GEO COMPANY, PLLC
Geotechnical & Materials Engineering
Geoenvironmental Engineering

June 23, 2002

Crater Development, Inc.
2981 West 133100 South
Riverton, Utah 84065

Attention: Mr. Kent Allred

Subject: Subsurface Investigation and Foundation Study
Proposed Silvercrest Subdivision
Approx. 11600 South Redwood Road
Riverton, Utah

GEO Project No. 2K061001.1

Gentlemen:

Enclosed is my report of a geotechnical investigation at the subject site. The study was carried out in accordance with our discussion in June 20002 and our standard procedures following your verbal authorization on June 10, 2002.

The current and all future phases of the development and any other buildings subsequently planned on this site can be founded on conventional spread footings on earth reinforced footing pads over the natural soils, clayey silts, silty clays, silts and silty sand. Both exterior and interior footings may bear in these variable soil materials founded at 30 and 18 inches below grade, respectively, following preparation and inspection of the footing excavations. These depths will provide frost protection for exterior footings and bearing and lateral resistance for interior footings. At the owner's discretion, to provide a working surface less susceptible to moisture variations (rains or snowmelt), a stabilizing layer may provide over the natural soils may be desirable; the natural soils may be covered with 6 inches of compacted sandy gravel or base course.

Construction on the undulating site may require significant earthwork operations other than the footing excavation and site modifications around existing ditches.

Groundwater is below the depth of most borings except for an isolated case and should not impede construction. The intrusion of surface water may present movement difficulty in the surficial fin-grained coils, but good weather or the gravel discussed above could alleviate such construction.

4767 South Ichabod Place • Salt Lake City, Utah 84117 • Phone (801) 272-2064 • Fax (801) 278-2612 • E-mail: jconly@webguy-prod.com

Pavement sections will require 12 inches of base course below standard asphalt thickness for car and truck areas, following critical proofrolling of the subgrade.

Detailed recommendations and additional design and construction criteria are contained in the attached report. Periodic site observation by the soils engineer will be prudent and provide confirmation and adjustment of the recommendations as appropriate.

The opportunity to be of service to you on this phase of the project is truly appreciated.

Sincerely,
GEO COMPANY

Jeffrey C. Olson, P.E., C.E.I.
Consulting Engineer

JCO/nf

Distribution: 5 - Addressee

TABLE OF CONTENTS

Subsurface Investigation and Foundation Study

APPENDICES

Appendix I - Field Exploration Program

Appendix II - Laboratory Test Results

Appendix III - Compaction Recommendations

1.0 INTRODUCTION

GEO Company has been retained by Crater Development to conduct a Subsurface Investigation and Foundation Study for the proposed Site (a vacant area) on bordering Midas reek on two sides, generally east and west, approximately 11750 South, in Riverton, Utah.

The scope of this investigation includes:

- Field Exploration, including test borings
- Laboratory Analysis
- Engineering Analysis

2.0 ABSTRACT

The subsurface conditions encountered at this site are very consistent. The subsurface materials are lake sediments placed predominantly during the Lake Bonneville Period, and consist primarily of interbedded silt, clay, sand and combinations thereof. The test borings encountered primarily stiff to very stiff fine-grained soils with varying fractions of sand and occasional gravel extending to the full depth explored, approximately 30 feet below grade. In several borings dense gravel was encountered at 12 to 15 feet below grade. Softer or less dense soils were discovered at depth in some areas, but are of sufficient depth as to not impact shallow footings.

Groundwater was not encountered within the depth of the borings except for isolated instances.

The recommended foundation system is conventional spread and continuous footings bearing on reinforced footing pads to distribute the loads and provide uniform support to the structures. These footings may be designed for a net allowable bearing pressure of 3,000 and 3,500 pounds per square foot, for continuous and isolated footings, respectively. Slab-on-grade construction is the recommended method of construction of floor slabs.

At the owner's discretion, to provide a working surface less susceptible to moisture variations (rains or snowmelt), a stabilizing layer may provide over the natural soils may be desirable; the natural soils

may be covered with 6 inches of compacted sandy gravel or base course. At the owner's discretion, to provide a working surface less susceptible to moisture variations (rains or snowmelt), a stabilizing layer may provide over the natural soils may be desirable; the natural soils may be covered with 6 inches of compacted sandy gravel or base course.

Detailed recommendations and construction considerations are contained in the body of this report.

3.0 PURPOSE AND SCOPE OF STUDY

This report presents the results of a subsoil investigation and foundation study for a proposed building at a site located in Riverton, Utah as shown on Figure 1, Site Vicinity Map.

The investigation was intended to determine the vertical sequence and pertinent physical and structural properties of the subsurface profile and establish groundwater conditions for formulation of recommendations relative to:

1. selection and design of a foundation system for the planned expansion,
2. groundwater control and drainage requirements,
3. earthwork operations and specifications, and
4. subgrade preparations for floor slab-on-grade and pavement support.

Our investigation has included field sampling and observations. The recovered samples have been visually inspected and submitted to various laboratory tests for evaluation of their structural and physical properties. These results and evaluations were then used in the formulation of the recommendations contained in this report.

4.0 SITE HISTORY AND PLANNED DEVELOPMENT

The area of the site planned for construction has been previously undeveloped. The site is comprised of approximately 28 acres over 58 lots at the cited location. Residential construction is planned for the site and presented in plans prepared by Neff Engineering, Inc. and shown on Figure No. 2, Boring Location Plan. The site

contours have been left on this plan for ease of site understanding the boring information. We understand that the planned construction includes residential structures with basements. We expect low to moderate foundation loads for these structures.

The proposed site borders the main thoroughfare, 118th South to the north. The site is undulating with variable slopes, all radiating from Midas Creek - see Figure 2 topographic annotations. The site is surrounded by residential development.

An aerial photograph taken on May 6, 2002 depict the site and area development. Current site grades will require a significant amount of earthwork to establish site grades. Basement construction may be included, although many residences may be garden level.

5.0 SITE CONDITIONS

The site is grass and weed covered. Topography slopes across the site as noted above, with some surface irregularities, depressions and ditches.

Surface drainage is to Midas Creek and slightly north across the site.

6.0 INVESTIGATION PROGRAMS

6.1 Field Exploration

Eight test borings were drilled on June 14 and 17, 2002 at the locations shown on the Test Boring Location Plan, Figure 2.

The building test borings were extended to depths ranging between 15.5 and 30.5 feet below current site grades; pavement samples were excavated at three of these locations from 1' to 4.5' below grade. Elevations were estimated from the site survey by Neff Surveying.

All soil samples obtained during the course of drilling operations were visually classified in the field and subsequently checked in the laboratory to identify various formations. The results of classification operations are presented on the accompanying Test Boring Logs.

Details of the field drilling and sampling operations are outlined in the appendix.

6.2 Laboratory Testing

All samples which were recovered during the exploration operation were physically inspected and classified in the laboratory by the Project Engineer. The testing program consisted of the following tests: In-situ Moisture Content, Atterberg Limits, unconfined compressive strength (penetrometer), pH, gradation analyses, and California Bearing Ratio tests.

In-situ or natural moisture content and dry density were performed to evaluate the structural state and the likelihood of the soil to swell upon change in moisture content. (See Table 1)

Grain size analyses, full gradation, percent passing No. 200 sieve and moisture-density relationship tests were performed to evaluate drainage characteristics and soil structure. (See Table 2)

Atterberg limits were performed on samples to define the various stages of soil consistency. The water contents are used to define the limits where soil behaves as a viscous liquid (Liquid Limit [LL]) or where the soil breaks apart and crumbles and is no longer plastic (Plastic Limit [PL]). The difference between LL and PL is known as the Plasticity Index (PI) and is used in conjunction with the percent fines (No. 200 sieve) and percent binder (No. 40 sieve) for classification purposes. Results are presented in Table 1.

pH was determined to evaluate the likelihood of corrosive attack on any concrete or metals in contact with the soil. (See Table I)

California Bearing Ratio was determined to evaluate the pavement support characteristics of a compacted surface of the subgrade.

7.0 SUBSURFACE CONDITIONS

The subsurface conditions encountered at this site are fairly consistent. The detailed subsurface conditions encountered in our test pits are described in the Test Boring Logs. The General Notes, which are needed to interpret these logs, are included with the logs and profiles in Appendix 1.

7.1 Topsoil and Cover

Topsoil was apparent at all boring locations, with the growth of grasses and weeds present over most of the site.

7.2 Overburden Soils

Upperlying **NATURAL SOILS** consisted of fine-grained soils, SILTS, CLAYS, CLAYEY SILTS and SILTY CLAYS. Fine SAND with a varying minor fraction of silt or gravel was encountered at several locations. These soils extended to the full depth of the test borings.

7.3 Bedrock

Bedrock was not encountered in this investigation.

Stratification changes in the test borings must be considered approximate as transition between soil types may be gradual.

7.4 Groundwater

Groundwater was encountered in only two borings, B-1 and B-7, near the southeast an northwest corners of the site, and at a depth of about 23.5 and 28.0 feet below site grades.

7.5 Discussion

The magnitude of the structural loads are not known at the time of writing this report, but the soils structural capacity is described as stiff to very stiff for fine-grained clays and dense to very dense for cohesionless soils with the resultant bearing capacity of the same order of magnitude. Little to no "creep'", slow settlement, is expected within these soils.

The working surface of the fine-grained soils may be improved with 6 inches of compacted sandy gravel or base course. A reinforcing fabric such as Mirafi 140N may be used as an alternative with a lesser gravel thickness.

8.0 RECOMMENDATIONS

8.1 Structure Foundations

Based on the field and laboratory test results, the nature of the subsoil and bedrock formations and the type of planned structure, it is our opinion that the most economical and structurally-feasible foundation system for the proposed office buildings will be a matrix of conventional spread and continuous footings founded on natural soils, or gravel veneer at the owner's discretion following a controlled earthwork and subgrade preparation program.

8.1.1 Spread Footings

Based on the available data and in compliance with the applicable data and in compliance with the applicable building codes, the recommended design parameters for footings bearing within the fine-grained soils beginning at the surface and extending to the depth of the borings are as follows:

Maximum Allowable Bearing Pressure	
1) Continuous (Wall) Footings	3,000 psf
2) Isolated Spread (Column) Footings	3,500 psf
Minimum Dead-Load Pressure	500 psf
Minimum Continuous Footing Width	18 in.
Minimum Isolated Footing Dimension	20 in.
Exterior Footing Frost Depth	30 in.
Interior Footing Embedment Depth	18 in.

Localized "soft" spots should not exist. As an added precaution, continuous (wall) footings should be designed to span 15 feet to account for local "soft" spots. Any "soft" or saturated areas observed during overlot grading or prior to footing construction should be removed or scarified, aerated and recompacted.

Recommendations for structural fill are contained in Section 8.2 of this report. All footing excavations should be observed and tested by a representative of this firm prior to placement of concrete.

8.2 Structural Fill

Any general fill or backfill should meet the requirements of our Specification for Compacted Fill Placement which is available in our office and key points included in this report. Key points within this specification include:

1. Prior to the initiation of any earthwork operations, general clearing of building footprints should be carried out. Select topsoil, organically-rich, and other objectionable materials should be removed from the proposed area of construction.

   Careful visual control of clearing and stripping operations should be maintained to assure that all deleterious materials are removed.

2. Subsequent to site area clearing and stripping, all structural subgrade sectors should be subjected to critical proof-rolling operations and careful visual observation of subgrade reaction.

   Any sectors which exhibit instability or excessive deflection are to be undercut to such depths as may be necessary to assure satisfactory supporting properties. These undercut areas shall then be backfilled with approved fill materials, placed and compacted under carefully-controlled procedures.

3. All those areas which are to receive structural fill are to be filled on a controlled lift-by-lift basis, employing select, clean, organically-free materials. Individual lifts are to be of maximum 8-inch loose-measure thickness. Each individual lift is to be adjusted in moisture content and systematically compacted to minimum in-place densities as tabulated in the Appendix. Throughout the course of fill construction, care is to be exercised to maintain positive drainage and to prevent inundation of either the existing subgrade or new fill materials.

   Specifications should require that the resulting subgrade and fill material densities be verified by test measurements conducted by a qualified testing and inspection agency under the overview or subcontract through the GEO Company.

4. Only minor amounts of import materials are anticipated on this Site subject to the final approved grading plan. Non-swell potential material should be utilized. Fill material should meet the following general soil index properties:

1)	Liquid Limit:	15 to 40
2)	Plasticity Index:	7 to 20
3)	Percent Passing No. 200 Sieve:	12 to 30
4)	Swell index under 200 psf surcharge load	<1%

5. Fill material intended for use on this project should be tested and approved by the GEO Company prior to delivery to the site.

   Low to medium swell potential soils are suitable as fill material in areas not subject to structural loads. High to very high swell potential materials should not be used as fill material. These materials should only be used away from structures in landscape or backlot areas.

6. On-site materials including the wasted fill piles are suitable for use as fill.

8.3 Floor Slabs

Design should anticipate small relative movements between the floor slab-on-grade and walls and columns. Slab on-grade construction is feasible and recommended on these soils. Maximum slab settlement should be limited to 1 inch. Excessive settlement or slab heaves are not anticipated if standard construction procedures are followed.

The following precautions are recommended in the use of slab-on-grade construction:

1. The on-site granular material will provide acceptable slab support, providing they are compacted in accordance with project specifications and they are not contaminated with fine-grained soils.

2. The slabs should be separated from exterior walls and interior bearing members. **Vertical movement** of the slabs should **not** be **restricted.**

3. If feasible, exterior slabs should be separated from the building; these slabs should be reinforced to function as independent units. Movement of these slabs should not be transmitted to the foundation of the structure.

   If practical considerations require that some connection be made, control joints should be used to locate the cracking which may occur.

4. Frequent control joints should be provided to reduce the problems associated with shrinkage. These control joints will also act to "absorb" or centralize small slab movements. Joints should be provided around columns and at a maximum of every 20 feet on centers in each direction.

5. Subgrade surfaces should be compacted in accordance Appendix III. A heavy smooth drum vibratory roller is recommended to compact this on-site material.

8.4 Drainage

8.4.1 Surface Drainage

Performance of foundations and slabs is influenced by the moisture conditions existing within the foundation and subgrade soils. Surface drainage should be designed to provide for rapid runoff of surface water away from the building foundation. We recommend the following precautions be observed during construction and be maintained at all times after construction is completed.

1. Excessive wetting or drying of the open foundation excavations should be avoided as much as possible during construction.

2. The ground surface surrounding the exterior of the building should be sloped to drain away from the building in all directions. We recommend a minimum slope of at least 12 inches in the first 10 feet.

3. Backfill around foundations should be moistened and compacted.

4. Roof downspouts and drains should discharge well beyond the limits of all backfill.

5. Any landscaping which requires considerable watering and lawn sprinkler heads should be located at least 10 feet from foundation walls of the building.

   Trickler or bubbler type irrigation systems are not recommended.

8.4.2 Subsurface Drainage

No subsurface drainage requirements are anticipated within the proposed construction, unless as an option to the drainage need stated above.

9.0 DESIGN AND CONSTRUCTION CONSIDERATIONS

9.1 Cement Type

We expect a negligible relative degree of sulfate attack on concrete in contact with these soils. Use of concrete which uses a Type I cement is adequate.

9.2 Lateral Earth Pressures

Lateral earth pressures presented here assume backfill will consist of free-draining granular material, such as on-site materials. The lateral pressures imposed upon subgrade facilities will be dependent upon the relative rigidity and movement of the backfilled structure. For active walls, such as retaining walls which can move with the pressure of backfill, granular backfill may be considered equivalent to fluid density of 35 pounds per cubic foot in computing lateral pressures. For rigid basement walls (< 10" thick and < 12' high), a fluid density of 45 pounds per cubic foot may be considered. Please contact the GEO Company with other configurations.

These pressures are for static loadings and should be increased by 15 pounds per cubic foot to account for dynamic loading of a moderately severe earthquake.

9.3 Floor Slabs

Because of the clean granular nature on the subsurface materials, an additional layer of free-draining material is not required.

9.4 Pavement Areas

Areas where pavement is likely should be prepared in much the same way as the floor slabs. The fine-grained soils exhibited moderate strength under simulated pavement support conditions (CBR of 12) but these soils are highly susceptible to loss of strength base on exposure to moisture.

A pavement section of 12 inches of granular base plus 2.5 inches of hot bituminous asphalt to provide support for all anticipated traffic. This section should be increased to 3 inches of asphalt in any high truck traffic areas.

9.5 Geoseismic Considerations

The Site in question lies within the Uniform Building Code (UBC) zone 3. In review of geologic maps of the region, no known faults exist within the Site area. Estimated horizontal accelerations for a 100 year time period are listed below for the Site area.

Exceedance Probability	50%	10%	5%
Maximum Ground Acceleration (g)	0.06%	0.17%	0.22%

Based on published data no active faults are known to traverse the site and no faulting was indicated during our field investigation. Review of the Surface Rupture and Liquefaction Potential Special Study Areas Map for Salt Lake County, Utah (copy enclosed in appendix) indicates that the nearest known fault is the Granger located west of the property. Because of the seismic environment and the potentially loose lake bottom sediments that exist in the Salt Lake Valley, liquefaction of the soils is considered to be a possible geologic hazard. Liquefaction is a phenomenon where soils lose their intergranular strength due to a rapid rise in pore water pressures during a seismic event.

Several factors must be present for liquefaction to be of concern. These factors include the following:

1. The soils must consist of fine-grained, uniformly graded sands or silts;
2. The sands and silts must be loosely deposited, and
3. The sands and silts must be saturated, usually by high ground water elevations.

At this site, a significant layer of uniformly graded, loosely deposited sands or silts, within the 30 feet investigated, was not observed. If a significant layer exists at depth, the upper soil cover will reduce the effects of the liquefied layer to a point of non-significance. Therefore, in our opinion, the risk of liquefaction at this site is low since all of the major factors are not present within the upper 30 feet. No specific seismic considerations are recommended other than the proposed structures should be designed in accordance with the "Zone 3" requirements of the Uniform Building Code. A seismic site coefficient of 2.0(S) is recommended.

9.6 Foundation Excavations

All foundation excavations should be protected against detrimental change in conditions such as disturbance, rain and freezing. Surface runoff should be directed away from the excavation and not be allowed to pond. If possible, all footing concrete should be poured the same day as the excavation is made. If this is not practical, the footing excavation should be adequately protected from freezing temperatures and any anticipated heavy rainfall.

9.7 Temporary Excavation Slopes

Temporary construction excavations or stockpiles greater than 4 feet in height should be shored or sloped. Furthermore, no heavy surcharge loads (stockpiles, construction equipment, etc.) should be placed within 10 feet of the top of the excavation slope. If any signs of instability are noted, immediate remedial action must be initiated.

SUBSURFACE INVESTIGATION
AND FOUNDATION STUDY

SIILVERCREST SUBDIVISION
APPROX 11950 4250 WEST
RIVERTON, UTAH

GEO Project No. 2K061001.1

Prepared for:

CRATER DEVELOPMENT
2981 West 1331 South
Riverton, Utah 84065

JUNE 23, 2002

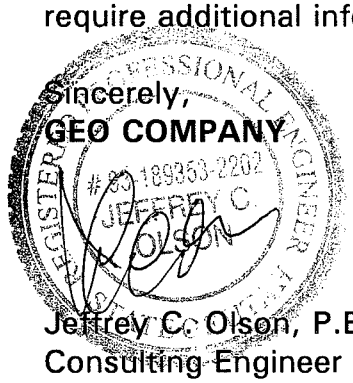
10.0 CLOSURE

The recommendations provided herein were developed from the information obtained from the soil test borings that reflect the subsurface conditions only at the specific locations and at the particular time designated. Soil and groundwater conditions may differ from conditions occurring at the test pit locations. The nature and extent of any variation in the test pits may not become evident until during the course of construction. If variations do appear, it may become necessary to reevaluate the recommendations of this report after we have observed the variation.

These professional services have been performed, findings obtained and recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices in this area at the time of execution. This warranty is in lieu of all other warranties either expressed or implied. Anyone using this report for bidding or construction purposes should perform such independent investigation as they deem necessary to satisfy themselves as to the surface conditions to be encountered and the procedures to be used in the performance of this project.

It has been a pleasure to serve you on this project. If you have any questions, or require additional information, please do not hesitate to contact me.

Sincerely,
GEO COMPANY



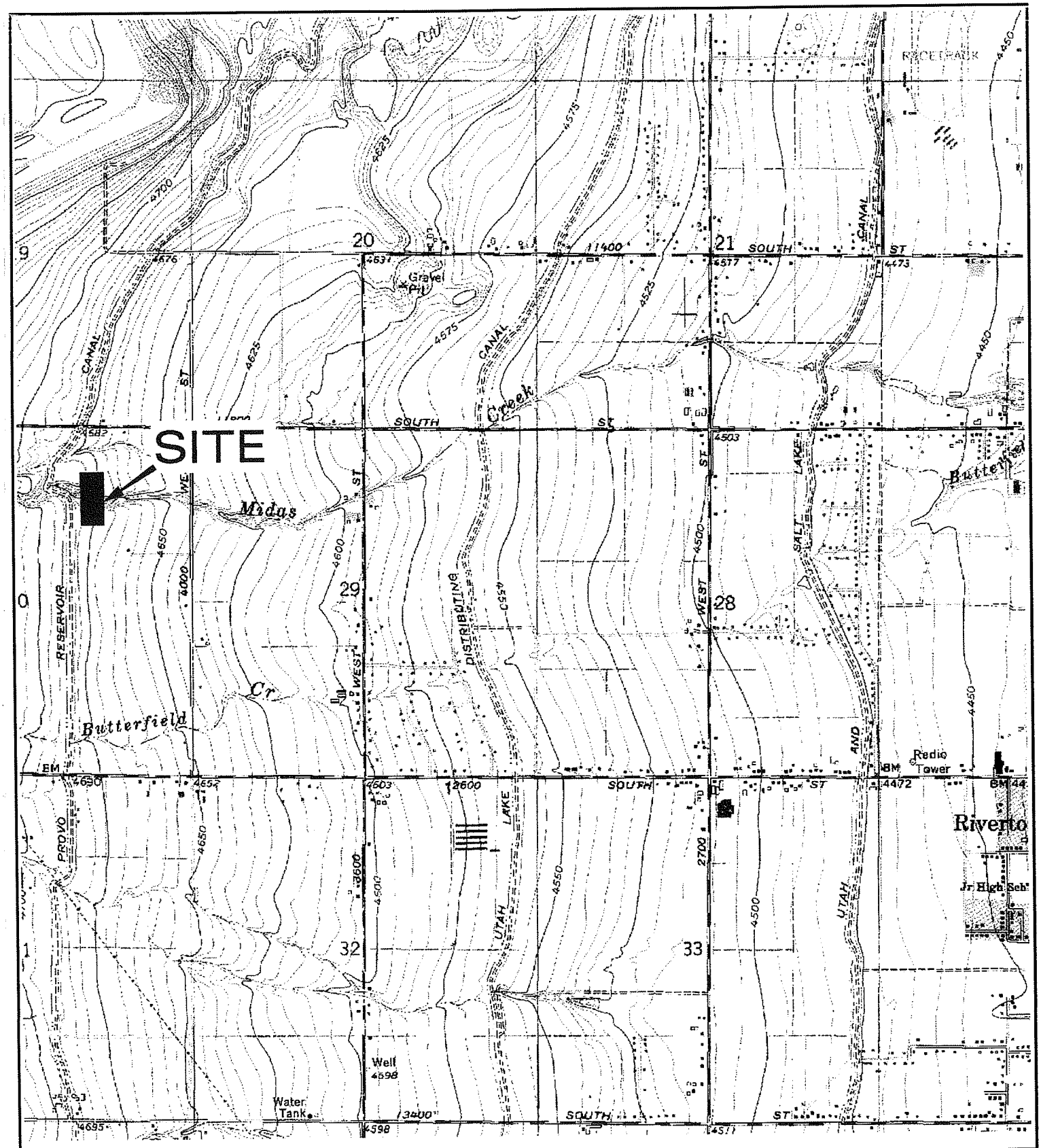
Jeffrey C. Olson, P.E., C.E.I.
Consulting Engineer

JCO/nf

APPENDIX

Field Exploration Program

- Site Vicinity Map
- Site Aerial Photograph
- Test Boring Location Plan
- Drilling and Sampling Procedures
- Test Boring Logs
- General Notes



NOTES:
1: BASE MAP SOURCE: U.S.G.S MIDVALE, 7.5 MINUTE QUADRANGLE DRG

N

2000 FEET
1 INCH = 2000 FEET
APPROXIMATE SCALE

GEO COMPANY
4767 SOUTH ICHABOD PLACE
SALT LAKE CITY, UTAH 84117

FIGURE 1
SITE LOCATION PLAN
SILVERCREST ESTATES
11950 SOUTH 4250 WEST
RIVERTON, UTAH

PROJECT:2K061001.1	JUNE 02	GEO-123

Drilling and Sampling Procedures

The test holes were drilled by conventional rotary-drive drilling procedures, employing solid-stem continuous flight augers.

Variations of soil and groundwater conditions encountered during the boring operations were noted and representative samples of the existing subsoils were taken at intervals by means of a 2-inch i.d. California-spoon sampling device driven by a 140-pound hammer, free-falling through a distance of 30 inches. The number of hammer blows required to achieve 12 inches of sample spoon penetration, after an initial seating penetration, was noted and is recorded in 6-inch increments under "Resist" on the accompanying Boring Logs.

The sum of the blow counts associated with the second and third 6-inch penetration intervals is similar to the Standard Penetration Test, which is described in ASTM Designation D-1586-87 (Reapproved 1974). The resistance of the last foot is known as the "Standard Penetration Resistance" and as the "N" value. The Penetration Test, when properly evaluated, is an index to the soil strength and density. The Penetration Test results are indicated on the Boring Logs.

The samples of the materials obtained as a result of drive sampling operations were removed from the sampler, visually classified and placed in properly-identified, sealed brass liners or glass sample jars. The subsoil material samples were then removed to our Salt Lake City soil mechanics laboratory for evaluation.

PROJECT NAME: SILVERCREST ESTATES | DATE: June 14, 2002

PROJECT LOCATION: 11950 SOUTH 4250 WEST | PROJECT NUMBER: 2K061001.1

SURFACE ELEVATION: 4858.00 | ELEVATION DATUM: | RIG TYPE: Mobile B-60

GEOLOGIST: Jeff Olson, P.E. | DRILLING METHOD: Hollow Stem Auger | HOLE DIAMETER: 8"

DRILLER: Interstate

SOIL DESCRIPTION	USCS	GRAPHICAL LOG	DEPTH (FEET)	SAMPLE (TYPE & NO)	RECOVERY (in.) DRIVEN (in.)	RESISTANCE	OVM (ppm)	WATER LEVEL	REMARKS
TOPSOIL - silty with some gravel	TS								
SILT,trace sand, trace clay, dense,dry gray				CA 1		10-18 20			
becoming clayey, dry, grayish white	ML			CA 2		7-10 12			
SAND, fine, some silt, dense, dry gray brown			10	CA 3		10-14 18			
with coarse gravel	SM			CA 4		35-50/5"			
SAND, medium to coarse, no gravel, dense, moiat, brown WATER ENTERS becoming gravelly			20	CA 5		18-41 33			
	SP			CA 6		7-50/5"			
CLAY, trace to some silt, stiff, moist to wet, gray	CL		30	CA 7		5-10 12			
BORONG TERMINATED AT 31.5' GROUNDWATER ENCOUNTERED AT 23.5' BORING CAVED TO 14'			40						

SUMMARY OF SUBSURFACE CONDITIONS: This log is part of the report prepared by GEO COMPANY for this project and should be read as part of the report. Subsurface conditions described in this log may change at this location with the passage of time. The data presented are a simplification of conditions encountered.

GROUNDWATER

	DEPTH	HOUR	DATE
▽			
▼			
▽			

SAMPLER TYPE

AC - Auger Cuttings: 1' - 4.5'

CA - California Sampler: 2.0" ID, 3.5" OD

SS - Split-Spoon Sampler:

ST - Shelby Tube Sampler:

GEO COMPANY

GEOTECHNICAL & ENVIRONMENTAL ENGINEERING

SHEET 1 of 1

BORING #	FIG. #
B-1	1

PROJECT NAME: SILVERCREST ESTATES | DATE: June 14, 2002

PROJECT LOCATION: 11950 SOUTH 4250 WEST | PROJECT NUMBER: 2K061001.1

SURFACE ELEVATION: 4762.00 | ELEVATION DATUM: | RIG TYPE: Mobile B-60

GEOLOGIST: Jeff Olson, P.E. | DRILLING METHOD: HSA | HOLE DIAMETER: 8"

DRILLER: Interstate

SOIL DESCRIPTION	USCS	GRAPHICAL LOG	DEPTH (FEET)	SAMPLE (TYPE & NO)	RECOVERY (in.) DRIVEN (in.)	RESISTANCE	OVM (ppm)	WATER LEVEL	REMARKS
TOPSOIL	TS								
CLAY, trace to some silt, stiff, moist gray-green oxide stained	CL			CA 1		8-13 16			
				CA 2		6-8 10			
very stiff			10	CA 3		3-10 27			
SAND, gravelly, some silt, very dense, moist, brown [CLAY LENSE - less than 6"] clayey	SC			CA 4		24-50/4"			
			20	CA 5		9-17.18			
BORING TERMINATED AT 20.5' NO GROUNDWATER ENCOUNTERED			30						
			40						

SUMMARY OF SUBSURFACE CONDITIONS: This log is part of the report prepared by GEO COMPANY for this project and should be read as part of the report. Subsurface conditions described in this log may change at this location with the passage of time. The data presented are a simplification of conditions encountered.

GROUNDWATER

	DEPTH	HOUR	DATE
▽			
▼			
▽			

SAMPLER TYPE

AC - Auger Cuttings:

CA - California Sampler: 2.0" ID, 3.5" OD

SS - Split-Spoon Sampler:

ST - Shelby Tube Sampler:

GEO COMPANY

GEOTECHNICAL & ENVIRONMENTAL ENGINEERING

SHEET 1 of 1

BORING #	FIG. #
B-2	1

PROJECT NAME: SILVERCREST ESTATES | DATE: June 14, 2002

PROJECT LOCATION: 11950 SOUTH 4250 WEST | PROJECT NUMBER: 2K061001.1

SURFACE ELEVATION: 4672.00 | ELEVATION DATUM: | RIG TYPE: Mobile B-6

GEOLOGIST: Jeff Olson, P.E. | DRILLING METHOD: HSA | HOLE DIAMETER: 8"

DRILLER: Interstate

SOIL DESCRIPTION	USCS	GRAPHICAL LOG	DEPTH (FEET)	SAMPLE (TYPE & NO)	RECOVERY (in.) DRIVEN (in.)	RESISTANCE	OVM (ppm)	WATER LEVEL	REMARKS
TOPSOIL	TS								
SILT, trace sand, trace clay, very stiff, dry to moist, gray				CA 1		15-18 28			
				CA 2		9-10 12			
	ML								
becomes stiff [SAND LENSE at tip of sampler - less that 3"]			10	CA 3		5-8 9			
				CA 4		7-12 12			
BORING TERMINATED AT 15.5' NO GROUNDWATER ENCOUNTERED			20						
			30						
			40						

SUMMARY OF SUBSURFACE CONDITIONS: This log is part of the report prepared by GEO COMPANY for this project and should be read as part of the report. Subsurface conditions described in this log may change at this location with the passage of time. The data presented are a simplification of conditions encountered.

GROUNDWATER

	DEPTH	HOUR	DATE
▽			
▼			
▽			

SAMPLER TYPE

AC - Auger Cuttings:

CA - California Sampler: 2.0" ID 3.5" OD

SS - Split-Spoon Sampler:

ST - Shelby Tube Sampler:

GEO COMPANY

GEOTECHNICAL & ENVIRONMENTAL ENGINEERING

SHEET 1 of 1

BORING #	FIG. #
B-3	1

PROJECT NAME: SILVERCREST ESTATES | DATE: June 14, 2002

PROJECT LOCATION: 11950 SOUTH 4250 WEST | PROJECT NUMBER: 2K061001.1

SURFACE ELEVATION: 4874.50 | ELEVATION DATUM: | RIG TYPE: Mobile B-60

GEOLOGIST: Jeff Olson, P.E. | DRILLING METHOD: HSA | HOLE DIAMETER: 8"

DRILLER: Interstate

SOIL DESCRIPTION	USCS	GRAPHICAL LOG	DEPTH (FEET)	SAMPLE (TYPE & NO)	RECOVERY (in.) DRIVEN (in.)	RESISTANCE	OVM (ppm)	WATER LEVEL	REMARKS
TOPSOIL - grassy	TS								
SILTY CLAY, stiff to very stiff, dry, light gray, oxide stained	CL			CA 1		18-27 24			
				CA 2		15-17 20			
			10	CA 3		6-13 24			
SAND, fine-grained, silty, moist, mediun dense to dense, buff to tan oxide stained	SM								
trace to some gravel				CA 4		24-40 50			
silty			20	CA 5		18-24 27			
SILTY CLAY, medium plastic, soft to medium, moist gray less silt and plastic wet sandy lenses and zones	CL			CA 6		3-4 5			
			30						
BORING TERMINATED AT 30.5' NO GROUNDWATER ENCOUNTERED									
			40						

SUMMARY OF SUBSURFACE CONDITIONS: This log is part of the report prepared by GEO COMPANY for this project and should be read as part of the report. Subsurface conditions described in this log may change at this location with the passage of time. The data presented are a simplification of conditions encountered.

GROUNDWATER

	DEPTH	HOUR	DATE
▽			
▼			
▽			

SAMPLER TYPE

AC - Auger Cuttings:

CA - California Sampler: 2" ID, 3.5" OD

SS - Split-Spoon Sampler:

ST - Shelby Tube Sampler:

GEO COMPANY

GEOTECHNICAL & ENVIRONMENTAL ENGINEERING

SHEET 1 of 1

BORING #	FIG. #
B-4	1

PROJECT NAME: SILVERCREST ESTATES | DATE: June 14, 2002

PROJECT LOCATION: 11950 SOUTH 4250 WEST | PROJECT NUMBER: 2K061001.1

SURFACE ELEVATION: 4867.00 | ELEVATION DATUM: | RIG TYPE: Mobile B-60

GEOLOGIST: Jeff Olson, P.E. | DRILLING METHOD: HSA | HOLE DIAMETER: 8"

DRILLER: Interstate

SOIL DESCRIPTION	USCS	GRAPHICAL LOG	DEPTH (FEET)	SAMPLE (TYPE & NO)	RECOVERY (in.) DRIVEN (in.)	RESISTANCE	OVM (ppm)	WATER LEVEL	REMARKS
TOPSOIL grassy cover	TS								
SILTY CLAY, cohesive, stiff to very stiff, dry, light gray	CL			CA 1		21-24 30			
				CA 2		14-12 19			
			10	CA 3		6-11 14			
SAND, fine-grained, silty and clayey, medium dense, moist, buf to light brown	SM								
SAND, gravelly, silty, dense to very dense to extremely dense, moist, gray	GM			CA 4		50/5"			
			20	CA 5		50/6"			
BORING TERMINATED AT 25.5' NO GROUNDWATER ENCOUNTERED			30						
			40						

SUMMARY OF SUBSURFACE CONDITIONS: This log is part of the report prepared by GEO COMPANY for this project and should be read as part of the report. Subsurface conditions described in this log may change at this location with the passage of time. The data presented are a simplification of conditions encountered.

GROUNDWATER

	DEPTH	HOUR	DATE
▽			
▼			
▽			

SAMPLER TYPE

AC - Auger Cuttings:

CA - California Sampler: 2" ID, 3.5" OD

SS - Split-Spoon Sampler:

ST - Shelby Tube Sampler:

GEO COMPANY

GEOTECHNICAL & ENVIRONMENTAL ENGINEERING

SHEET 1 of 1

BORING # B-5 | FIG. #

PROJECT NAME: SILVERCREST ESTATES | DATE: June 17, 2002

PROJECT LOCATION: 11950 SOUTH 4250 WEST | PROJECT NUMBER: 2K061001.1

SURFACE ELEVATION: 4889.00 | ELEVATION DATUM: | RIG TYPE: Mobile B-60

GEOLOGIST: Jeff Olson, P.E. | DRILLING METHOD: HSA | HOLE DIAMETER: 8"

DRILLER: Interstate

SOIL DESCRIPTION	USCS	GRAPHICAL LOG	DEPTH (FEET)	SAMPLE (TYPE & NO)	RECOVERY (in.) DRIVEN (in.)	RESISTANCE	OVM (ppm)	WATER LEVEL	REMARKS
TOPSOIL - grassy sufrace SILTY CLAY, stiff to very stiff, dry, light gray	TS			CA 1		17-27 28			
	CL			CA 2		13-18 20			
SAND, fine-grained, slightly silty, trace to some mica, dry, brown	SM		10	CA 3		15-20 25			
GRAVEL, sandy, slightly silty, dense to very sense, dry to damp, brownish gray clayey, moist to wet	GP			CA 4		16-14 14			
BORING TERMINATED AT 15.5' NO GROUNDWATER ENCOUNTERED			20 30 40						

SUMMARY OF SUBSURFACE CONDITIONS: This log is part of the report prepared by GEO COMPANY for this project and should be read as part of the report. Subsurface conditions described in this log may change at this location with the passage of time. The data presented are a simplification of conditions encountered.

GROUNDWATER

	DEPTH	HOUR	DATE
▽			
▼			
▽			

SAMPLER TYPE

AC - Auger Cuttings:
CA - California Sampler: 2.0" ID, 3.5" OD
SS - Split-Spoon Sampler:
ST - Shelby Tube Sampler:

GEO COMPANY
GEOTECHNICAL & ENVIRONMENTAL ENGINEERING

SHEET 1 of 1

BORING # B-6 | FIG. #

PROJECT NAME: SILVERCREST ESTATES | DATE: June 17, 2002

PROJECT LOCATION: 11950 SOUTH 4250 WEST | PROJECT NUMBER: 2K061001.1

SURFACE ELEVATION: 4697.00 | ELEVATION DATUM: | RIG TYPE: Mobile B-60

GEOLOGIST: Jeff Olson, P.E. | DRILLING METHOD: HSA | HOLE DIAMETER: 8"

DRILLER: Interstate

SOIL DESCRIPTION	USCS	GRAPHICAL LOG	DEPTH (FEET)	SAMPLE (TYPE & NO)	RECOVERY (in.) DRIVEN (in.)	RESISTANCE	OVM (ppm)	WATER LEVEL	REMARKS
TOPSOIL - grassy surface SILTY CLAY, very stiff to stiff, dry, light gray	TS			CA 1		15-34 36			
				CA 2		10-13 14			
becomes damp and more cohesive	CL		10	CA 3		3-4 6			
GRAVEL, sandy, trace silt and clay, dense to very dense, moist to dry	GP			CA 4		13-20 31			
			20	CA 5		33-41 46			
				CA 6		17-37 41			
SAND, medium-grained, saturated	SM								
CLAY, with sand seams, stiff ti very stiff, wet, light gray	CL		30	CA 7		11-12 17			
BORING TERMINATED AT 30.5' GROUNDWATER ENCOUNTERED ABOUT 28' BELOW GRADE			40						

SUMMARY OF SUBSURFACE CONDITIONS: This log is part of the report prepared by GEO COMPANY for this project and should be read as part of the report. Subsurface conditions described in this log may change at this location with the passage of time. The data presented are a simplification of conditions encountered.

GROUNDWATER

	DEPTH	HOUR	DATE
▽			
▼			
▽			

SAMPLER TYPE

AC - Auger Cuttings: 2' - 4.5'

CA - California Sampler: 2.0" ID, 3.5" OD

SS - Split-Spoon Sampler:

ST - Shelby Tube Sampler:

GEO COMPANY

GEOTECHNICAL & ENVIRONMENTAL ENGINEERING

SHEET 1 of 1

BORING #	FIG. #
B-7	

PROJECT NAME: SILVERCREST ESTATES | DATE: June 17, 2002

PROJECT LOCATION: 11950 SOUTH 4250 WEST | PROJECT NUMBER: 2K061001.1

SURFACE ELEVATION: 4701.00 | ELEVATION DATUM: | RIG TYPE: Mobile B-60

GEOLOGIST: Jeff Olson, P.E. | DRILLING METHOD: HSA | HOLE DIAMETER: 8"

DRILLER: Interstate

SOIL DESCRIPTION	USCS	GRAPHICAL LOG	DEPTH (FEET)	SAMPLE (TYPE & NO)	RECOVERY (in.) DRIVEN (in.)	RESISTANCE	OVM (ppm)	WATER LEVEL	REMARKS
TOPSOIL - grassy surface CLAYEY SILT, very stiff to stiff, damp, light gray	TS ML			CA 1 CA 2		14-26 24 13-12 11			
GRAVEL, sand, some silt, dense to bery dense, dry	GP		10 20	CA 3 CA 4 CA 5 CA 6		5-6 5 11-16 14 28-29 33 18-19 41			
SAND, medium-grained, moist to wet	SP		30	CA 7		14-11 13			
BORING TERMINATED AT 30.5' NO GROUNDWATER ENCOUNTERED			40						

SUMMARY OF SUBSURFACE CONDITIONS: This log is part of the report prepared by GEO COMPANY for this project and should be read as part of the report. Subsurface conditions described in this log may change at this location with the passage of time. The data presented are a simplification of conditions encountered.

GROUNDWATER

	DEPTH	HOUR	DATE
▽			
▼			
▽			

SAMPLER TYPE

AC - Auger Cuttings: 1.5' - 4.5'

CA - California Sampler: 2.0" ID, 3.5' OD

SS - Split-Spoon Sampler:

ST - Shelby Tube Sampler:

GEO COMPANY

GEOTECHNICAL & ENVIRONMENTAL ENGINEERING

SHEET 1 of 1

BORING # B-8 | FIG. #

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS

CA	California Sampler	VS	Vane Shear
SS	Split Spoon – 1⅜" I.D., 2" O.D., unless otherwise noted	OS	Osterberg Sampler – 3" Shelby Tube
		HS	Hollow Stem Auger
ST	Shelby Tube – 2" O.D., unless otherwise noted	WS	Wash Sample
PA	Power Auger	FT	Fish Trail
DB	Diamond Bit – NX:BX:AX	RB	Rock Bit
AS	Auger Sample	BS	Bulk Sample
JS	Jar Sample	PM	Pressuremeter test-in situ

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split spoon, except where noted.

WATER LEVEL MEASUREMENT SYMBOLS

WL	Water Level
WCI	Wet Cave In
DCI	Dry Cave In
WS	While Sampling
WD	While Drilling
BCR	Before Casing Removal
ACR	After Casing Removal
AB	After Boring

MOISTURE CONTENT VISUAL DESCRIPTION

Dry	Below Plastic Limit
Slightly Damp	Difficult to Mold
Damp	Below Optimum Moisture Content
Moist	At Optimum Moisture Content
Wet	Above Optimum Moisture Content
Saturated	Fluid

Water levels indicated on the boring logs are the levels measured in the boring at the times indicated. In pervious soils, the indicated elevations are considered reliable ground water levels. In impervious soils, the accurate determination of ground water elevations is not possible in even several days observation, and additional evidence of ground water elevations must be sought.

GRADATION DESCRIPTION & TERMINOLOGY

Coarse Grained or Granular soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: clays or clayey silts if they are cohesive, and silts if they are non-cohesive. In addition to gradation, granular soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their strength or consistency, and their plasticity.

Major Component Of Sample	Size Range	Descriptive Terms Of Components Also Present in Sample	Percent of Dry Weight Coarse	Fine
Boulders	Over 8 in. (200mm)	Trace	1 – 9	0 – 5
Cobbles	8 in. to 3 in. (200mm to 75mm)	Little	10 – 19	
Gravel	3 in. to #4 sieve (75mm to 2mm)	Some	20 – 29	6 – 12
Sand	#4 to #200 sieve (2mm to 0.074mm)	(*component*)-y	30 – 44	13 – 44
Silt	Passing #200 sieve (0.074mm to 0.005mm)	And	45 – 50	45 – 50
Clay	Smaller than 0.005mm			

CONSISTENCY OF COHESIVE SOILS

Unconfined Comp. Strength, Qu, tsf	Consistency
<0.25	Very Soft
0.25 – 0.49	Soft
0.50 – 0.99	Medium (Firm)
1.00 – 1.99	Stiff
2.00 – 3.99	Very Stiff
4.00 – 8.00	Hard
>8.00	Very Hard

RELATIVE DENSITY OF GRANULAR SOILS

N – Blows/ft.	Relative Density
0 – 3	Very Loose
4 – 9	Loose
10 – 29	Medium Dense
30 – 49	Dense
50 – 80	Very Dense
80 +	Extremely Dense

Qp = Unconfined compressive strength in tons per square foot (TSF) obtained with calibrated penetrometer.

APPENDIX

Compaction Criteria

Table I
COMPACTION CRITERIA

Non-Expansive Materials

Area	Compaction*	Moisture Content*
1) Below spread footings, floor labs and other structural support areas	minimum 95%	± 3 percent of Optimum Moisture content (OMC)
2) Driveways and Parking Lots	minimum 95%	± 3 percent of OMC
3) Landscape areas around the structures	minimum 90%	± 3 percent of OMC
4) Landscape areas	minimum 85%	± 3 percent of OMC

* Modified Proctor Test (ASTM D-1557)

Low to Medium Expansive Materials

Area	Compaction**	Moisture Content**
1) Below spread footings, floor slabs and other structural support areas	Not recommended	Not recommended
2) Driveways and parking lots (to a depth of 3 feet below proposed grade)	minimum 95%	1 percent point below to 3 percent above OMC
3) Landscape areas around the structures	minimum 90%	1 percent below to 3 percent above OMC
4) Landscape areas	minimum 85%	3 percent below to 3 percent above OMC

** Standard Proctor Test (ASTM D-698)
Alternatively, Modified Proctor Test with recommended compaction decreased by 5%