base

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

It is recommended that "drive-thru" lanes where transactions occur be paved with rigid pavement equivalent to that stipulated for internal roadway in order to eliminate potential rutting from the high volume of tight-maneuvering vehicles.

For dumpster pads, we recommend a pavement section consisting of 7.0 inches of Portland cement concrete, 6.0 inches of aggregate base, over properly prepared suitable natural subgrade or site grading structural fills extending to suitable natural soils. Dumpster pads shall not be constructed overlying non-engineered fills.

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 5,000 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.

5.7 CEMENT TYPES

The laboratory tests indicate that the natural soils tested contain a negligible amount of water soluble 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.

5.8 GEOSEISMIC SETTING

5.8.1 General

Utah municipalities have adopted the International Building Code (IBC) 2015. The IBC 2015 code determines the seismic hazard for a site based upon 2008 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).

5.8.2 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 Broadmouth Canyon Fault, located about 4.6 miles to the north-northwest of the site.

5.8.3 Soil Class

For dynamic structural analysis, the Site Class D - Stiff Soil Profile as defined in Chapter 20 of ASCE 7 (per Section 1613.3.2, Site Class Definitions, of IBC 2015) can be utilized.

5.8.4 Ground Motions

The IBC 2015 code is based on 2008 USGS mapping, which provides values of short and long period accelerations for the Site Class B boundary for the Maximum Considered Earthquake (MCE). This Site Class B boundary represents average bedrock values for the Western United States and must be corrected for local soil conditions. The table on the following page summarizes the peak ground and short and long period accelerations for the MCE event and incorporates the appropriate soil amplification factor for a Site Class D soil profile. Based on the site latitude and longitude (41.3035 degrees north and 111.8275 degrees west, respectively), the values for this site are tabulated on the following page.

Spectral Acceleration Value, T	Site Class B Boundary [mapped values] (% g)	Site Coefficient	Site Class D [adjusted for site class effects] (% g)	Design Values (% g)
Peak Ground Acceleration	37.2	F_a = 1.128	42.0	28.0
0.2 Seconds (Short Period Acceleration)	S_S = 93.1	F_a = 1.128	S_{MS} = 105.0	S_{DS} = 70.0
1.0 Second (Long Period Acceleration)	S_1 = 31.7	F_v = 1.766	S_{M1} = 56.0	S_{D1} = 37.4

5.8.5 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.

Liquefaction was not included in the scope of this study and would require a deeper (30+ foot) boring for engineering analysis.

5.9 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 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.

5.10 CLOSURE

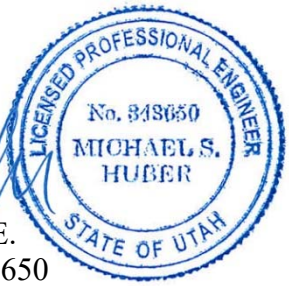
If you have any questions or would like to discuss these items further, please feel free to contact us at (801) 685-9190.

Respectfully submitted,

GSH Geotechnical, Inc.

Robert A. Gifford
Project Engineer/Geologist

Reviewed by:



Michael S. Huber, P.E.
State of Utah No. 343650
Vice President/Senior Geotechnical Engineer

RAG/MSH:jlh

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

Addressee (email)

GOLDENWEST CREDIT UNION
JOB NO. 2545-003-19

1 0 1 2 3 4 KM 5

1 0 1 MI 2

FIGURE 1
VICINITY MAP

REFERENCE:
ALL TRAILS - NATIONAL GEOGRAPHIC TERRAIN
DATED 2019

GSH

GOLDENWEST CREDIT UNION
JOB NO. 2545-003-19

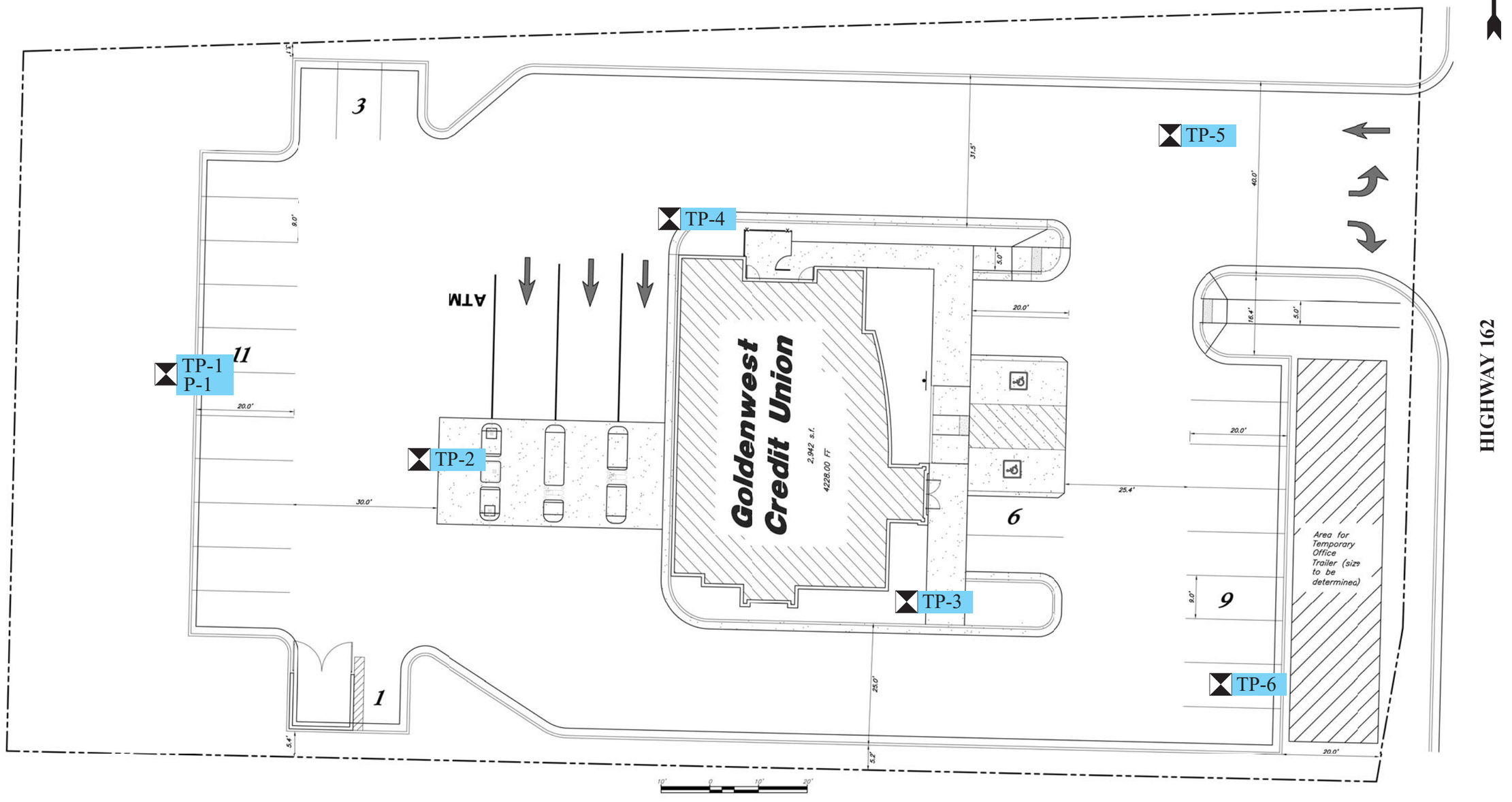


FIGURE 2
SITE PLAN

REFERENCE:
ADAPTED FROM DRAWING ENTITLED
"CONCEPTUAL SITE PLAN A" BY ANDERSON WAHLEN & ASSOCIATES
DATED 17 DECEMBER 2018

GSH

TEST PIT LOG

Page: 1 of 1

TEST PIT: TP-1

CLIENT: Goldenwest Credit Union
PROJECT NUMBER: 2545-003-19

PROJECT: Proposed Goldenwest Credit Union
DATE STARTED: 1/23/19 DATE FINISHED: 1/23/19

LOCATION: 2461 North Highway 162, Eden, Utah
GSH FIELD REP.: SH

EXCAVATING METHOD/EQUIPMENT: CAT TRAC 315

GROUNDWATER DEPTH: Not Encountered (1/23/19)
ELEVATION: ---

WATER LEVEL	USCS	DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0							
	SC	CLAYEY FINE TO COARSE SAND with trace fine gravel; major roots (topsoil) to 6"; light brown								slightly moist medium dense
	GP	FINE AND COARSE GRAVEL with some cobbles and fine to coarse sand; brown	10							slightly moist medium dense
		End of exploration at 20.5'. Significant sidewall caving below 13.5'. No groundwater encountered at time of excavation.	20							
			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: Goldenwest Credit Union | PROJECT NUMBER: 2545-003-19

PROJECT: Proposed Goldenwest Credit Union | DATE STARTED: 1/23/19 | DATE FINISHED: 1/23/19

LOCATION: 2461 North Highway 162, Eden, Utah | GSH FIELD REP.: SH

EXCAVATING METHOD/EQUIPMENT: CAT TRAC 315

GROUNDWATER DEPTH: Not Encountered (1/23/19 & 1/31/19) | ELEVATION: ---

WATER LEVEL	USCS	DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0							
	SC	CLAYEY FINE AND COARSE GRAVEL with some fine to coarse sand; major roots (topsoil) to 6"; brown			14.5		31.5			slightly moist medium dense
		grades with some cobbles	5							
	GP/GM	FINE TO COARSE SANDY FINE AND COARSE GRAVEL with some cobbles and silt; brown	10		5.7		8.3			slightly moist medium dense
		End of exploration at 15.5'. No significant sidewall caving. No groundwater encountered at time of excavation. Installed 1.25" diameter slotted PVC pipe to 15.5'.	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: Goldenwest Credit Union | PROJECT NUMBER: 2545-003-19

PROJECT: Proposed Goldenwest Credit Union | DATE STARTED: 1/23/19 | DATE FINISHED: 1/23/19

LOCATION: 2461 North Highway 162, Eden, Utah | GSH FIELD REP.: SH

EXCAVATING METHOD/EQUIPMENT: CAT TRAC 315

GROUNDWATER DEPTH: Not Encountered (1/23/19 & 1/31/19) | ELEVATION: ---

WATER LEVEL	USCS	DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0							
	SC	CLAYEY FINE TO COARSE SAND with some fine gravel; major roots (topsoil) to 6"; light brown								slightly moist dense
					4.6	111				
			5							stiff
	GP	FINE TO COARSE SANDY FINE AND COARSE GRAVEL with some cobbles and trace silt; brown	10							slightly moist very dense
			15		3.8		1.4			
			20							
		End of exploration at 20.5'. No significant sidewall caving. No groundwater encountered at time of excavation. Installed 1.25” diameter slotted PVC pipe to 20.5’.	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: Goldenwest Credit Union | PROJECT NUMBER: 2545-003-19

PROJECT: Proposed Goldenwest Credit Union | DATE STARTED: 1/23/19 | DATE FINISHED: 1/23/19

LOCATION: 2461 North Highway 162, Eden, Utah | GSH FIELD REP.: SH

EXCAVATING METHOD/EQUIPMENT: CAT TRAC 315

GROUNDWATER DEPTH: Not Encountered (1/23/19 & 1/31/19) | ELEVATION: ---

WATER LEVEL	USCS	DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0							
	GC	CLAYEY FINE AND COARSE GRAVEL with some fine to coarse sand; major roots (topsoil) to 6"; brown								slightly moist medium dense
	GP	FINE TO COARSE SANDY FINE AND COARSE GRAVEL with some cobbles and trace silt; brown	5							slightly moist medium dense
			10		3.7		1.2			
		End of exploration at 10.5'. No significant sidewall caving. No groundwater encountered at time of excavation. Installed 1.25” diameter slotted PVC pipe to 10.5’.	15							
			20							
			25							

See Subsurface Conditions section in the report for additional information.

FIGURE 3D

TEST PIT LOG

Page: 1 of 1

TEST PIT: TP-5

CLIENT: Goldenwest Credit Union | PROJECT NUMBER: 2545-003-19

PROJECT: Proposed Goldenwest Credit Union | DATE STARTED: 1/23/19 | DATE FINISHED: 1/23/19

LOCATION: 2461 North Highway 162, Eden, Utah | GSH FIELD REP.: SH

EXCAVATING METHOD/EQUIPMENT: CAT TRAC 315

GROUNDWATER DEPTH: Not Encountered (1/23/19) | ELEVATION: ---

WATER LEVEL	USCS	DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0							
	SC	CLAYEY FINE TO COARSE SAND with trace fine gravel; major roots (topsoil) to 6"; light brown								slightly moist medium dense
				■	6.9	99				
			5	■	21.5	90				
		End of exploration at 5.5'. No significant sidewall caving. No groundwater encountered at time of excavation.								
			10							
			15							
			20							
			25							

See Subsurface Conditions section in the report for additional information.

FIGURE 3E

TEST PIT LOG

Page: 1 of 1

TEST PIT: TP-6

CLIENT: Goldenwest Credit Union | PROJECT NUMBER: 2545-003-19

PROJECT: Proposed Goldenwest Credit Union | DATE STARTED: 1/23/19 | DATE FINISHED: 1/23/19

LOCATION: 2461 North Highway 162, Eden, Utah | GSH FIELD REP.: SH

EXCAVATING METHOD/EQUIPMENT: CAT TRAC 315

GROUNDWATER DEPTH: Not Encountered (1/23/19) | ELEVATION: ---

WATER LEVEL	USCS	DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0							
	SC	CLAYEY FINE TO COARSE SAND with some fine and coarse gravel; major roots (topsoil) to 4"; brown								moist medium dense
					11.1	101				
	SP/SM	FINE TO COARSE SAND with some fine gravel and some silt; brown	5							moist medium dense
		End of exploration at 5.5'. No significant sidewall caving. No groundwater encountered at time of excavation.								
			10							
			15							
			20							
			25							

See Subsurface Conditions section in the report for additional information.

FIGURE 3F

CLIENT: Goldenwest Credit Union
PROJECT: Proposed Goldenwest Credit Union
PROJECT NUMBER: 2545-003-19

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:

Weakly: Crumbles or breaks with handling or slight finger pressure.

Moderately: Crumbles or breaks with considerable finger pressure.

Strongly: Will not crumble or break with finger pressure.

MODIFIERS:

Trace <5%

Some 5-12%

With > 12%

MOISTURE CONTENT (FIELD TEST):

Dry: Absence of moisture, dusty, dry to the touch.

Moist: Damp but no visible water.

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