SCOTT, COX & ASSOCIATES, INC. consulting engineers • surveyors

September 26, 2006

Harvey M. Hine, Architects
2505 Walnut Street, Suite 300
Boulder, Colorado 80302

Attn: Mr. Harvey M. Hine

Project: 06269S

Dear Mr. Hine:

Enclosed with this letter are three copies of the Subsurface Investigation Report for the proposed new structure to replace the existing structures at 1437-1441 Arapahoe Avenue in Boulder, Colorado.

If there are any questions regarding our investigation or the report, please do not hesitate to contact us.

Sincerely,

SCOTT, COX & ASSOCIATES, INC.

By: Kevin L. Hinds

Kevin L. Hinds, P.E.

Enclosures

1530 55th Street • Boulder, Colorado 80303 • (303) 444-3051 • Fax: (303) 444-3387

Project 6269S

SUBSURFACE INVESTIGATION

Proposed New Structure to
Replace the Existing Structures
1437-1441 Arapahoe Avenue
Boulder, Colorado

Prepared For:

Harvey M. Hine, Architects
2505 Walnut Street, Suite 300
Boulder, Colorado 80302

September 2006

Prepared By:

Scott, Cox & Associates, Inc.
1530 55th Street
Boulder, Colorado 80303
(303) 444-3051

Table of Contents
Project 06269S

SUBSURFACE INVESTIGATION
PROPOSED NEW STRUCTURE TO
REPLACE THE EXISTING STRUCTURES
1437-1441 ARAPAHOE AVENUE
BOULDER, COLORADO

PURPOSE

This report presents the results of a subsurface investigation performed September 12, 2006, for the proposed new structure to replace the existing structures at 1437-1441 Arapahoe Avenue in Boulder, Colorado. This investigation was made to provide design criteria for the foundation system of the proposed new structure to be located on this site. A total of three (3) borings were completed during the course of this investigation. The locations of the borings are indicated on the Boring Location Map (Figure 1).

Factual data gathered during the fieldwork is summarized in Figure 2 and Table 1 attached. The results of this investigation, our opinions that are based on this investigation, and our experience in the general area, are summarized in this report.

INVESTIGATION DETAILS

The field investigation consisted of drilling three (3) borings across the site in the areas of the proposed construction and where accessible with a drill rig. The borings were completed with 4-inch diameter, continuous flight power augers using a truck-mounted drill rig.

The augers are utilized to bore and clean the hole to the desired sampling depth. The augers are then removed, and a 2-inch I.D. California spoon sampler is inserted to the desired testing depth. The sampler is then driven with blows of a standard 140-pound hammer falling a distance of 30 inches.

The sampler is driven a total of 12 inches or a maximum of 50 blows. The number of blows required to drive the sampler 12 inches, or a fraction thereof, constitutes the penetration test. The test is similar to the Standard Penetration Test described in ASTM D1586. This test, when properly evaluated, is a measure of the soil strength and density. The results of these tests are shown on the Graphic Boring Logs (Figure 2).

The testing program consisted of performing the following tests where appropriate:

Consolidation/Swell

- Consolidation/Swell tests were performed to determine the relative stability of the different subsurface soil types.

Natural Dry Density

- The dry density of the soils provides us with an indication of the relative compaction of the surficial soils.

Natural Moisture Content

- The moisture content test provides us with information, which may indicate the probability of instability due to consolidation or swell that, may be caused by excessive wetting or drying.

Unconfined Compressive Strength

- The approximate unconfined compressive strength was determined by use of a calibrated hand penetrometer. The unconfined compressive strength can be useful in determining the bearing capacity of a soil.

PROPOSED DEVELOPMENT

As currently planned, the existing structures are to be razed and the proposed new structure is to be placed over most of the site at or above the existing grade. The structure is to extend three stories above grade and is to contain retail/office space with residential above. The structure is to be steel frame with concrete deck and brick veneer or stucco supported by poured-in-place reinforced concrete foundation walls. The loadings are anticipated to be moderate to heavy, typical of this type of construction.

If actual building plans differ from the above description, we should be notified so that our recommendations can be reviewed and revised, if necessary.

SITE CONDITIONS

At the time of our investigation, the building site consisted of an asphalt or concrete parking and drive areas with the existing structures on the central and northern portion of the site. The site was relatively flat. The site was bordered on the south by Arapahoe Avenue, to the east by 15th Street, to the west by an alley and existing structures and to the north by existing structures. Vegetation on the site consisted of trees and shrubs in the landscaped areas. It is also our understanding that the site at one time contained a gas station and possibly buried tanks.

SUBSOILS

All of the borings encountered a thin layer of asphalt at the surface. The subsoils at the site generally consisted of varying amounts of fill consisting of silty, clay and sand with gravel to depths of approximately 1 to 5 feet. Dark brown clayey silt and sand was encountered beneath the fills in one of the borings and extended to a depth of approximately 3 feet. Brown, silty, slightly clayey sand and gravels containing cobbles and boulders were encountered at depths of approximately 2 to 5 feet and extended to depths of approximately 20 to 22½ feet. Bedrock was encountered below the sand and gravel in all of the borings and extended to the maximum depths explored of approximately 24 feet. The bedrock consisted of a gray, silty, claystone.

A detailed description of the soils encountered in this investigation is presented with the Graphic Boring Logs (Figure 2).

GROUNDWATER CONDITIONS

Groundwater was noted in the borings at the time of drilling and when checked subsequent to drilling at depths ranging from approximately 12 to 13½ feet below the existing ground surface. We are past the time of the seasonal high groundwater table, and some rise of the groundwater table must still be anticipated. It is not possible to forecast the seasonal high groundwater table based on short duration monitoring. The only sure method of such determination is monitoring of the water table through the spring and early summer (typical seasonal high groundwater levels occur about July 1). Groundwater is not considered to be a design and construction concern due to the proposed at or above grade construction. However, improper drainage could result in a "perched" groundwater table. This is discussed further in the "Site Drainage Considerations" section that is included later in this report. Also, the depth of water flowing in nearby Boulder Creek will also influence the groundwater table at the site.

FOUNDATION RECOMMENDATIONS

The existing fill is not considered suitable as a foundation bearing material. The clayey silt and sands are of low expansive potential and are light weight and somewhat collapse prone. The sand and gravel is considered to be very low to non-expansive. The claystone is considered to be of low expansive potential, however when tested on nearby investigations indicates some lenses and layers of moderately to highly expansive material. In general, the proposed foundation cuts would place the structure down near the sand and gravel, well above the claystone.

With the considerations presented above, it is our opinion that the structure can be supported on conventional spread footings, either continuous spread footings or isolated pad footings, founded on the native sand and gravel soils, utilizing a uniform soil bearing pressure not to exceed 3,500 PSF. The loading should be based on the dead load plus 100% of the maximum anticipated live load.

Please note that it may be necessary to verify that existing fill or weak soils are not present within the proposed footing locations. This should be accomplished at the time of excavation and may require the digging of test pits (away from the footing lines and pad locations). If fill soils are identified, then it will be necessary to remove these materials and place back a granular structural fill as outlined below.

The footing lines should be carefully inspected by an engineer from our office prior to placement of the footings. Any areas of soft, loose, or existing fill soils, which are present at the proposed footing level, should be removed down to satisfactory, undisturbed soil. Footings can then be placed directly upon the native undisturbed soils, or the excavation can be backfilled to the desired footing elevation with compacted, select granular fill placed in lifts not to exceed 9 inches in thickness and compacted to a minimum of 100% of maximum density as determined by the moisture/density relationship ASTM D698. We recommend that all disturbed footing bearing surfaces be compacted with a conventional vibratory compactor prior to setting the footing forms.

Differential settlement must be considered in the design of the foundation system. Differential settlement should be kept to a minimum, which can be achieved by keeping loads as uniform as possible throughout the foundation elements.

An alternative foundation would be to found the structure on straight-shaft piers drilled into bedrock. This would require relatively long piers drilled through wet caving soils. We are available to provide appropriate recommendations if you would like to pursue this option.

SLABS-ON- GRADE

The soils beneath slabs-on-grade (excluding the existing fill and upper level clayey silt and sand soils) are anticipated to be relatively stable under light slab loads. Therefore, in this case, slabs-on-grade can be placed directly on natural, undisturbed sand and gravel or properly compacted granular fill.

Fill, debris and organic materials should be stripped prior to placing any slab. Prior to placing the slab, we recommend that the area on which the slab is to be placed be carefully inspected to delineate any areas of soft or loose soil. These areas should be densified in place or removed down to acceptable sand and

gravel soil and replaced with compacted fill. It is our opinion that granular site materials would be satisfactory for this purpose. If fill is required to bring the site to the desired slab elevation, we recommend that granular fill be utilized and that the fill be compacted in maximum 9 inch lifts to a minimum of 95% maximum density, as determined by the standard moisture/density relationship test ASTM D698. It should be noted that failure to provide adequate fill compaction could result in settlement, which may cause slab damage such as cracking and tilting.

SITE DRAINAGE CONSIDERATIONS

It is essential that site grading be provided to prevent infiltration of surface water into the foundation system. The following methods of preventing this infiltration are recommended. These recommendations will also assist in preventing a "perched" groundwater table.

1. Mechanically compact all fill around the building, including the backfill. Compaction by ponding or saturation must not be permitted. The backfill should be compacted to not less than 90% of maximum density as determined by the standard moisture/density relationship ASTM D698. Backfill, which is to support slabs should be compacted to 95% of maximum dry density. Note that some moisture may need to be added to the soils in order to obtain the proper compaction.

2. Provide an adequate grade for rapid runoff of surface water away from the structure (a minimum of 5% for the first 10 feet away from the structure is recommended or 2% if paved).

3. A well constructed, leak-resistant series of gutters, or other roof drainage system, is essential.

4. Discharge roof downspouts and all other water collection systems well beyond the limits of the backfill, a minimum of 5 feet.

5. Observe and comply with any other precautions, which may be indicated during design and construction.

It is our opinion that perimeter drainage systems are not necessary with the at or above grade construction. If plans change to include any below grade spaces, we should be contacted to provide appropriate recommendations.

EARTH RETAINING STRUCTURES

At this site we recommend that the walls be designed using a lateral earth pressure equivalent to that developed by a fluid weighing 40 pcf plus any

additional surcharge loads. Use of this value assumes that the wall will be backfilled with the very granular site soils and that these soils will not be allowed to become saturated at any time during the life of the wall. Saturation can be prevented by proper site grading and drainage and installation of drainage systems at the base of any walls that are to retain soil above grade.

PAVEMENT INVESTIGATION

The upper level soils consisting of silty clay, sand and gravel anticipated to be beneath pavements are of low to moderate strength and are somewhat moisture sensitive.

An "R" value of 10 is considered appropriate for use at this site for the subgrade soils. However, there may be areas where removal and replacement will also be necessary.
For the purpose of this report, we are presenting two different pavement sections, one for light traffic use for the parking lot and the other for heavy traffic loadings which will be subject to semi-trucks, and garbage trucks. We have used an 18 KIP EDLA value of 5 for the parking lot and an 18 KIP EDLA value of 20 for the heavy truck use. These values should be confirmed when traffic studies are completed.

A design ESAL of 36,500 (EDLA of 5) is used for car and light truck parking. And, a design ESAL of 146,000 (EDLA of 20) is used for travelways and truck access. Therefore, the design parameters are as shown on the table below.

	Car & Light Truck Parking	Travelways & Truck Access
ESAL	36,500	146,000
Reliability	80.00	80.00
Overall Deviation	0.440	0.440
Resilient modulus of subgrade	3,562	3,562
PSI Loss due to Traffic	2.500	2,500

Utilizing the CDOH flexible pavement computer design program, we obtained a design structural number of 2.40 for the car and light truck parking and a design structural number of 2.96 for travelways and truck access. These values are the basis for the design calculations.

Groundwater was encountered during our investigation at depths greater than 5 feet. It is our opinion that groundwater is not a major factor in the pavement design provided no major cuts are planned.

Following are the pavement sections recommendations:

Car and Light Truck Parking Only

Alternative 1	3.0" Asphaltic Concrete over 8.0" Aggregate Base Course (Class 6)
Alternative 2	6.0" Full Depth Asphaltic Concrete
Alternative 3	6.0" Portland Cement concrete

Travelways and Truck Access

Alternative 1	4.0" Asphaltic Concrete over 9.0" Aggregate Base Course (Class 6)
Alternative 2	7.0" Full Depth Asphaltic Concrete
Alternative 3	7.0" Portland Cement concrete

Additionally, we recommend that areas that are subject to loadings such as trash truck stopping, turning, and off-loading dumpsters be designed with concrete pads. The pads should be a minimum of 10 inches thick and reinforced with a minimum of #4 bars at 12 inch centers, both directions. The bars should be placed 3 inches above the bottom of the pad.

It should be noted that this design is based on typical strength coefficients for road pavement materials being utilized in the area. The assumptions are as follows:

Material	Strength Coefficient (per inch)
Asphaltic concrete pavement	.43
Base Course	.14

The strength coefficients of the materials to be used in the construction should be obtained from the contractor supplying the materials. Adjustment in the pavement section should be made to reflect the actual strength of the materials being utilized.

Subgrade Preparation

It is important to note that successful implementation of any of the pavement sections assumes a properly prepared subgrade. In connection with subgrade preparation, we recommend that:

1. Topsoil, any organic materials and any debris should be stripped from all areas to be paved.

2. The subgrade soils should be brought to proper grade for the selected section.

3. The subgrade materials should be scarified to the minimum depth of 6 inches to a minimum of 95% of maximum dry density as determined by the ASTM D698 specification. Further, any fills which are required should utilize, if available, on-site materials with a classification equal to or greater than the subgrade soils on which the design is based. Any fill material shall be subject to the approval of the geotechnical engineer. Compaction of any fill should be to the above requirements. When compaction of the subgrade is achieved, the pavement section should be placed on the compacted subgrade. We recommend that the base course be compacted to a minimum of 95% as determined by the modified moisture/density test ASTM D1557 and the asphalt compacted to a minimum of 95% as determined by the standard Marshall Test ASTM D1559.

Due to the relative moisture sensitivity of the on-site soils, it is extremely important that proper site grading and drainage by maintained on and around the areas to be paved. Water should not be allowed to pond on top of the pavement, and landscaping should not create negative drainage toward the edge of the paved area. Care should be taken so that landscaping which requires irrigation does not create adverse effects to the pavement.

It should also be noted that there are many alternative remedial treatments, such as lime stabilization and moisture conditioning that could add additional stability to the pavement areas, by making the subgrade soils less moisture sensitive. There are different cost considerations with each possible alternative. If you would like to discuss the alternatives, please contact us.

We recommend that all work be inspected by a qualified geotechnical engineer and that density tests be performed to assure that the required compaction is being obtained.

LIMITATIONS

The borings in this investigation are believed to present a reasonably accurate knowledge of the existing subsoils. However, variations of subsoils not indicated by the borings are always possible. Therefore, we recommend that all excavations be inspected by an engineer knowledgeable in foundation soils to confirm that the soils actually are as indicated by the investigation and to make recommendations if differences are noted.

Identification of potential hazardous waste material, if any, at this site is beyond the scope of work for which the activities of this project were intended.

It should be mentioned that the recommendations presented in this report assume that the drainage recommendations provided in this report are strictly adhered to. If the soil supporting the foundation elements becomes totally inundated due to poor surface drainage, it is possible that there could be damage to the foundation system and the slabs-on-grade.

We would like to stress that it is not possible to fully determine the seasonal groundwater table fluctuations (and, therefore, the seasonal high groundwater table) with the short durations monitoring completed during the scope of this investigation. We have presented the method necessary to do such determination in the section titled "Groundwater Conditions". It is always possible that the ground water table could rise to unanticipated levels, due to unknown or unrecognized groundwater sources. Unanticipated groundwater levels will also impact the recommendations, contained in this report, for the perimeter drainage system type and extent, which may be inappropriate for the groundwater table levels that rise to unanticipated levels.

Due to the changing nature of geotechnical engineering practices, the information and recommendations provided in this report shall only be valid for two (2) years following the date of issue. After that time, our office should be contacted to review the information presented in this report and provide updated recommendations and design criteria appropriate for the engineering methodologies used in standard practice at that time.

INSPECTION AND QUALITY CONTROL

Placement of any significant thickness of fill, particularly fill that is to remain in place beneath loaded slabs or other structural elements, should be inspected and tested by a representative from our office. We also recommend that all foundation excavations be inspected by an engineer from our office.

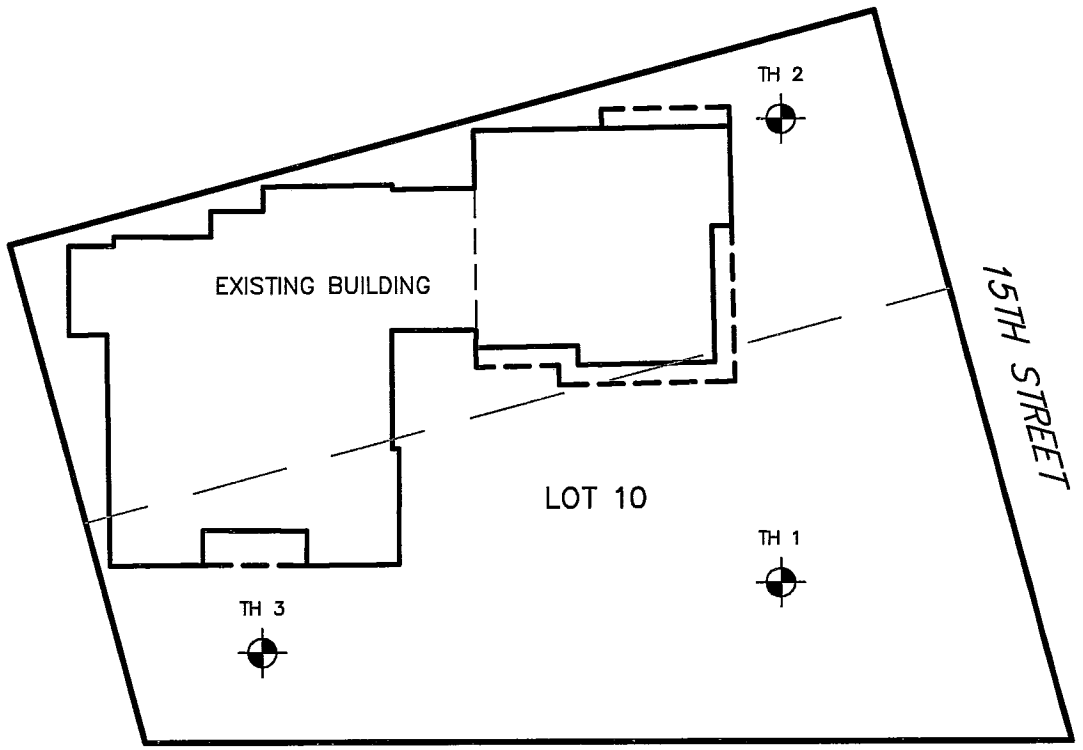
Sincerely,

SCOTT, COX & ASSOCIATES, INC.

By: _____
Kevin L. Hinds, P.E.

Reviewed

By: _____
M. Edward Glassgow, P.E.



Scale: 1" = 30'

0 7.5 15 30

LEGEND

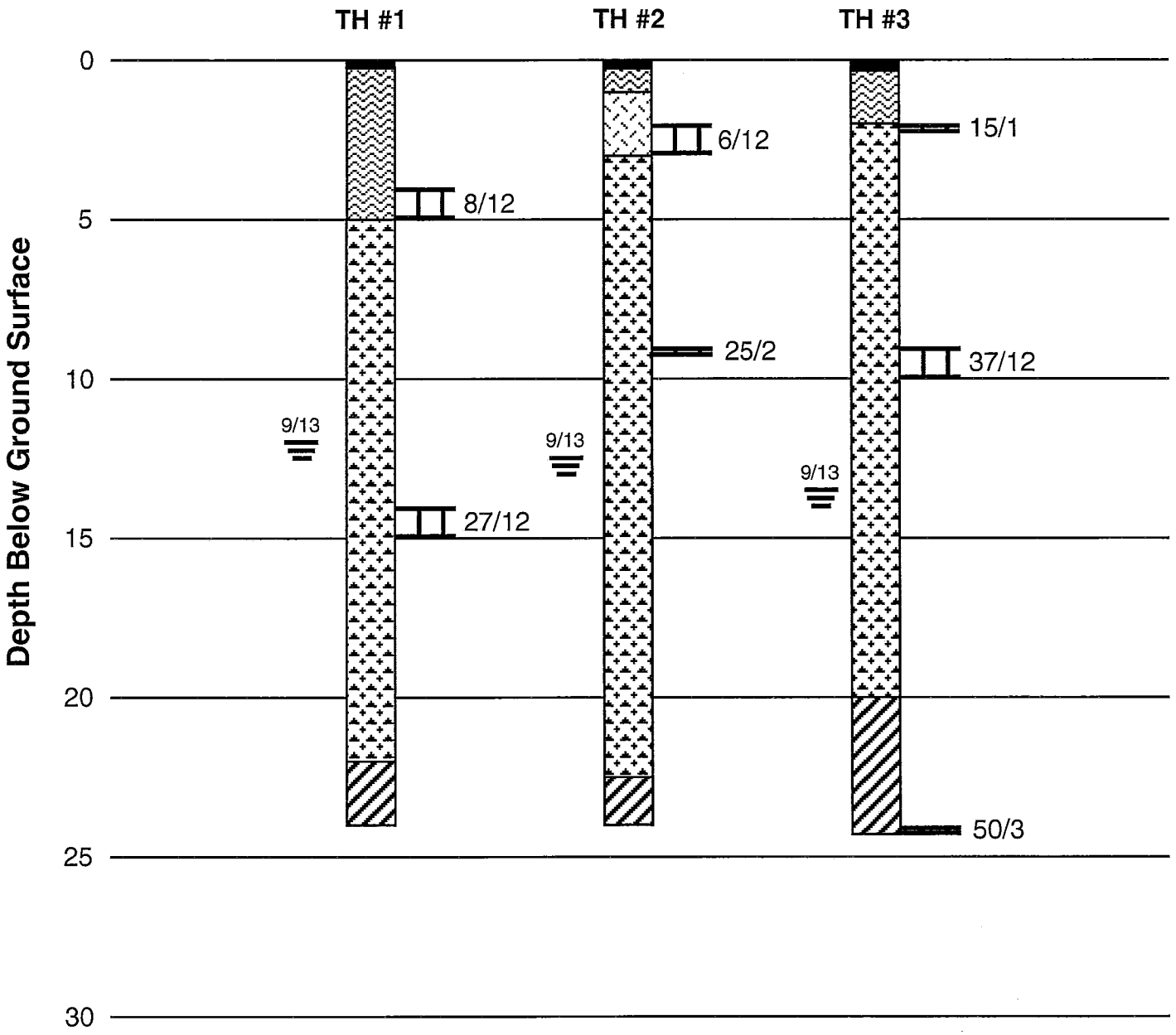
SOILS INVESTIGATION BORING LOCATION

FIGURE 1
BORING LOCATION MAP

SCOTT, COX & ASSOCIATES, INC.
consulting engineers • surveyors
1530 55th Street • Boulder, Colorado 80303
(303) 444 – 3051

9/21/06 JOB NO. 06269S DRAWING NO. 06269S

Graphic Boring Logs



SCOTT, COX & ASSOCIATES, INC.
consulting engineers • surveyors
1530 55th Street • Boulder, Colorado 80303
(303) 444-3051

Project 06269S

Description of Soil Types

Asphalt

Fill - Brown, silty, clay, sand and gravel - Contains some brick pieces

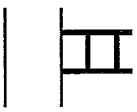
Dark brown, clayey silt and sand

Brown, silty, slightly clayey sand and gravel - Contain some cobbles and small boulders

Gray, silty claystone

TH #1 Soils investigation boring number

Indicates a change in soil type - May be gradual.



12/12 indicates that 12 blows of a 140-pound hammer falling 30 inches were required to drive a 2-inch, inside diameter sampler 12 inches.

Indicates the groundwater table and the date that the measurement was taken

Notes

1. Borings were performed September 12, 2006 with four-inch diameter, continuous flight power augers.

2. Boring logs shown in this report are subject to the limitations, explanations and conclusions of the report.

SCOTT, COX & ASSOCIATES, INC.
consulting engineers • surveyors
1530 55th Street • Boulder, Colorado 80303
(303) 444-3051

Table 1
Summary of Soils Properties
Page 1/1
Project
06269S

PROPERTIES AT NATURAL MOISTURE CONTENT			CONSOLIDATION/SWELL				DESCRIPTION
Natural Moisture (%)	Natural Dry Density (PCF)	Unconfined Compression (PSF)	Loading (PSF)	Settlement (Dry) (%)	Settlement (Saturated) (%)	Swell (%)	
TH # 2 @ 2							
10.0	78.0	6000	100	0.00		3.90	Dark brown, clayey, silt
			1000			0.60	and sand
			2000		2.20		
3.9 % Swell upon the addition of water							