State of Utah

JON M. HUNTSMAN, JR.
Governor

GARY R. HERBERT
Lieutenant Governor

Department of Administrative Services
KIMBERLY K. HOOD
Executive Director

Division of Facilities Construction and Management
DAVID G. BUXTON
Director

ADDENDUM #1

Date:	1 February 2008
To:	Design/Build Teams
From:	Matthias Mueller, Project Manager
Reference:	Southern Utah University Campus Housing Phase II DFCM Project No. 07032730
Subject:	**Addendum No. 1**

Pages			
	Addendum	2	page
	Geo Technical Survey	44	pages
	Civil Site Plan	1	page
	Total	**47**	**pages**

Note: This Addendum shall be included as part of the Contract Documents. Items in this Addendum apply to all drawings and specification sections whether referenced or not involving the portion of the work added, deleted, modified, or otherwise addressed in the Addendum.

1.1 SCHEDULE CHANGES – There are no changes to the project schedule per this addendum.

1.2 Request for Proposals for Design/Build Services Stage 1

Schedule – While the project's substantial completion date (July 23, 2009) listed on the RFP schedule is DFCM/SUU's prefered date, we will consider alternate dates. Please contact Matthias with DFCM if your design-build team would like to change the date.

1.3 Questions

Question #1 – What is the schedule for completion of asbestos abatement activities?
Answer – The end of June 2008.

Question #2 – How many beds are there in the existing Manzanita Court complex?
Answer – Approximately 180 (one hundred eighty).

Question #3 – Is SUU contemplating three replacement facilities as opposed to two?
Answer – No.

Question #4 – Can I get the soils report for this project and a civil plan showing the existing utilities?
Answer – The geotech and site survey are furnished with this addendum. However, these documents are available to the design-build teams for information only and are ***not*** *a part of this addendum or DFCM's Campus Housing Phase 2 RFP. The documents and the information on the documents are not intended as representations or warranties of accuracy. DFCM/SUU will not be responsible for interpretations or conclusions drawn from this data by the design-build teams.*

End of Addendum #1

APPENDIX I:
GEOTECHNICAL SURVEY

Gordon Spilker Huber
Geotechnical Consultants, Inc.

REPORT
GEOTECHNICAL STUDY
PROPOSED NEW RESIDENTIAL HALL STRUCTURE
MANZANITA COURT RESIDENTIAL HOUSING AREA
SOUTH OF 200 SOUTH STREET AT APPROXIMATELY 600 WEST
SOUTHERN UTAH UNIVERSITY CAMPUS
CEDAR CITY, UTAH

Submitted To:

Architectural Design West PC
255 South 300 West
Logan, Utah 84321

Submitted By:

Gordon Spilker Huber Geotechnical Consultants, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123

October 18, 2007

Job No. 0128-014-07

Gordon Spilker Huber
Geotechnical Consultants, Inc.

October 18, 2007
Job No. 0128-014-07

Architectural Design West PC
255 South 300 West
Logan, Utah 84321

Attention: Mr. Tony Wegener

Gentlemen:

Re: Report
Geotechnical Study
Proposed New Residential Hall Structures
Manzanita Court Residential Housing Area
South of 200 South Street at Approximately 600 West
Southern Utah University Campus
Cedar City, Utah

1. INTRODUCTION

1.1 GENERAL

This report presents the results of our geotechnical study performed at the site of the proposed new residential hall structures to be constructed in the Manzanita Court residential housing area. The site is south of 200 South Street at approximately 600 West within the Southern Utah University Campus in Cedar City, Utah. The general location of the site with respect to major topographic features and existing facilities, as of 1978, is presented on Figure 1, Vicinity Map. A more detailed layout showing the site and existing facilities on an air photograph base is presented on Figure 2, Area Map. A detailed layout of the site showing existing and proposed facilities is presented on Figure 3, Site Plan. The locations of the borings drilled in conjunction with this study and the studies dated December 18, 1985[1] and April 21, 2003[2] are also presented on Figure 3.

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1 "Final Report, Soils and Foundation Study, Settlement Problems, Southern Utah State College Campus, Cedar City, Utah, For Utah State Division of Facilities Construction and Management," Dames & Moore Job No. 04000-064-06.

2 "Report, Geotechnical Study, Proposed New Student Housing, Just West of 500 West Street and South of 200 South Street on the Southern Utah University Campus, Cedar City, Utah," AMEC Job No. 3-817-004385.

Gordon Spilker Huber Geotechnical Consultants, Inc.
4426 South Century Drive, Suite 100
Salt Lake City, Utah 84123
Tel: (801) 685-9190 Fax: (801) 685-2990
www.gshgeotech.com

Gordon Spilker Huber Geotechnical Consultants, Inc.

1.2 OBJECTIVES AND SCOPE

The objectives and scope of this study were planned in discussions between Mr. Tony Wegener of Architectural Design West PC, and Mr. Bill Gordon of Gordon Spilker Huber Geotechnical Consultants, Inc. (GSH).

In general, the objectives of our study were to:

1. Accurately define and evaluate the subsurface soil and groundwater conditions in the area of the proposed new residential housing units.

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

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

1. A field program consisting of the drilling, logging, and sampling of four exploration borings.

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 Mr. Tony Wegener of Architectural Design West PC.

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 borings, 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

At the present time, 2 three-level residential hall structures are to be constructed at the referenced site. The structures will be of wood-frame construction and will incorporate brick, stucco, and possibly some wood perimeter walls. Structural loads will be transmitted down through bearing walls and a few isolated columns to supporting foundations. In addition, there will be a few independent columns outside the perimeter of the building which will support overhead decks. Maximum anticipated wall and column loads will be on the order of 4 to 6 kips per lineal foot and 30 to 50 kips, respectively. The proposed structures will be very similar to the recently constructed residential hall units to the immediate east. The existing structures were supported upon deep foundations because of underlying collapsible soils. The deep foundations extend from grade beams at the base of the crawlspace-mechanical level, which extends approximately five to six feet below the main level of the structure.

It is anticipated that the new structure will similarly utilize a crawlspace-mechanical level. The main level of the structure is generally anticipated to be established one to one and one-half feet above existing site grade. At this time, it is anticipated that a concrete slab will be established at the base of the crawlspace.

Associated with the new housing units will be some adjacent at-grade parking and roadway areas.

3. SITE INVESTIGATIONS

3.1 FIELD PROGRAM

In order to define and evaluate the subsurface soil and groundwater conditions across the site, 4 borings were drilled to depths ranging from 26.5 to 39.0 feet with a truck-mounted rig equipped with hollow-stem augers. All borings met refusal on dense silty sands and gravels. The locations of these borings, along with borings drilled in conjunction with the December 18, 1985 and April 21, 2003 studies in the area, are also presented on Figure 3.

The field portion of this 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, relatively undisturbed and small disturbed 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 have been supplemented by subsequent inspection and testing in our laboratory. Detailed graphical representation of subsurface conditions encountered in conjunction with this study is presented on Figures 4A through 4D, Log of Borings. Logs of applicable borings drilled in conjunction with the December 18, 1985 study are presented on Figures 5A and 5B, Log of Borings (December 18, 1985 study). Soils drilled in conjunction with the April 21, 2003 study are presented on Figures 6A through 6B, Log of Borings (April 21, 2003 study). Soils were classified in accordance with the nomenclature described on Figure 7, Unified Soil Classification System.

A 3.25-inch outside diameter, 2.42-inch inside diameter drive (Dames & Moore) sampler was utilized in the subsurface sampling at the site. The blow-counts recorded on the boring logs were those required to drive the sampler 12 inches with a 140-pound hammer dropping 30 inches.

Following completion of excavation/drilling operations, one and one-quarter-inch diameter slotted PVC pipe was installed in Borings B-1B, B-2B, and B-4B in order to provide a means of monitoring the groundwater fluctuations.

3.2 LABORATORY TESTING

3.2.1 General

In order to provide data necessary for our engineering analyses, a laboratory testing program was performed. The program included moisture and density tests, collapse-consolidation, and pH-sulfate tests. A description of these tests plus a summary of test results are presented in the following sections.

It must be noted that in addition to the laboratory testing data developed in conjunction with this study, test data summarized in the April 21, 2003 study were revised.

3.2.2 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 undisturbed samples. The results of these tests are presented on the boring logs, Figures 4A through 4D, Log of Borings.

3.2.3 Collapse-Consolidation Tests

In order to provide data necessary for our settlement analyses, collapse-consolidation test were performed on a series of four representative samples of the finer-grained soils encountered. The collapse portion of the tests was performed in accordance with the following procedure:

1. Load sample at in-situ moisture content to specific axial pressure.

2. Measure and record axial deflection.

3. Saturate sample.

4. Measure and record resulting collapse.

The results of the test are tabulated below:

Boring No.	Depth (feet)	Soil Type	Natural Dry Density (pcf)	Natural Moisture Content (percent)	Axial Load When Saturated (psf)	Collapse (-) or Swell (+) (percent)
To follow.						

Subsequent to the collapse test, normal consolidation test loading was applied. Results of these tests show that the soils which exhibit collapse characteristics also become highly compressible after saturation. Detailed results of the consolidation portion of tests are maintained in our files but can be provided to you, upon your request.

3.2.4 Chemical Tests

In order to determine if the site soils will react deleteriously with concrete, sulfate and pH tests were performed on representative samples. The results of the tests are tabulated below:

Boring No.	Depth (feet)	pH	Total Water Soluble Sulfate (ppm)
To follow.			

4. SITE CONDITIONS

4.1 SURFACE

The site is located in the Manzanita Court Residential Housing Unit area at the south end of the Southern Utah University Campus. The site is just south of 200 South Street and just west of a series of three-level residential structures, which were constructed approximately three years ago. The existing structures are located immediately west of 500 West Street.

The site of the new structures is presently occupied by two older three-level residential hall structures and surrounding asphalt pavements, parking areas, and landscaping.

The site slopes gently from the southeast down to the northwest with total relief on the order of five to eight feet. Site grade is approximately equal to 200 South Street to the north. Numerous large pine and deciduous trees to 40-feet tall surround the existing buildings. Further to the west are single-family residential structures. The existing residential hall structures, which will be demolished, include a near full-depth below-grade crawlspace-mechanical level.

4.2 SUBSURFACE SOIL AND GROUNDWATER

At the locations of all the borings drilled at and just east of the site, the predominate soils to depths of approximately 14.0 to more than 37.5 feet (in Boring B-2B) consist of reddish-brown silty clay with zones of sandy clays, clayey silts, and fine sandy silts. Laboratory testing shows that most of these soils are collapsible. Collapsible soils when not saturated or near saturated will exhibit moderate strength and compressibility characteristics. When saturated, the soils exhibit very low strength and high compressibility characteristics and collapse.

Beneath the surface silty clays, layers of silty fine sand/fine sandy silt, silty sand, more silty clays, and silty sand and gravels were encountered. Except for the dense to very dense silty sands and gravels most of these soils also exhibit some to significant collapse potential.

The silty sand and gravels are not collapsible and are the soils to which deep foundations systems should extend. Significant layers of silty sands and gravels have been encountered at depths of 39.5 to 57.0 feet. Some layers of medium dense silty sands and gravels are present as shallow as 17 to 23 feet. These layers are of limited thickness.

Groundwater was not encountered to the depths penetrated and is projected to be more than 70 to 80 feet below grade.

5. DISCUSSIONS AND RECOMMENDATIONS

5.1 SUMMARY OF FINDINGS

As anticipated, extensive and variable zones of collapsible soils have been encountered in the exploration borings. These conditions correspond to data obtained in conjunction with the previously referenced studies dated December 18, 1985 and April 21, 2003. Data indicates that the more highly collapsible soils extend to depths on the order of 20 to 25 feet. With depth except for the silty sands and gravels, many of the soils are slightly to moderately collapsible. If these soils become saturated or near saturated, significant total and differential settlements would be experienced. Many of the existing structures on the Southern Utah University Campus have experienced detrimental total and differential settlements because of this condition. The silty clays extending to 5 to 10 feet in the recent borings are near saturated and exhibit very high compressibility characteristics.

To control total and long-term differential settlements, we recommend that the structures be supported upon deep foundations extending into the top of the relatively thick continuous layers of dense to very dense silty sands and gravels encountered at depths of 37.5 to 57.0 feet in many borings and at depths of 17.0 to 23.0 feet in others.

Even though the structures will be supported upon deep foundations extending to non-collapsible soils, it is essential that a prudent water management program also be incorporated into the design and construction to reduce the possibility of deep infiltration of the soils over the lifetime of the structures.

Subsurface conditions encountered in conjunction with this study are extremely similar to the soils encountered beneath the three most-recently constructed residential structures to the immediate east. Loads associated with the new structures are also similar to those of the existing structures.

In conjunction with this study, deep foundation systems including driven piles, drilled piers, micro piles, and helical piers were considered. Based upon our experience, it is our recommendation that both drilled piers and helical piers be considered. Helical piers were used to support the recently constructed residential housing structure to the immediate east. To date, this system has functioned well. However, many of those piers, in our opinion, were extended to depths greater than necessary. This was a cost overrun.

Detailed discussion pertaining to drilled piers and helical piers followed by earthwork, moisture control, cement types, pavement, and geoseismic discussions and recommendations are presented in the following sections.

5.2 DRILLED PIERS

5.2.1 Subsurface

A suitable end-bearing stratum has generally been encountered at depths of 37.5 to 57.10 feet below grade in many of the borings drilled at the site area. In some borings relatively thin layers of medium dense silty sands and gravels have been excavated at lesser depth. We recommend that these layers be penetrated. It is our recommendation that drilled piers extend to the deep silty soils and gravels.

5.2.2 Design Data

The majority of the capacity of the drilled piers is based upon end-bearing on the dense to very dense silty sands and gravel. In design we have considered that over the life of the structures that the upper 20 feet of soils (which exhibit moderate to moderately high collapse potential) could become saturated or near saturated. If this occurs the soils could settle along the outside perimeter of the drilled piers. This would impose a down-drag force. Projected downward forces on drilled piers 2.0, 2.5, and 3.0 feet in diameter have been calculated.

The ultimate end-bearing pressure which should be utilized in the design of the drilled piers is quite high. Considering factors of safety against end-bearing failure, settlement content, and the affects of down-drag forces reduced end-bearing pressures have been developed. Appropriate end-bearing pressure which can be utilized for varying diameter piers are tabulated on the following page.

Pier Diameter (feet)	**End-Bearing Pressure (kips per square foot)**
2.0	8.6
2.5	12.8
3.0	15.4

Again, it should be noted that these pressures have been developed considering the down-drag forces may ultimately develop along the upper 20 feet of the piers. With these value settlements of the piers, even under down-drag loading should not exceed one-half to five-eighths of an inch.

5.2.3 Installation

Drilled piers must be installed by qualified contractors being able to demonstrate installation of piers in similar conditions. Indications are that casing should not be required in the drilling operations; however, it should be noted that occasional coarse gravels and cobbles will be penetrated. Minimum recommended diameter to facilitate installation of the drilled piers is two feet. Samples of the soils encountered in the borings are available for review in our office.

It is essential that appropriate equipment be brought on-site to be able to effectively clean the bottom of the drilled piers since the piers capacity is going to be dependent almost entirely on end-bearing.

5.2.4 Lateral Resistance

Lateral resistance for 2.0-, 2.5-, and 3.0-feet diameter drilled piers extending to depths of 25 and 52 feet for fixed and free head conditions and 0.25 and 0.375 inch top deflection are tabulated below:

24" Diameter Pier

Deflection at TOP (inches)	Length of Pier (feet)	Ultimate Lateral Capacity (kips)	
		Fixed	Free
0.25	25	19.6	11.1
0.375	25	22.2	13.5
0.25	52	20.1	11.2
0.375	52	23.3	13.6

30" Diameter Pier

Deflection at TOP (inches)	Length of Pier (feet)	Ultimate Lateral Capacity (kips)	
		Fixed	Free
0.25	25	20.9	12.1
0.375	25	23.9	14.4
0.25	52	21.4	12.1
0.375	52	24.7	14.5

36" Diameter Pier

Deflection at TOP (inches)	Length of Pier (feet)	Ultimate Lateral Capacity (kips)	
		Fixed	Free
0.25	25	22.2	12.9
0.375	25	25.4	15.3
0.25	52	22.5	12.9
0.375	52	26.0	15.3

5.3 HELICAL PIERS

5.3.1 Design Data

As stated previously, helical piers support the recently constructed residential housing structure to the immediate east. Individual helical piers extending to the dense silty sands and gravels will exhibit downward axial capacities of 37.5 to 50.0 kips depending on the size of the shaft. To facilitate installation and increase lateral capacity, it is our recommendation that the piers incorporate a minimum two and one-half-inch diameter center shaft. The helical piers should extend to the depth of drilling refusal encountered in the borings drilled in conjunction with this study, 27.5 to 28.0 feet.

Anticipated piers settlement should not exceed one-half of an inch.

5.3.2 Installation

Helical piers must be installed by qualified contractors familiar with the subsurface conditions in the area. Most of the piers supporting the structure to the east extended to depths of 40 to 50 feet. A few piers extended to depths of approximately 90 feet.

At the site of the structure covered by this study, drilling refusal was encountered at depths of approximately 27.5 to 38.0 feet. This should be the anticipated depth of penetration.

5.3.3 Lateral Resistance

The lateral resistance of individual vertical helical piers is low. For the existing buildings to the east, lateral resistance of seismic and wind loading was provided by the passive resistance of the structural backfill placed against pier cap-grade beams and subgrade walls. For initial design, properly compacted granular backfill may be considered equivalent to a fluid with a density of 400 pounds per cubic foot.

5.4 EARTHWORK

5.4.1 Site Preparation

Site preparation will initially consist of the demolition of existing structures. All foundations, floor slabs, subgrade walls, etc., associated with the structures must be removed from the area extending at least five feet from the perimeter of the new structures. In proposed pavement an building areas, the subgrade facilities must be removed to at least 12 inches below new construction. Floor slabs, if left in place should be “broken up” so that they do not act as a water trap. Subsequently, all surface vegetation, topsoil, pavements, curbs and gutters, and other deleterious materials must be removed. In addition, utility lines which pass through or immediately adjacent to the individual building sites must either be abandoned and/or removed. All relocated water conveying utilities must be pressured tested before they are backfilled to verify non-leakage.

5.4.2 Construction Excavations

Construction excavations not exceeding four feet in depth can be constructed with near-vertical sideslopes. Deeper excavations up to eight feet in depth and encountering predominantly finer-grained cohesive soils may be constructed with sideslopes not steeper than one-half horizontal to one vertical. If excessive zones of clean granular soils and/or groundwater are encountered, significant and flatter sideslopes will be required. All excavations must be inspected periodically by qualified personnel. If any signs of instability are noted, immediate remedial action must be initiated.

5.4.3 Structural Fill

Structural fill will be required primarily as backfill over foundations and utilities and possibly as structural site grading fill. Structural site grading fill is defined as fill placed over fairly large open areas to raise the overall site grade. All structural fills must be free of sod, rubbish, construction debris, frozen soil, and other deleterious materials. The maximum particle size within structural site grading fill should generally not exceed four inches. In confined areas, the maximum particle size should generally not exceed two and one-half inches. If granular soils are utilized, the granular soils must include at least 20 to 22 percent fines, (silts or clays) so that when these soils are properly placed and compacted they will not exhibit high permeability characteristics. Most of the on-site soils removed for the crawlspace will be silty clay/clayey silt type soils with varying amounts of sands. These soils will be difficult to properly handle, prepare, place, and compact as structural fills, especially in confined areas.

5.4.4 Fill Placement and Compaction

All structural fill must be placed in lifts not exceeding eight inches in loose thickness. It does not appear that structural fills will be placed beneath any of the proposed foundations. Structural fills not exceeding three to four feet in depth, placed beneath pavements, outside floor slabs or floor slabs, sidewalks, etc., should be compacted to at least 90 percent of the maximum dry density as determined by the AASHTO[3] T-180 (ASTM[4] D-1557) compaction criteria.

Prior of the placement of structural site grading fill, all loose and disturbed soils must be removed from the surface of the subgrade and subsequently the subgrade must be proofrolled by running moderate-weight rubber tire-mounted construction equipment uniformly over the surface at least three times. If any soft of otherwise unsuitable zones are encountered, they must be removed and replaced with compacted structural fill. In confined areas, preparation must consist of the removal of all loose and disturbed soils.

5.5 MOISTURE CONTROL

It is anticipated that the proposed buildings will be constructed with a crawlspace-mechanical level. We strongly recommend that the base of the crawlspace be covered with a four-inch concrete slab to facilitate access and to suppress the amount of water infiltration if water conveying utility suspended from the first structural level were to leak. It is essential that inspection of the crawlspace for leakage be a periodic maintenance item. In addition, all utilities passing through the perimeter walls of the crawlspace must be constructed such that there is a minimum one-inch annular space between the outside of the pipe and the cut hole. The void may ultimately be backfilled with a flexible polymer caulk or foam.

In addition, it is essential that in conjunction with final grading, ground surface around the immediate perimeter of the building extending out at least 10 to 15 feet slope at least 4 to

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3 American Association of State Highway and Transportation Officials
4 American Society for Testing and Materials

5 percent away from the building. Minimal use of landscape irrigation in this zone is also recommended.

The primary source of water which could infiltrate into the soils around the perimeter of the structure is runoff from the roofs. It is essential that the building be designed with gutters and that the water be directed to down spouts which discharge at least to 10 to 15 feet outside the perimeter of the building preferably on hard surface pavements. Discharge of downspout water immediately around the perimeter of the structure will most certainly lead to deep infiltration and subsidence of the collapsible soils.

5.6 PAVEMENTS

Projected traffic over the pavements at the site will consist of a moderate volume of automobile and light trucks, a light volume of medium-weight trucks, and occasional heavy-weight trucks. For the traffic area, projecting that the subgrade will consist of potentially collapsible silty clays the following pavement section is recommended:

3.0 inches	Asphalt concrete
8.0 inches	Aggregate base
Over	Properly prepared subgrade

Because of the collapsible soils, rigid Portland cement concrete pavements are not recommended.

For dumpster areas, a reinforced six-inch Portland cement concrete slab underlain by six inches of aggregate base is recommended. Reinforcing should consist of No. 4 rebar of 18-inch centers, both directions.

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.

5.7 CEMENT TYPES

To follow.

5.8 GEOSEISMIC SETTING

5.8.1 General

Utah municipalities adopted the International Building Code (IBC) on January 1, 2007. The IBC 2006 code determines the seismic hazard for a site based upon 2002 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).

The structure must be designed in accordance with the procedure presented in Section 1613, Earthquake Loads, of the IBC 2006 edition.

5.8.2 Faulting

Based on our review of available literature, no active faults pass through or immediately adjacent to the site. The most significant nearby fault with regard to earthquake generation is the Hurricane fault. The northern portion of the fault terminates approximately 0.8 of a mile southeast of the site. The fault is projected to be capable of a magnitude 7 earthquake.

5.8.3 Soil Class

For dynamic structural analysis, the Site Class D - Stiff Soil Profile as defined in Table 1613.5.2, Site Class Definitions, of the IBC 2006 can be utilized.

5.8.4 Ground Motions

The IBC 2006 code is based on 2002 USGS (United States Geologic Survey) mapping, which provides values of short and long period accelerations for the Site Class B-C boundary for the Maximum Considered Earthquake (MCE). This Site Class B-C boundary represents a hypothetical bedrock surface and must be corrected for local soil conditions. The following table summarizes the peak ground and short and long period accelerations for a MCE event and incorporates a soil amplification factor for a Site Class D soil profile in the second column. Based on the site latitude and longitude (37.6734 degrees north and 113.0714 degrees west, respectively), the values for this site are tabulated below:

Spectral Acceleration Value, T Seconds	**Site Class B-C Boundary [mapped values] (% g)**	**Site Class D [adjusted for site class effects] (% g)**
Peak Ground Acceleration	0.138	0.210
0.2 Seconds, (Short Period Acceleration)	$S_S = 0.344$	$S_{MS} = 0.525$
1.0 Seconds (Long Period Acceleration)	$S_1 = 0.092$	$S_{M1} = 0.222$

The IBC 2006 code design accelerations (S_{DS} and S_{D1}) are based on multiplying the above accelerations (adjusted for site class effects) for the MCE event by two-thirds (⅔).

GSH
Gordon Spilker Huber
Geotechnical Consultants, Inc.

5.8.5 Liquefaction

Due to the lack of a water table to the depths explored, 60 plus feet, the soils at the site are not susceptible to liquefaction, even during a major seismic event.

We appreciate the opportunity of providing this service for you. If you have any questions or require additional information, please do not hesitate to contact us.

Respectfully submitted,

Gordon Spilker Huber Geotechnical Consultants, Inc.

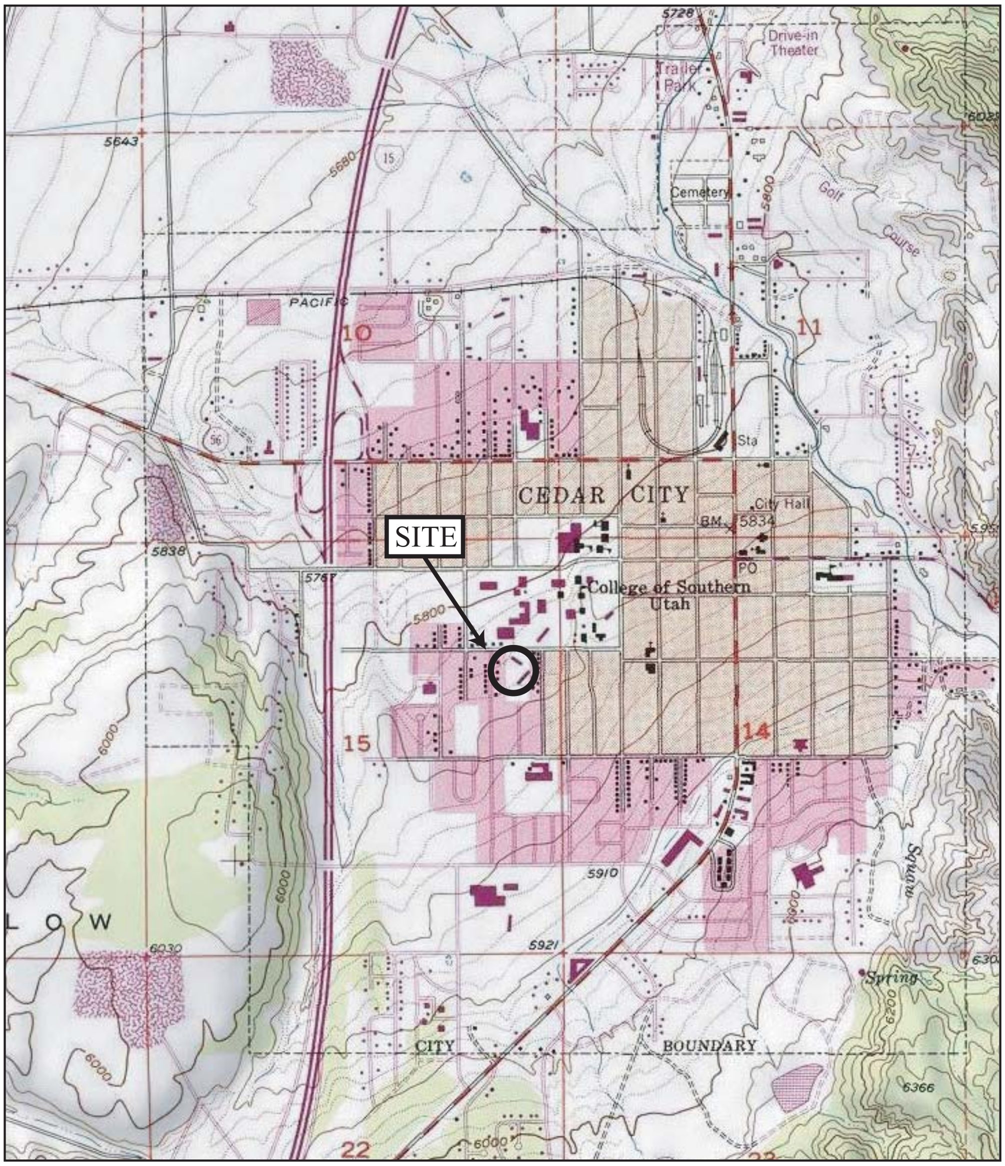
William J. Gordon, State of Utah No. 146417
Professional Engineer

WJG:jlh/sn

Encl.	Figure	1,	Vicinity Map
	Figure	2,	Area Map
	Figure	3,	Site Plan
	Figures	4A	through 4D, Log of Borings
	Figures	5A	and 5B, Log of Borings (December 18, 2985 Study)
	Figures	6A	through 6E, Log of Borings (April 21, 2003 Study)
	Figure	7,	Unified Soil Classification System

Addressee (3 + email)
c: Mr. Keith Bennett (3 + email)
KCB Architecture
2033 Dan Drive
Layton, Utah 84040

ARCHITECTURAL DESIGN WEST PC
JOB NO. 0128-014-07



SCALE IN FEET
1000 0 1000 2000

FIGURE 1
VICINITY MAP

REFERENCE:
USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE MAP
TITLED "CEDAR CITY, UTAH,"
DATED 1978

GSH
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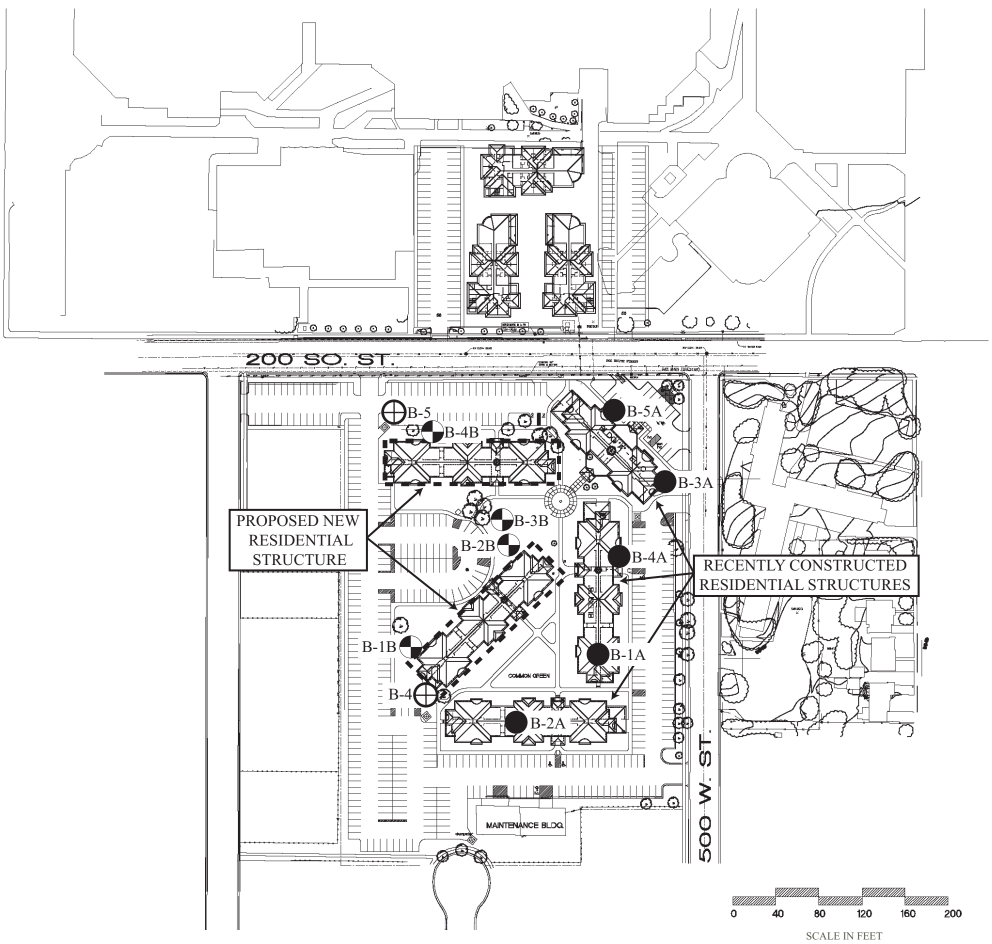
Geotechnical Consultants, Inc.


FIGURE 2
AREA MAP
GSH
Gordon Spilker Huber
Geotechnical Consultants, Inc.
SITE
South Dewey Avenue
South 450 West
South 500 West
South 700 West
South 800 West
800 West
South 900 West
South 1025 West
West 200 South
200 S 700 W, Cedar City, UT 84720
289
NOT TO SCALE
ARCHITECTURAL DESIGN WEST PC
JOB NO. 0128-014-07
REFERENCE:
ADAPTED FROM AERIAL PHOTOGRAPH
GOOGLE EARTH 2007

ARCHITECTURAL DESIGN WEST PC
JOB NO. 0128-014-07



KEY:

- THIS STUDY
- DECEMBER 18, 1985 STUDY
- APRIL 21, 2003 STUDY

FIGURE 3
SITE PLAN

REFERENCE:
ADAPTED FROM DRAWING ENTITLED "MASTER SITE PLAN, OPTION 1/PHASE 2, ECCLES LIVING LEARNING CENTER, SOUTHERN UTAH UNIVERSITY, NEW STUDENT HOUSING COMMUNITY, SHEET NO. MS 1.2," PROVIDED BY CLIENT, DATED JUNE 25, 2007

GSH
Gordon Spilker Huber
Geotechnical Consultants, Inc.

BOREHOLE B-1B

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Page: 1 of 2

Project Name: Prop. New Residential Hall Structure - SUU
Project No.: 0128-014-07
Location: South of 200 S St at Apprx. 600 W, Cedar City, UT
Client: Architectural Design West PC
Drilling Method: 3-3/4" ID Hollow-Stem Auger
Date Drilled: 09-24-07
Elevation: Approximately 5820' +/-
Water Level: No groundwater encountered.
Remarks:

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
		Ground Surface									
		SITLY CLAY with some fine sand; major roots (topsoil) to 3'" reddish-brown (CL)	0								loose to 3"-6" moist
				5							very moist soft
		grades with up to 1/4" layers of silt and zones of clayey silt with some fine sand	5	4							
		SILTY VERY FINE SAND/VERY FINE SANDY SILT reddish-brown (SM/ML)	10	9							moist loose
		CLAYEY SILT with some fine sand; reddish-brown (ML)									moist medium stiff
		SILTY FINE SAND with occasional zones of clayey silt with some fine sand; brown (ML)	15	18							moist loose
		SILTY CLAY with some fine sand; reddish-brown with some white mottling (CL)	20	39							slightly moist very stiff
			25								moist

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4A

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

BOREHOLE B-1B

Page: 2 of 2

Project Name: Prop. New Residential Hall Structure - SUU
Location: South of 200 S St at Apprx. 600 W, Cedar City, UT
Drilling Method: 3-3/4" ID Hollow-Stem Auger
Elevation: Approximately 5820' +/-
Remarks:

Project No.: 0128-014-07
Client: Architectural Design West PC
Date Drilled: 09-24-07
Water Level: No groundwater encountered.

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
		SILTY/CLAYEY SAND AND GRAVEL fine to coarse sand; fine gravel; reddish-brown (SM/GC)		55							dense
		Drilling refusal at 27.5'. Stopped sampling at 26.5'. Installed 1-1.4" diameter slotted PVC pipe to 27.5'. No groundwater encountered.	30								
			35								
			40								
			45								
			50								

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4A
(con't)

BOREHOLE B-2B

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Page: 1 of 2

Project Name: Prop. New Residential Hall Structure - SUU	Project No.: 0128-014-07
Location: South of 200 S St at Apprx. 600 W, Cedar City, UT	Client: Architectural Design West PC
Drilling Method: 3-3/4" ID Hollow-Stem Auger	Date Drilled: 09-24-07
Elevation: Approximately 5820' +/-	Water Level: No groundwater encountered.
Remarks:	

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
		Ground Surface									
		SITLY CLAY with some fine sand; major roots (topsoil) to 3"' reddish-brown (CL)	0								loose to 3"-6" very moist soft
				4							
		grades with zones of clayey silt with some fine sand and very fine sandy silt; pinhole structure									slightly moist medium stiff
			5	6							
				11							stiff
			10								
				14							
		CLAYEY SILT with some fine sand and zones of very fine sandy silt; reddish-brown (ML)	15								moist medium stiff
		grades with occasional up to 4" layers of silty fine sand									
				8							
			20								
		SILTY CLAY with some fine sand; reddish-brown (CL)									moist stiff
				21							
			25								

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4B

BOREHOLE B-2B

Page: 2 of 2

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: Prop. New Residential Hall Structure - SUU
Project No.: 0128-014-07
Location: South of 200 S St at Apprx. 600 W, Cedar City, UT
Client: Architectural Design West PC
Drilling Method: 3-3/4" ID Hollow-Stem Auger
Date Drilled: 09-24-07
Elevation: Approximately 5820' +/-
Water Level: No groundwater encountered.
Remarks:

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
				14							
			30								
				11							
			35								
		CLAYEY/SILTY SAND fine sand; reddish-brown (SC/SM)									moist stiff
				16							
		Drilling refusal at 37.5'.	40								
		Stopped sampling at 39.0'.									
		Installed 1-1.4" diameter slotted PVC pipe to 39.0'.									
		No groundwater encountered.									
			45								
			50								

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4B
(con't)

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

BOREHOLE B-3B

Page: 1 of 2

Project Name: Prop. New Residential Hall Structure - SUU	Project No.: 0128-014-07
Location: South of 200 S St at Apprx. 600 W, Cedar City, UT	Client: Architectural Design West PC
Drilling Method: 3-3/4" ID Hollow-Stem Auger	Date Drilled: 09-24-07
Elevation: Approximately 5820' +/-	Water Level: No groundwater encountered.
Remarks:	

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
		Ground Surface									
		CLAYEY SAND major roots (topsoil) to 3"'; fine sand; reddish-brown (SC)	0								loose to 3"-6" very moist soft
				3							
		SILTY CLAY with some fine sand; pinhole structure; reddish-brown (CL)	5								moist medium stiff
		grades with occasional up to 1/4" layers of silty fine sand									
				7							
			10								
		grades with zones of clayey fine sand									
				7							
			15								
		SILTY SAND AND GRAVEL fine to coarse sand; fine and coarse gravel; reddish-brown (SM/GM)		23							moist medium dense
			20								
		grades with trace clay		29							
			25								

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4C

BOREHOLE B-3B

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Page: 2 of 2

Project Name: Prop. New Residential Hall Structure - SUU
Location: South of 200 S St at Apprx. 600 W, Cedar City, UT
Drilling Method: 3-3/4" ID Hollow-Stem Auger
Elevation: Approximately 5820' +/-
Remarks:

Project No.: 0128-014-07
Client: Architectural Design West PC
Date Drilled: 09-24-07
Water Level: No groundwater encountered.

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
				30							
				26							
		Drilling refusal at 27.5'.	30								
		Stopped sampling at 29.0'.									
		No groundwater encountered.									
			35								
			40								
			45								
			50								

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4C
(con't)

BOREHOLE B-4B

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Page: 1 of 2

Project Name: Prop. New Residential Hall Structure - SUU
Project No.: 0128-014-07
Location: South of 200 S St at Apprx. 600 W, Cedar City, UT
Client: Architectural Design West PC
Drilling Method: 3-3/4" ID Hollow-Stem Auger
Date Drilled: 09-24-07
Elevation: Approximately 5820' +/-
Water Level: No groundwater encountered.
Remarks:

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
		Ground Surface									
		SILTY CLAY with fine sand; major roots (topsoil) to 3'"; reddish-brown (CL)	0								loose to 3"-6" moist medium stiff
				9	X						
			5	11	X						
		grades with zones of silty fine sand									
			10	10	X						
		grades with zones of clayey fine sand									
		SILTY CLAY/CLAYEY SILT with some fine sand; reddish-brown (CL)									moist stiff
			15	13	X						
			20	23	X						
		SILTY SAND AND GRAVEL fine to coarse sand; fine and coarse gravel; reddish-brown (SM/GM)									moist medium dense
		SILTY CLAY with some fine sand; reddish-brown (CL)									moist stiff
			25		X						

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4C

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

BOREHOLE B-4B

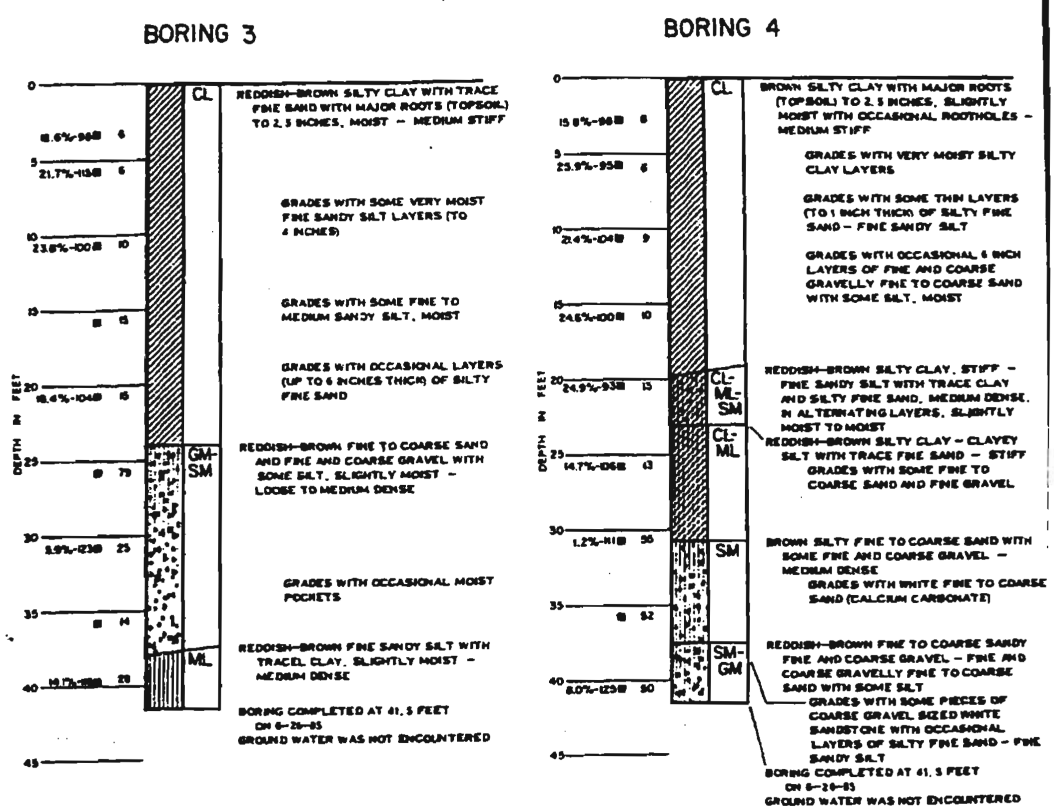
Page: 2 of 2

Project Name: Prop. New Residential Hall Structure - SUU
Project No.: 0128-014-07
Location: South of 200 S St at Apprx. 600 W, Cedar City, UT
Client: Architectural Design West PC
Drilling Method: 3-3/4" ID Hollow-Stem Auger
Date Drilled: 09-24-07
Elevation: Approximately 5820' +/-
Water Level: No groundwater encountered.
Remarks:

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
				13							
			30	12							
		Drilling refusal at 29.0'. Stopped sampling at 30.5'. Installed 1-1/4" diameter slotted PVC pipe to 30.0'. No groundwater encountered.	35								
			40								
			45								
			50								

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4C
(con't)

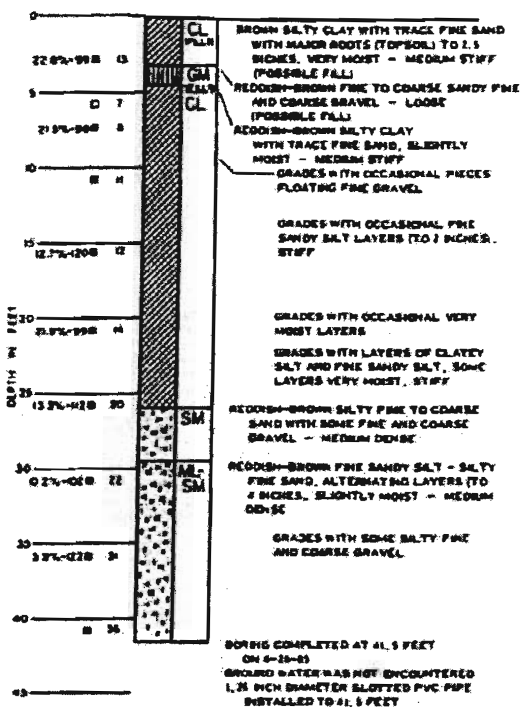


LOG OF BORINGS

FIGURE 5A

Dames & Moore

BORING 5



LOG OF BORINGS

FIGURE 5B

Dames & Moore

Page 1 of 3

LOG OF TEST BORING NO. B-1A

PROJECT: SUU Student Housing, Cedar City, Utah

JOB NO. 3-817-004385 DATE 03-25-03

RIG TYPE: CME 55
BORING TYPE: 3-1/4" ID Hollow-Stem Auger
SURFACE ELEV.:
DATUM:

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0										2" ASPHALT
								SM/GM/FILL	"dense"	6" SILTY FINE TO COARSE SAND AND FINE GRAVEL ROADBASE
								CL	moist stiff	SILTY CLAY with occasional up to 1/2" layers of silty fine sand; some pinholes structure; red-brown
			X	D	19					
5										grades with zones of clayey silt with some fine sand
			X	D	16					
			X	D	17	97	11.4			
10										
15			X	D	17			SM/ML	slightly moist loose	SILTY FINE SAND/FINE SANDY SILT with occasional to 1" layers of fine sandy silt; red-brown
										grades with some coarse sand and 1" to 2" layers of clayey silt with trace fine sand
20			X	D	38					
								SM	slightly moist medium dense	SILTY FINE TO COARSE SAND with some fine gravel; red-brown
								SM/GM	slightly moist very dense	FINE TO COARSE SAND AND FINE GRAVEL with some silt; red-brown
25										

GROUNDWATER

DEPTH	HOUR	DATE
	*	

SAMPLE TYPE

A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE 6A

amec

LOG OF TEST BORING NO. B-1A

PROJECT: SUU Student Housing, Cedar City, Utah

JOB NO. 3-817-004385 DATE 03-25-03

RIG TYPE: CME 55
BORING TYPE: 3-1/4" ID Hollow-Stem Auger
SURFACE ELEV.:
DATUM:

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
25			X	D	100/5"	109	5.9			
30			X	D	100/6"					grades with occasional silty sand and gravel layers to 1" thick
								SM/ SC	moist medium dense	**CLAY AND SILTY FINE SAND**; occasional pinhole structure; red-brown
35			X	D	30	116	10.0			
								SM/ GM	slightly moist dense	**SILTY FINE TO COARSE SAND AND FINE AND COARSE GRAVEL** with occasional up to 2.5" layers of clayey sand and gravel; red-brown
40			X	D	74					
								SC/ SM/ ML	moist medium dense	**CLAYEY AND SILTY FINE SAND/CLAYEY SILT WITH FINE SAND**; red-brown
45			X	D	37	116	10.8			
50										

GROUNDWATER

DEPTH	HOUR	DATE
	*	

SAMPLE TYPE

A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.

FIGURE 6A
(con't)

amec

Page 3 of 3

PROJECT SUU Student Housing
Cedar City, Utah

JOB NO. 3-817-004385 DATE 03-25-03

LOG OF TEST BORING NO. B-1A

RIG TYPE CME 55
BORING TYPE 3-1/4" ID Hollow-Stem Auger
SURFACE ELEV.
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
50				D	100/3"	116	10.5	SM/GM	slightly moist very dense	SILTY FINE TO COARSE SAND AND FINE AND COARSE GRAVEL with occasional up to 3" layers of clay and silty fine sand; red-brown
55				D	100/6"					
60				D	100/4"					Stopped drilling at 60.0'. Stopped sampling at 60.33'. * Groundwater not encountered. Asphalt-paved parking area.
65										
70										The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
75										

GROUNDWATER

DEPTH	HOUR	DATE
	*	

SAMPLE TYPE

A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.

FIGURE 6A
(con't)

amec

PROJECT SUU Student Housing
Cedar City, Utah

JOB NO. 3-817-004385 DATE 03-25-03

Page 1 of 3

LOG OF TEST BORING NO. B-2A

RIG TYPE CME 55
BORING TYPE 3-1/4" ID Hollow-Stem Auger
SURFACE ELEV.
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0										2" ASPHALT CONCRETE (POOR CONDITIONS)
								SM/GM/FILL	"medium dense"	7" FINE TO COARSE SAND AND FINE GRAVEL ROADBASE
								CL		SILTY CLAY with up to 1/2" layers of silty fine sand; red-brown
			X	D	19				very moist stiff	
			X	D	15	88	18.3			
5										
									medium stiff	grades with some silt with some fine sand
10			X	D	9					
										grades with occasional up to 1" layers of silty fine sand
15			X	D	16				stiff	
20			X	D	7	101	22.5		medium stiff	
25										

GROUNDWATER

	DEPTH	HOUR	DATE
		*	

SAMPLE TYPE
A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE 6B

amec

LOG OF TEST BORING NO. B-2A

PROJECT: SUU Student Housing, Cedar City, Utah
JOB NO. 3-817-004385 DATE 03-25-03

RIG TYPE: CME 55
BORING TYPE: 3-1/4" ID Hollow-Stem Auger
SURFACE ELEV.:
DATUM:

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
25				D	27	88	26.3		very stiff	grades with numerous up to 2" layers of silty fine to medium sand
								SM/ GM	moist very dense	SILTY FINE TO COARSE SAND AND FINE GRAVEL with some coarse gravel; red-brown grades with occasional cobbles
30				D	134					
35				D	47				medium dense	
								CL	moist very stiff	SILTY CLAY with some fine sand; occasional up to 2" layers of clayey silt; red-brown
40				D	46					
								SM	moist medium dense	SILTY FINE SAND with occasional zones of clayey silt; red-brown
45				D	34	110	10.5			
								SM/ GM	moist very dense	SILTY FINE TO COARSE SAND AND FINE AND COARSE GRAVEL; red-brown
50										

GROUNDWATER

DEPTH	HOUR	DATE

SAMPLE TYPE
A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE 6B (con't)

amec

Page 3 of 3

PROJECT SUU Student Housing
Cedar City, Utah

JOB NO. 3-817-004385 DATE 03-25-03

LOG OF TEST BORING NO. B-2A

RIG TYPE CME 55
BORING TYPE 3-1/4" ID Hollow-Stem Auger
SURFACE ELEV.
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
50				D	100/5"	96	5.8			grades with occasional up to 6" layers of clayey silt with fine sand and silty fine sand
55				D	100/6"					
60										Drilling refusal at 59.83' on cobbles. * Groundwater not encountered. Asphalt parking area.
65										
70										
75										The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.

GROUNDWATER

DEPTH	HOUR	DATE
	*	

SAMPLE TYPE

A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE 6B
(con't)

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PROJECT SUU Student Housing
Cedar City, Utah

JOB NO. 3-817-004385 DATE 03-26-03

Page 1 of 3

LOG OF TEST BORING NO. B-3A

RIG TYPE CME 55
BORING TYPE 3-1/4" ID Hollow-Stem Auger
SURFACE ELEV.
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								CL	moist stiff	SILTY CLAY with occasional up to 1" layers of fine sandy silt; major roots (topsoil) to 3"; dark brown grades red-brown at 12"
				D	12					
5										
				D	17					grades numerous layers up to 1" layers of fine sandy silt
				D	11	95	12.0		medium stiff	
10										
15				D	13					
								SC/ SM/ ML	moist loose to stiff	CLAYEY AND SILTY FINE SAND/FINE SANDY CLAYEY SILT with numerous up to 24" layers of silty fine sand and fine and coarse gravel; red-brown
20				D	27					
								SM/ GM	slightly moist to moist medium dense	SILTY FINE TO COARSE SAND AND FINE AND COARSE GRAVEL with occasional 1" to 3" layers of clayey silt with some fine
25										

GROUNDWATER

DEPTH	HOUR	DATE

SAMPLE TYPE

A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE 6C

amec

PROJECT SUU Student Housing
Cedar City, Utah

JOB NO. 3-817-004385 DATE 03-26-03

Page 2 of 3

LOG OF TEST BORING NO. B-3A

RIG TYPE CME 55
BORING TYPE 3-1/4" ID Hollow-Stem Auger
SURFACE ELEV.
DATUM

Depth In Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
25				D	64					sand; red-brown
										clayey silt layers grade out
30				D	40					
								SP/ SM	slightly moist medium dense	FINE SAND with some silt and occasional 3" to 6" layers of fine to coarse sand and fine and coarse gravel; red-brown
35				D	34					
								SC/ SM/ ML	moist medium dense stiff	CLAYEY AND SILTY FINE SAND/FINE SANDY CLAYEY SILT; red-brown
40				D	30					
										grades with numerous up to 12" to 18" layers of some fine to coarse sand and fine and coarse gravel; occasional cobbles
45				D	35			SM	slightly moist medium dense	SILTY FINE SAND; red-brown
								SC/ SM/ ML	slightly moist medium dense stiff	CLAYEY AND SILTY FINE SAND/FINE SANDY CLAYEY SILT; red-brown
50										

GROUNDWATER

	DEPTH	HOUR	DATE
▽		*	
▼			

SAMPLE TYPE

A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE 6C
(con't)

amec

PROJECT SUU Student Housing
Cedar City, Utah

JOB NO. 3-817-004385 DATE 03-26-03

Page 3 of 3

LOG OF TEST BORING NO. B

RIG TYPE CME 55
BORING TYPE 3-1/4" ID Hollow-Stem Auger
SURFACE ELEV.
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
50				D	25	110	13.6			
55				D	32					grades with occasional 6" to 12" layers fine to coarse sand and fine and coarse gravel
								SM/ GM	moist very dense	**SILTY FINE TO COARSE SAND AND FINE AND COARSE GRAVEL**; red-brown
60				D	100/3"					
										Stopped drilling at 60.0'. Stopped sampling at 60.25'. * Groundwater not encountered.
65										
70										The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
75										

GROUNDWATER

	DEPTH	HOUR	DATE
∇		*	
▼			

SAMPLE TYPE

A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE (
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Page 1 of 3

PROJECT SUU Student Housing
Cedar City, Utah

JOB NO. 3-817-004385 DATE 03-27-03

LOG OF TEST BORING NO. B-4A

RIG TYPE CME 55
BORING TYPE 3-1/4" ID Hollow-Stem Auger
SURFACE ELEV.
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0										2" ASPHALT CONCRETE
								SM/GM/FILL	"medium dense"	7" FINE TO COARSE SAND AND FINE GRAVEL; dark gray; base course
								CL		
				D	20				slightly moist stiff	SILTY CLAY with some fine sand; red-brown
5				D	14					significant pinhole structure
10				D	22	84	11.6		very stiff	
15				D	17			SC/ SM/ ML	slightly moist to moist loose	CLAYEY AND SILTY FINE SAND/FINE SANDY CLAYEY SILT; red-brown
								CL	slightly moist very stiff	SILTY CLAY with trace fine sand; pinhole structure; red-brown
20				D	36					
25										

GROUNDWATER

DEPTH	HOUR	DATE
	*	

SAMPLE TYPE
A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.

FIGURE 6D

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PROJECT SUU Student Housing
Cedar City, Utah

JOB NO. 3-817-004385 DATE 03-27-03

Page 2 of 3

LOG OF TEST BORING NO. B-4A

RIG TYPE CME 55
BORING TYPE 3-1/4" ID Hollow-Stem Auger
SURFACE ELEV.
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
25				D	24	100	7.7		slightly moist very stiff	
								SC/SM/ML	slightly moist medium stiff	CLAYEY AND SILTY FINE SAND/FINE SANDY CLAYEY SILT; silty fine to medium sand with pinhole structure; red-brown
								SM/ GM		
30				D	36					
								SM	moist medium dense stiff	SILTY FINE TO COARSE SAND AND FINE GRAVEL AND OCCASIONAL UP TO 3" THICK LAYERS OF CLAYEY SILT with some fine sand; red-brown
										SILTY FINE TO MEDIUM SAND with trace pinholes; red-brown
35				D	34					
40				D	34	112	10.2	SC/ SM/ ML	slightly moist medium dense stiff	CLAYEY SILTY FINE SAND/FINE SANDY CLAYEY SILT; red-brown
										grades with occasional up to 2" layers of silty fine to medium sand and fine gravel
45				D	34					
								SM/ GM	moist very dense	SILTY FINE TO COARSE SAND AND FINE AND COARSE
50										

GROUNDWATER

	DEPTH	HOUR	DATE
▽		*	
▼			

SAMPLE TYPE

A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE 6D
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Page 3 of 3

PROJECT SUU Student Housing
Cedar City, Utah

JOB NO. 3-817-004385 DATE 03-27-03

LOG OF TEST BORING NO. B

RIG TYPE CME 55
BORING TYPE 3-1/4" ID Hollow-Stem Auger
SURFACE ELEV.
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
50				D	119					GRAVEL with occasional 3" layers of clayey silt with some fine sand; red-brown
										grades with occasional cobbles
55				D	100/0"					
60				D	100/4"					
										Stopped drilling at 60.33'.
										Stopped sampling at 60.33'.
										* Groundwater not encountered.
										Asphalt parking area.
65										
70										
										The discussion in the text under th section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
75										

GROUNDWATER

DEPTH	HOUR	DATE
	*	

SAMPLE TYPE

A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.

FIGUR
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PROJECT SUU Student Housing
Cedar City, Utah

JOB NO. 3-817-004385 DATE 03-31-03

Page 1 of 3

LOG OF TEST BORING NO. B-5A

RIG TYPE CME 55
BORING TYPE 3-1/4" ID Hollow-Stem Auger
SURFACE ELEV.
DATUM

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								CL	moist to very moist stiff	SILTY CLAY with trace fine sand and major roots (topsoil) to 2"; dark brown grades red-brown at 12"
									slightly moist	
				D	14					
5				D	11	87	8.7			
										grades with occasional up to 4" layers of clayey silt and fine sandy silt
10				D	25					grades with numerous layers silty fine sand to 2" thick
15				D	15	99	8.7	SM/ ML	moist loose	**ALTERNATING UP TO 4" LAYERS OF SILTY FINE SAND AND FINE SANDY SILT;** red-brown
20				D	29			SC/ ML/ SM	moist medium dense	**CLAYEY AND SILTY FINE SAND/FINE SANDY CLAYEY SILT;** some pinhole structure; red-brown
25										

GROUNDWATER

DEPTH	HOUR	DATE
	*	

SAMPLE TYPE
A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.

FIGURE 6E

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Page 2 of 3

LOG OF TEST BORING NO. B-5A

PROJECT: SUU Student Housing, Cedar City, Utah

JOB NO. 3-817-004385 DATE 03-31-03

RIG TYPE: CME 55
BORING TYPE: 3-1/4" ID Hollow-Stem Auger
SURFACE ELEV.:
DATUM:

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
25				D	15	106	13.6			
30				D	19					grades 6" layers of fine to coarse sand with fine and coarse gravel
35				D	49					grades with occasional up to 6" layers of fine and coarse gravel and fine to coarse sand with occasional cobbles
								SM/ GM	slightly moist very dense	SILTY FINE TO COARSE SAND AND FINE AND COARSE GRAVEL AND COBBLES; red-brown
40				D	100/3"					
								SC/ SM/ ML	moist medium dense	CLAYEY AND SILTY FINE SAND/FINE SANDY CLAYEY SILT; numerous up to 6" layers of silty fine to coarse sand and fine and coarse gravel; red-brown
45				D	70	129	10.4			
50										

GROUNDWATER

	DEPTH	HOUR	DATE
▽		*	
▼			

SAMPLE TYPE

A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.

FIGURE 6E
(con't)

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PROJECT: *SUU Student Housing*, Cedar City, Utah

LOG OF TEST BORING NO. B-5A

JOB NO. 3-817-004385 DATE 03-31-03

RIG TYPE: CME 55
BORING TYPE: 3-1/4" ID Hollow-Stem Auger
SURFACE ELEV.:
DATUM:

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows/foot 140 lb. 30" free-fall drop hammer	Dry Density lbs. per cubic foot	Moisture Content Percent of Dry Weight	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
50				D	36	108	7.4			
55				D	46					
								SM/ GM	moist very dense	**SILTY FINE TO COARSE SAND AND FINE GRAVEL** with occasional layers with coarse gravel and possibly small cobbles to 12" thick; red-brown
60				D	100/3"	118	8.3			
										Stopped drilling at 60.75'. Stopped sampling at 60.75'. * Groundwater not encountered.
65										
70										The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
75										

GROUNDWATER

	DEPTH	HOUR	DATE
▽		*	
▼			

SAMPLE TYPE

A - Auger cuttings
S - 2" O.D. 1.38" I.D. tube sample.
U - 3" O.D. 2.42" I.D. tube sample.
T - 3" O.D. thin-walled Shelby tube.
D - 3 1/4" O.D. 2.42" I.D. tube sample.
C - California Split Spoon Sample

FIGURE 6E (con't)

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UNIFIED SOIL CLASSIFICATION SYSTEM

FIELD IDENTIFICATION PROCEDURES				LETTER SYMBOL [1]	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS More than half of material is larger than No. 200 sieve size. [2] (The No. 200 sieve size is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size. (For visual classifications, the 1/4" size may be used as equivalent to the No. 4 sieve size.)	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			Predominantly one size or a range of sizes with some intermediate sizes missing.	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).	GM	Silty gravels, poorly graded gravel-sand-silt mixtures.
			Plastic fines (for identification procedures see CL below).	GC	Clayey gravels, poorly graded gravel-sand-clay mixtures.
	SANDS More than half of coarse fraction is smaller than No. 4 sieve size. (For visual classifications, the 1/4" size may be used as equivalent to the No. 4 sieve size.)	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.	SW	Well graded sands, gravelly sands, little or no fines.
			Predominantly one size or a range of sizes with some intermediate sizes missing.	SP	Poorly graded sands, gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).	SM	Silty sands, poorly graded sand-silt mixtures.
			Plastic fines (for identification procedures see CL below).	SC	Clayey sands, poorly graded sand-clay mixtures.

		IDENTIFICATION PROCEDURES ON FRACTION SMALLER THAN No. 40 SIEVE SIZE				
		DRY STRENGTH (CRUSHING CHARACTERISTICS)	DILATANCY (REACTION TO SHAKING)	TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT)	LETTER SYMBOL	TYPICAL DESCRIPTIONS
FINE GRAINED SOILS More than half of material is smaller than No. 200 sieve size. (The No. 200 sieve size is about the smallest particle visible to the naked eye)	SILTS AND CLAYS Liquid limit less than 50	None to slight	Quick to slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sand with slight plasticity.
		Medium to high	None to very slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		Slight to medium	Slow	Slight	OL	Organic silts and organic silt-clays of low plasticity.
	SILTS AND CLAYS Liquid limit greater than 50	Slight to medium	Slow to none	Slight to medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		High to very high	None	High	CH	Inorganic clays of high plasticity, fat clays.
		Medium to high	None to very slow	Slight to medium	OH	Organic clays of medium to high plasticity.
HIGHLY ORGANIC SOILS		Readily identified by color, odor, spongy feel and frequently by fibrous texture.			Pt	Peat and other highly organic soils.

[1] Boundary classifications:—Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW–GC, well graded gravel–sand mixture with clay binder.
[2] All sieve sizes on this chart are U.S. standard.

GENERAL NOTES

1. In general, Unified Soil Classification Designations presented on the logs were evaluated by visual methods only. There rore, actual designations (based on laboratory testing) may differ.

2. Lines seperating strata on the logs represent approximate boundaries only Actual transitions may be gradual.

3. Logs represent general soil conditions observed at teh point of exploration onthe date indicated.

4. No warranty is provided as to the continuity of soil conditions between individual sample locations.

FINE - GRAINED SOIL

CONSISTENCY	SPT (blows/ft)	TORVANE UNDRAINED SHEAR STRENGTH (tsf)	POCKET PENETROMETER UNCONFINED COMPRESSIVE STRENGTH (tsf)	FIELD TEST
Very Soft	<2	<0.125	<0.25	Easily penetrated several inches by Thumb. Squeezes through fingers.
Soft	2 - 4	0.125 - 0.25	0.25 - 0.5	Easily penetrated 1 " by Thumb . Molded by light finger pressure.
Medium Stiff	4 - 8	0.25 - 0.5	0.5 - 1.0	Penetrated over 1/2 " by Thumb with moerate effort. Molded by strong finger pressure.
Stiff	8 - 15	0.5 - 1.0	1.0 - 2.0	Indented about 1/2 " by Thumb but penetrated only with great effort
Very Stiff	15 - 30	1.0 - 2.0	2.0 - 4.0	Readily indented by Thumbnail
Hard	>30	>2.0	>4.0	Indented with difficulty by Thumbnail

LOG KEY SYMBOLS

- Bulk / Bag Sample
- Standard Penetration Split Spoon Sampler
- Rock Core
- Water Level
- Thin Wall
- No Recovery
- 3-3/4" ID D&M Sampler
- 3" ID D&M Sampler
- California Sampler

COARSE -GRAINDE SOIL

APPERENT DENSITY	SPT (blows/ft)	RELATIVE DENSITY (%)	FIELD TEST
Very Loose	<4	0 - 15	Easily penetrated with 1/2 " reinforcing rod pushed by hand
Loose	4 - 10	15 - 35	Difficult to penetrated with 1/2 " reinforcing rod pushed by hand
Medium Dense	10 - 30	35 - 65	Easily penetrated a foot with 1/2 " reinforcing rod driven with 5-lb hammer
Dense	30 - 50	65 - 85	Difficult to penetrated a foot with 1/2 " reinforcing rod driven with 5-lb hammer
Very Dense	>50	85 - 100	Penetrated only a few inches with 1/2 " reinforcing rod driven with 5-lb hammer

STRATIFICATION

DESCRIPTION	THICKNESS
SEAM	1/16 - 1/2 "
LAYER	1/2 - 12 "

DESCRIPTION	THICKNESS
Occasional	One or less per foot of thickness
Frequent	More than on per foot of thichness

CEMENTATION

DESCRIPTION	DESCRIPTION
Weakely	Crumbles or breaks with handling of slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumbles or breaks with finger pressure

MODIFIERS

DESCRIPTION	%
Trace	<5
Some	5 - 12
With	>12

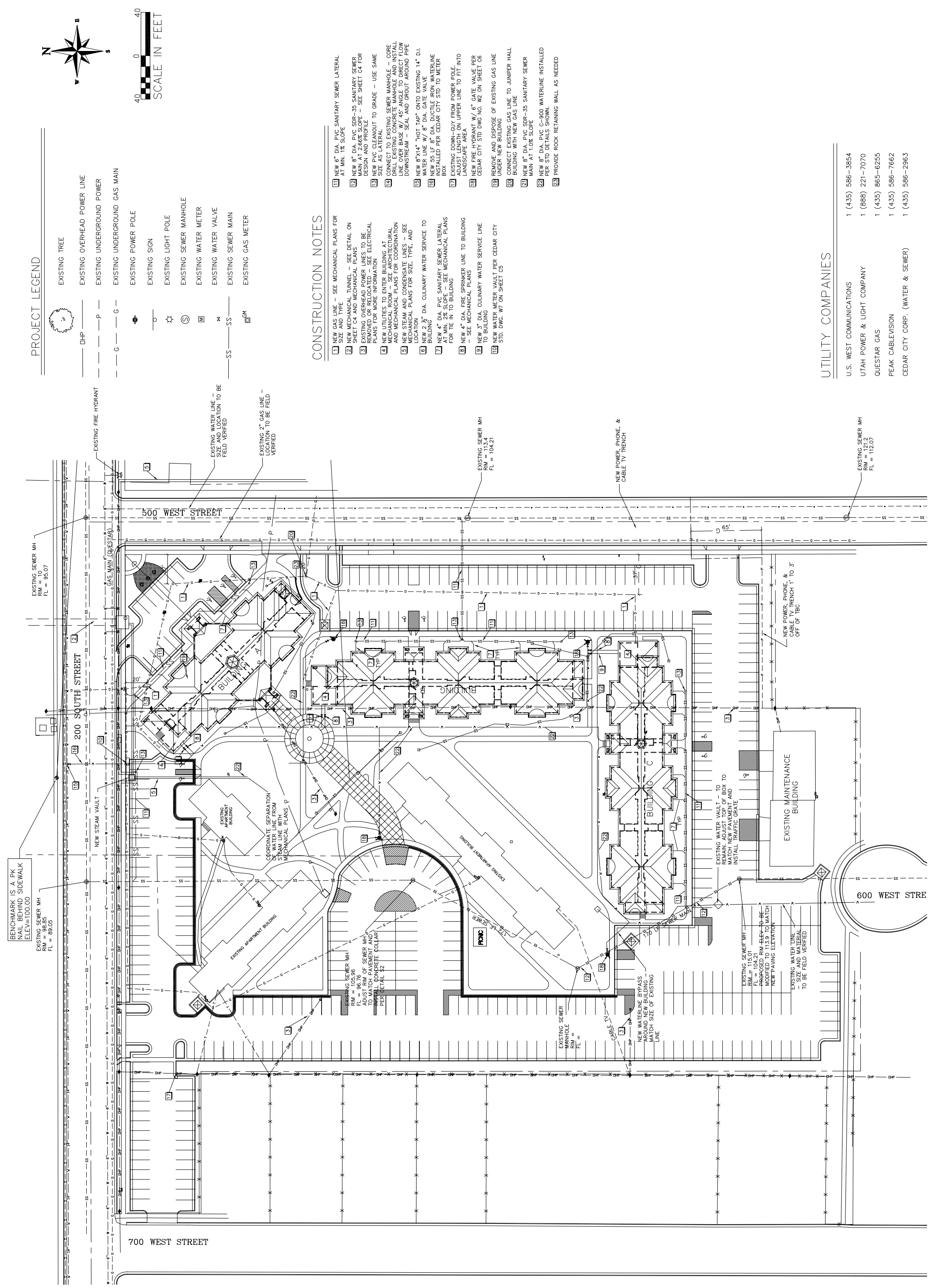
MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible water, usually soil below Water Table

FIGURE 7

Gordon Spilker Huber
Geotechnical Consultants, Inc.

APPENDIX F:
CIVIL SITE PLAN



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