

Geologic Reconnaissance Study
Preliminary Geotechnical Evaluation,
Proposed Development
Lake View Condominium Development
Silver Creek
Grand County, Colorado

Prepared for:

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Job Number 99-1123

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GROUND

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TABLE OF CONTENTS

	Page
Purpose and Scope of Study	1
Proposed Development.....	1
Site Conditions	1
Field Investigation	2
Laboratory Investigation	2
Surficial Soil Conditions	2
Overburden Conditions	2
Bedrock Conditions	3
Geologic Setting	3
Geologic Hazards Considerations	4
Preliminary Geotechnical Recommendations	7
Limitations	9
Site Vicinity Map	Figure 1
Geologic Site Map	Figure 2
Location of Test Holes	Figure 3
Log of Test Holes	Figures 4 - 6
Legend and Notes	Figure 7
Summary of Laboratory Test Results	Table 1
References	Appendix A

**Preliminary Geotechnical Evaluation
Geologic Hazards Study
Proposed Lakeview Condominium Development
Grand County, CO**

PURPOSE AND SCOPE OF STUDY

This report presents the results of a preliminary geologic reconnaissance and geotechnical evaluation for the proposed Lake View Condominium Project located in Grand County, Colorado. The project area is shown in Figure 1.

A field reconnaissance and literature review were conducted to obtain information on potential geologic or geotechnical impacts to the proposed development. The results of the field study are contained herein. This report has been prepared to summarize the data obtained and to present our preliminary conclusions and recommendations based on the observed conditions and proposed construction.

PROPOSED DEVELOPMENT

The proposed development will include development of an approximately 30 acre parcel of land located at Township 1 North, Range 76 West in Southeast Portion of Section 8, located west of the 6th P.M. The proposed development includes approximately twenty-nine multi-family dwelling areas of four to eight units each comprising a total of 216 individual units, local streets, and underground utilities.

SITE CONDITIONS

The site conditions generally consist of undulating mountainous meadow terrain accessed by Village Road. Ten Mile Creek, a tributary of the Fraser River is the principal drainage closest to the site and is located approximately one-half mile to the west. A small established intermittent swale is located in the north portion of the site. The site slopes predominately to the west at approximately 15 to 25 percent. The maximum elevation across the site is located in the east portion of the site, at approximately 8,370 feet. The minimum elevation at the site is approximately 8,080 feet and is located in the northwest portion of the site, where the established swale leaves the site. Direction of slope varies with topography but generally slopes down to the west, toward Ten Mile Creek. The steepest slope observed was on the order of 25 percent, and was located in the upland east portion of the site.

The project area is typically vegetated with typical alpine grasses and sage. Colluvial material was observed on the surface of most of the site area, and contained cobbles and boulders of Dakota Sandstone. A site vicinity map is shown in Figure 1.

**Preliminary Geotechnical Evaluation
Geologic Hazards Study
Proposed Lakeview Condominium Development
Grand County, CO**

FIELD INVESTIGATION

A preliminary subsurface exploration program for the proposed development was conducted on November 18, 1999. A total of twelve (12) test pits were excavated with a track backhoe. These locations are shown on Figure 3.

The soil samples obtained from the investigation were examined and classified in the laboratory by the project engineer. The graphic logs of the test holes are shown on Figures 4 through 6 with an explanatory legend and notes on Figure 7.

LABORATORY INVESTIGATION

Samples obtained from our exploratory holes were examined and classified in the laboratory by the project engineer. Laboratory testing included standard property tests such as natural moisture contents, dry unit weights, grain size analyses, and liquid and plastic limits. Swell-consolidation tests were performed on selected undisturbed samples of the on-site soils to determine swell potential upon wetting and loading. Results of the laboratory testing program are summarized on Table 1. The laboratory testing was conducted in general accordance with applicable ASTM specifications.

SURFICIAL SOIL CONDITIONS

Cimmarron loam has been identified as the surficial soil on the site. This information was obtained by the from the Soil Survey of Grand County Area, Colorado, United States Department of Agriculture, Soil Conservation Service.

This soil type is derived generally from weathering of shale and claystone materials. It is considered to be deep, well drained with a slow permeability rate.

OVERBURDEN CONDITIONS

The subsurface conditions encountered in the test holes were variable and consisted of 1 to 1.5 feet of topsoil underlain by isolated areas of overburden soils which consisted of colluvial materials varying in thickness of up to 2 feet. The colluvial material consisted of unsorted unstratified colluvial materials including clays, silts, sands, and sands/gravel mixtures with occasional cobbles and boulders of sandstone. The highly variable nature of the overburden conditions are a result of in-place weathering of the multi-lithologic Morrison Formation, and also previous deposition of colluvial sandstone materials from the Dakota Sandstone Formation

**Preliminary Geotechnical Evaluation
Geologic Hazards Study
Proposed Lakeview Condominium Development
Grand County, CO**

located upgradient from the site. The overburden material samples taken in the field are classified as follows.

Topsoil: brown to black, moist, humic.

Clay: Silty to sandy to gravelly with occasional gravels, cobbles and boulders of sandstone, medium to highly plastic, stiff to hard, slightly moist, brown to gray in color.

Gravel: Sandy to silty to clayey with occasional cobbles and boulders of sandstone, non to medium plastic, medium dense to dense, slightly moist, brown in color.

BEDROCK CONDITIONS

The Jurassic Age Morrison Formation underlies the site area and is composed claystone with lenses of light tan to brown arkosic sandstone and conglomerate. The claystone material samples taken in the field are classified as follows.

Claystone: Sandy to very sandy with interbedded sandstone lenses and occasional near surface sandstone cobbles and boulders, medium plastic, hard to very hard, slightly moist, green to gray to brown.

GEOLOGIC SETTING

The site is situated on the western flank of the Front Range of the Rocky Mountains just south of the North Park Basin. The underlying bedrock in the site area is the Jurassic Age Morrison Formation (Schroeder 1995). This Mesozoic sedimentary unit, along with others is located in an uplifted horst block environment as a result of Larimide Age mountain building events. Subsequent folding of the bedrock resulted in the occurrence of a northward plunging to almost level anticline structure mapped as the Ten Mile Anticline. The bedrock underlying the site in the east portion of the site is located along the axis of the anticline with no apparent dipping of beds noticeable in the test pits. The west portion of the site is located in the west leg of the anticline, with poorly defined apparent bedding dip angles of up to approximately 20 degrees to the west observed in the test pits. Subsequent erosional processes have shaped the topography seen today. A geologic site map is shown in Figure 2.

**Preliminary Geotechnical Evaluation
Geologic Hazards Study
Proposed Lakeview Condominium Development
Grand County, CO**

GEOLOGIC HAZARDS CONSIDERATIONS

Ground Water: During test pit excavating, free groundwater was not encountered, however groundwater elevations should be expected to fluctuate in response to periods of heavy precipitation, run-off, and landscape irrigation. Groundwater in the immediate proximity of the intermittent drainage in the north portion of the site may be 5 to 10 feet below the existing ground surface due to recharge from surficial snow melt in the spring.

Flooding: The possibility of a flood event occurring from the Fraser River and/or from the accompanying tributary Ten Mile Creek would be considered low, given the elevation of the site above these drainages.

Seismic Activity/Faulting: The site is located approximately 5 miles south of a series of 4 faults which trend generally northwest/southeast. Each of these faults is approximately 5 miles in length. The most recent movement is considered to have occurred prior to the Troublesome Formation deposition (greater than 5 million years) and is primarily a normal type fault. The risk of movement in these faults is relatively low. Faults with documented evidence of recent geologic activity (movement in the last 10, 000 years) are not known to be present in the area.

A report prepared by Amuedo and Ivey in October of 1974 indicates the presence of two small faults in or near the site. One fault is mapped offsite to the north, trending generally east/west. The other fault is mapped near the center of the property and trends approximately north/south. During the field reconnaissance and test pits excavations, recent geologic activity (movement in the last 10, 000 years) was not observed leading to the conclusion that these faults are Tertiary Age or older.

The project area falls within Seismic Performance Category A based on AASHTO guidelines, and considered to have a low probability for large, damaging earthquakes. The site is in the Uniform Building Code Seismic Zone 1. Compared with other regions in Colorado, recorded earthquake frequency in the project vicinity is low.

Slope Stability: During our preliminary site reconnaissance of slope area, no evidence of mass-wasting processes associated with steep slopes, such as landslides or soil creep of colluvial material were apparent on the site.

**Preliminary Geotechnical Evaluation
Geologic Hazards Study
Proposed Lakeview Condominium Development
Grand County, CO**

The existence of a landslide was observed only a few hundred feet north of the site. The underlying bedrock in this area is composed of the Benton Shale Formation. The Benton shale is known for slope instability in the Silver Creek area, and the bedding orientation is adverse to the existing slope angle. This landslide appears to have activated many times in the past, and was likely reactivated by road construction in the 1970's

The geologic setting in the proposed Lakeview development site area is considerable different from the conditions that resulted in this offsite landslide described to the north.

Rockfall Hazard: This area was previously mapped as a rock fall hazard in the Amuedo and Ivey Engineering Geology report dated 1974. Since that time numerous single family and multifamily structures have been developed down gradient of the site, and have not incurred any damage as a result of rock fall. Numerous boulders are located on the site, which appear to be partially buried in the soil and are not free to move. Weathering of slab-shaped boulders of sandstone from the upgradient Dakota Formation will occur over time, and some may weather to an equate shape. Mitigation with regard to scaling of this area upgradient of the site will reduce the present low rockfall hazard.

Wetlands Potential: Based on our reconnaissance, it appeared that wetlands were not apparent in the site area with the possible exception of the proposed detention pond area in the northwest portion of the site. During site development, all regulations concerning wetland protection for these areas, as well as any other areas designated as wetlands by the Federal Wetlands Protection Act should be adhered to.

Mining Activity: During site reconnaissance, no mining activity, (tailings, structures, etc.) was found in the project area.

Radon Potential: According to the Geologic Map of Colorado, compiled by Ogden Tweto, 1979 (U.S.G.S.), the near surface bedrock underlying the site is associated with the Tertiary Troublesome formation, generally consisting of sandstone or siltstone. According to the Map and Directory of Colorado Uranium and Vanadium Mining and Milling Activities, by James D. Collier, et al., Colorado Geological Survey, 1978, there are no known radioactive mineral occurrences in the vicinity of the site, as plotted from information from the Colorado Geological Survey, Bulletin 40. Additionally, the Uranium and Vanadium Map does not indicate any mining or milling activities on or near the site. The nearest known occurrence of radioactive

**Preliminary Geotechnical Evaluation
Geologic Hazards Study
Proposed Lakeview Condominium Development
Grand County, CO**

minerals near the site, is located near the Moffat Tunnel, east of Winter Park.

In 1991, the Colorado Geological Survey (CGS) completed the organization and compilation of Radon test results from studies conducted in Colorado during 1987 and 1988. The Radon test results were organized into the CGS Open File Report 91-4, Results of the 1987-1988 EPA Supported Radon Study in Colorado, With a Discussion on Geology. The study results are organized in a report format generally focused on geologic formation, zip code, and test results, although there are also other reported subcategorizations of the test data. Radon gas tests were conducted during the winter months of 1987 and 1988 using a 48-hour test method employing charcoal canisters. The placement strategy (testing strategy) for conducting the tests was to cover the entire state, focusing on geologic formation and population. Referencing the Geologic Map of Colorado (Ogden Tweto, 1979, U.S.G.S.), Colorado's geologic environment consists of, and was identified by 76 individual lithologic units. The number of tests to be performed within each of the individual lithologic units was dependent on the population density within each, with an ultimate goal of conducting two tests within a reasonable geographic distribution of zip code zones in Colorado.

Based on the near surface bedrock geology of the site, and the site's geographic location, some information may be extrapolated from the Radon Study results however use of this information is very general in nature, with regard to the site, since the exact locations of test sites were not reported, and may not be representative of actual radon hazards at the site therefore, the Radon Study data extrapolated for this assessment should not be interpreted as a scientific evaluation of the Radon gas conditions at the site.

The occurrence of radon gas is difficult to predict and can be a potential hazard if its occurrence is combined with a structure that allows it to enter a structure and to build up or concentrate. The only way to determine if radon is present in a structure is to test for it after construction. In cases where the structure is to be built over a ventilated crawl space (as many homes are in Grand County), radon will not present a problem since buildup does not occur. In homes with at grade or below grade levels, a relatively simple and inexpensive measure can be taken to allow for underslab ventilation.

Based on the published information obtained for the site and our preliminary investigation, the site appears to be feasible for development with respect to geologic and geologic concerns.

**Preliminary Geotechnical Evaluation
Geologic Hazards Study
Proposed Lakeview Condominium Development
Grand County, CO**

PRELIMINARY GEOTECHNICAL RECOMMENDATIONS

In our opinion, the proposed development is feasible from a geotechnical standpoint, based on our initial site reconnaissance, review of published literature and preliminary investigation. Condominium foundations will be founded on shallow or deep systems. Each structure site should be investigated individually to determine appropriate bearing capacities and foundation depths.

Anticipated Foundation Systems. The foundation system which has the greatest likelihood to reduce movement due to potentially expansive subsurface conditions is a straight-shaft pier system drilled into claystone bedrock. We estimate minimum pier lengths to be on the order of 20 to 30 feet. Longer minimum lengths may be required depending upon near surface bedrock and swell potentials following site grading. In addition, piers drilled into bedrock of this nature can be typically designed for end bearing values of 25,000 to 35,000 psf and skin friction values of 2,500 to 3,500 psf for the portion of pier in bedrock. Minimum dead load pressures will be required for piers depending upon the swelling characteristics of the materials at the site. Based on the results of the swell-consolidation testing, we estimate dead load pressures in the range of 10,000 to 20,000 psf based on pier end area only will be required. A void form of 6 inches, depending upon the swelling characteristics of the moisture-density treated materials at the site, will be required beneath grade beams to prevent swelling soils from exerting uplift forces on the grade beams and to concentrate pier loads.

If the client is willing to accept an additional amount of risk with regard to movement associated with potentially expansive bedrock conditions, an alternate foundation system for structures underlain by low to moderate claystone bedrock, would be a spread footing foundation system placed on imported structural fill or onsite moisture-density treated fill. The amount of imported or onsite fill will depend on a structure specific determination of the underlying bedrock swell potential. The fill should also extend beyond the edges of the footings in all directions. Footings placed on properly compacted fill may be designed for a maximum allowable soil bearing pressures ranging from 1,500 to 2,500 psf. The footings may also require minimum dead load pressures of approximately 750 to 1,000 psf.

Floor Systems: Floor slabs present a very difficult problem where swelling materials are present near floor slab elevation because sufficient dead load cannot be imposed on them to resist the uplift pressure generated when the materials are wetted and expand. Based on the moisture-volume change characteristics of the materials encountered at this site, a structural floor above a

**Preliminary Geotechnical Evaluation
Geologic Hazards Study
Proposed Lakeview Condominium Development
Grand County, CO**

well-ventilated crawl space is a viable alternative for building floor systems underlain by claystone bedrock.

The use of a slab-on-grade system in areas underlain by claystone bedrock is an alternate floor system option provided the owner must recognize that this will result in a risk of slab movement and potential distress to the structure. Moisture-density treated fill will need to be properly placed beneath the floor slabs. The amount of moisture-density treated fill will depend on a structure specific determination of the underlying bedrock swell potential.

Underdrain Systems: We anticipate that perched groundwater conditions may develop on top of the bedrock/overburden materials after development of the site is complete and landscape irrigation begins. In addition, seasonal snowmelt may result in saturated subsurface conditions for an extended period of time. Therefore, the below grade level of each structure must be protected by underdrain systems. The underdrain system for each of the structures should be sloped to a sump where water can be removed by pumping or gravity drainage.

Cut and Fill Slopes: We observed no signs of major slope instability during our field investigation. Natural hillsides within the site area appear to have a stable geologic history. Major stability problems are not anticipated if site grading is carefully planned and cuts and fills do not exceed approximately 15 feet in height.

Permanent unretained cuts of less than 15 feet in height may be initially planned at 3 horizontal to 1 vertical. The risk of slope instability will be significantly increased if seepage is encountered in cuts. We do not anticipate seepage will be encountered. However, if it is, a stability investigation should be conducted to determine if the seepage would adversely affect the cut. Good surface drainage should be provided around all permanent cuts to direct surface runoff away from the cut face. Cut slopes and other stripped areas should be protected against erosion by revegetation or other methods. Fills up to 15 feet in height can be used if the fill slopes do not exceed 3(H):1(V), and the fills are properly compacted and drained.

No formal stability analysis was performed to evaluate the slopes recommended above. Published literature and our experience with similar cuts and fills indicate that the recommended slopes should have adequate factors of safety. If a detailed stability analysis is required, we should be notified. An additional investigation may be required depending on the final cut/slope configuration.

If areas of large near surface sandstone boulders or highly cemented sandstone are encountered during site grading, conventional earth moving operations in this material will be very difficult.

**Preliminary Geotechnical Evaluation
Geologic Hazards Study
Proposed Lakeview Condominium Development
Grand County, CO**

If these materials cannot be broken down during filling operations, the material should be placed in common areas, or disposed of off site. Excavation in some areas having large sandstone boulders or sandstone bedrock if encountered, may require light controlled blasting.

Excavation / Utilities: Overlot grading should be feasible with conventional, heavy duty construction equipment, however light controlled blasting will be required to remove near surface sandstone boulders or competent sandstone/claystone bedrock. Utility excavations will be made through the overburden soils and bedrock materials. Excavation in portions of the claystone associated with the underlying Morrison Formation and also the intrusive bedrock, may prove difficult in trench excavations, “rock excavation” methods will most likely be necessary.

Preliminary Pavement Sections: The overburden soils encountered in the upper 3 feet of the test pits generally classified as A-2-4 to A-7-6 soils in accordance with the AASHTO soil classification system. This silty sand to sandy clay material is considered to have good to poor soil support characteristics.

Based on the existing subsurface conditions with assuming minor cuts and fills during overlot grading and a typical traffic load for access roadways, we anticipate that the thickness of full depth asphalt sections may range from approximately 6.5 to 7.5 inches for the access drives and fire lanes. The thickness of full depth asphalt sections may be reduced to 6.0 to 6.5 inches for the parking areas. However, the actual pavement sections required at the site will depend upon the results of further laboratory testing, actual traffic loading, and subgrade preparation. A detailed subsurface investigation for pavement design is recommended once overlot grading is complete.

LIMITATIONS

This preliminary report has been prepared in accordance with generally accepted geotechnical engineering practices in this area for use by the client for initial design purposes. The preliminary conclusions and recommendations submitted in this report are based upon the data obtained from the exploratory test pits at the locations indicated on the site plan, a site reconnaissance and a review of selected published literature. The nature and extent of variations between the exploratory holes may not become evident until excavation is performed.

Swelling soils and bedrock may occur on this site. These soils and bedrock are stable at their natural moisture content but can shrink or swell with changes in moisture. The behavior of swelling soils and bedrock is not fully understood. The swell potential of any particular site can

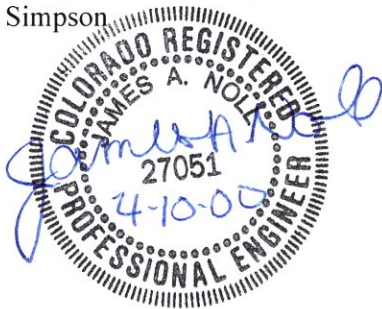
**Preliminary Geotechnical Evaluation
Geologic Hazards Study
Proposed Lakeview Condominium Development
Grand County, CO**

change erratically both in lateral and vertical extent. Moisture changes also occur erratically, resulting in conditions which cannot always be predicted. The recommendations presented in this report are based on the current state-of-the-art for foundations, floor slabs, and pavements on swelling soils and bedrock. The owner should be aware that there is a risk in construction on these types of soils and bedrock. Performance of the buildings and pavement will depend on following the recommendations and in proper maintenance after construction is complete. As water is the main cause for volume change of these soils and bedrock, it is necessary that the changes in moisture content be kept to a minimum. Any distress noted in the building, structures, or pavement should be brought to the attention of a professional engineer.

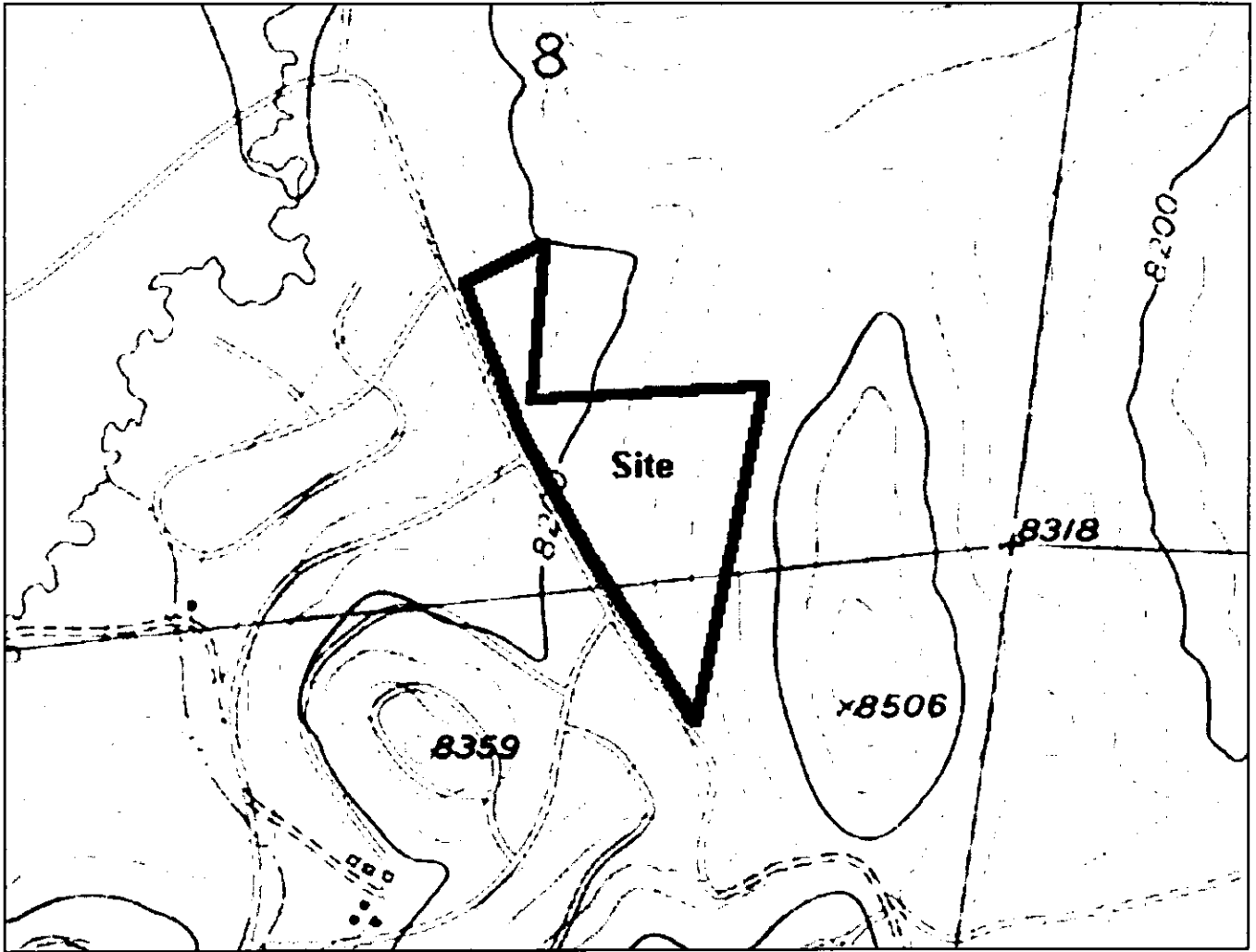
Sincerely,
Ground Engineering Consultants, Inc.



Bryan K. Simpson



Reviewed by James A. Noll, P.E.

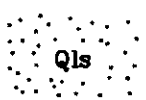
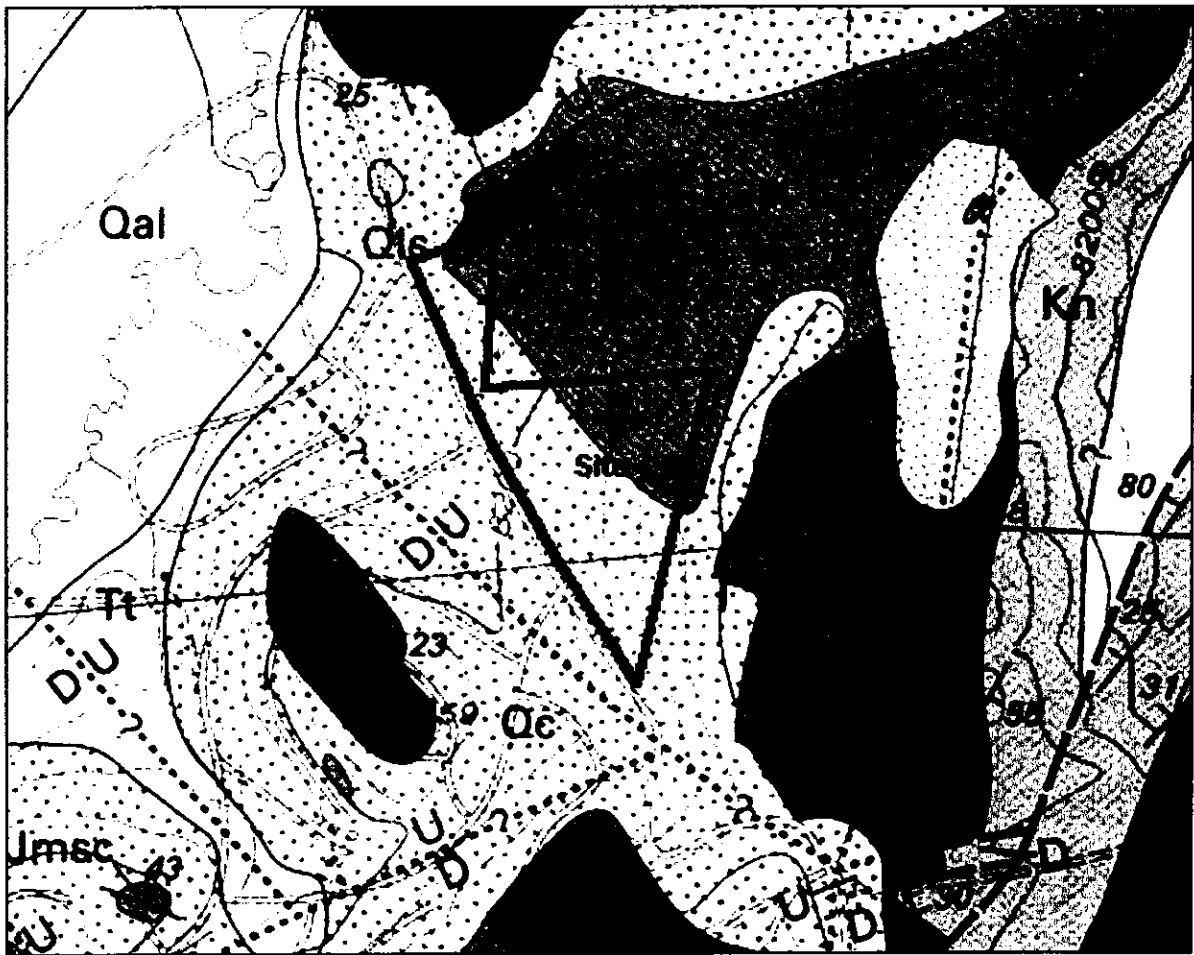


From the Topographic Map of
 Granby Quadrangle, Grand County,
 Colorado, USGS Revised 1978

(Not to Scale)



GROUND ENGINEERING CONSULTANTS	
SITE VICINITY MAP	
JOB NO. 99-1123	DRAWN BY: HB
FIGURE: 1	APPROVED BY: JN
CADFILE NAME: 1123SITE1.DWG	



Qls Holocene and late Pleistocene Landslide Deposit - Jumbled material commonly composed of Troublesome Formation, Benton Shale, Pierre Shale or Morrison Formation with respective superjacent units.



Qc Holocene and Pleistocene Colluvium - mantle of locally derived, poorly sorted, unstratified, weathered material ranging in size from blocks to clay. Thickness as much as 10 feet or more.



Kd Upper Cretaceous Dakota Sandstone Formation - light tan to gray, fine grained to conglomeritic sandstone.



Jmsc Upper Jurassic Morrison Formation - Gray, green, and red claystone with lesser amounts of tan to white sandstone.

? — — ? Possible fault as indicated by topographic expression.

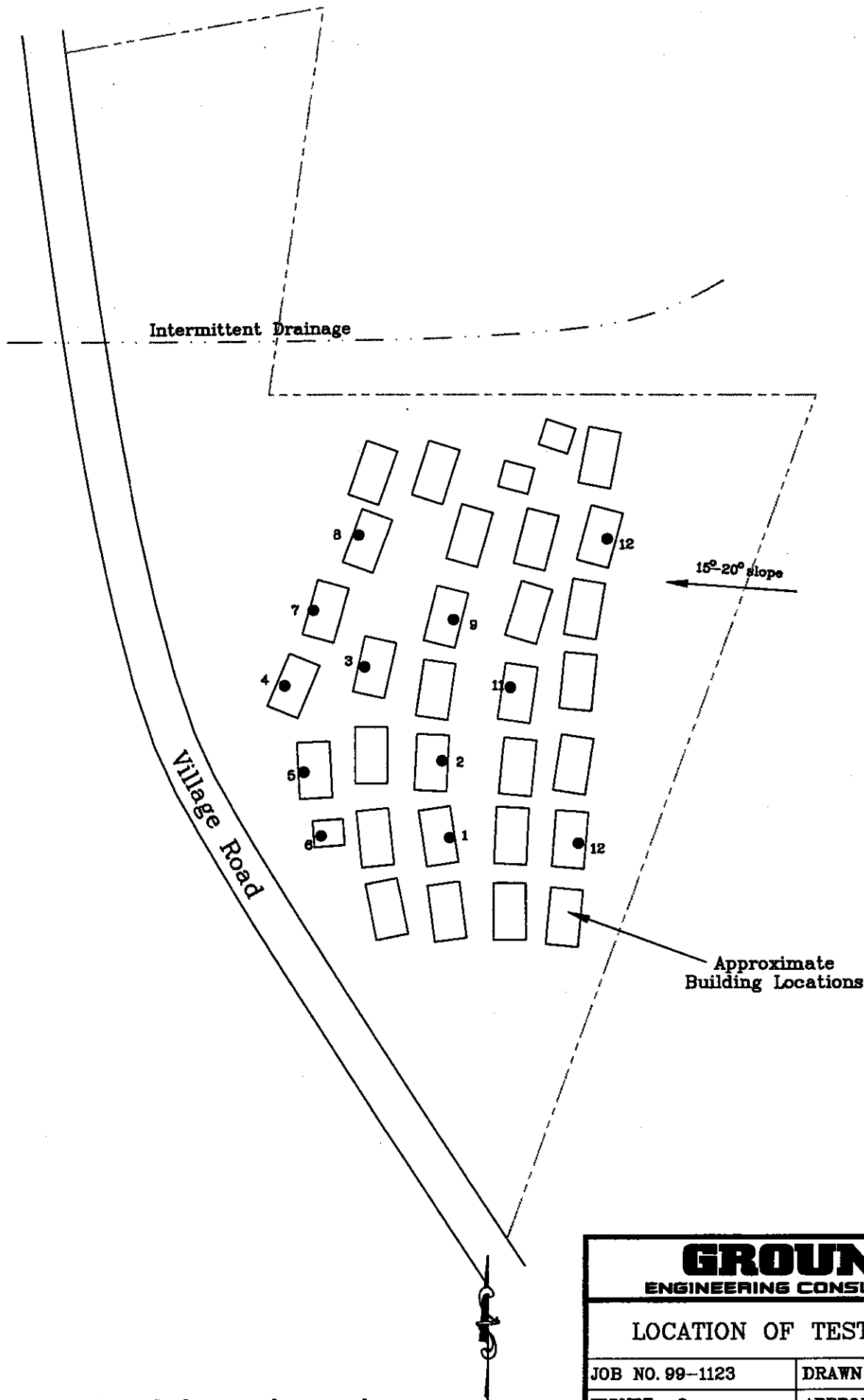
— — — Contact - Dashed where approximately located; dotted where concealed.



(Not to Scale)

From the Geologic map of the Granby Quadrangle
Grand County, Colorado USGS-GQ-1763

GROUND ENGINEERING CONSULTANTS	
SITE GEOLOGIC MAP	
JOB NO. 99-1123	DRAWN BY: HN
FIGURE: 2	APPROVED BY: JN
CADFILE NAME: 1123SITE2.DWG	



1 Indicates test hole number and
 ● approximate location.

(Not to Scale)

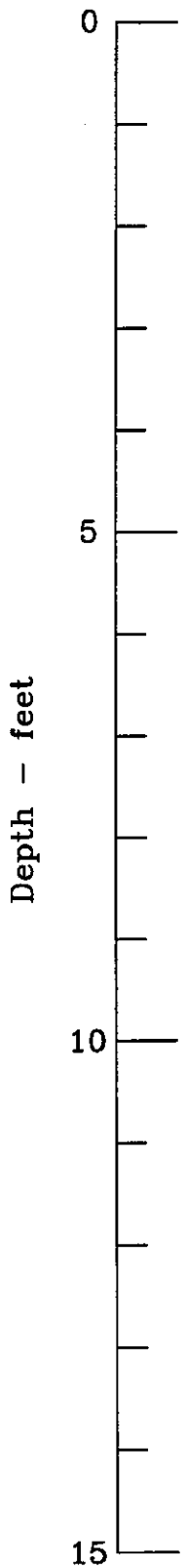
GROUND ENGINEERING CONSULTANTS	
LOCATION OF TEST HOLES	
JOB NO. 99-1123	DRAWN BY: HB
FIGURE: 3	APPROVED BY: JN
CADFILE NAME: 1123SITE3.DWG	

Test Hole
1

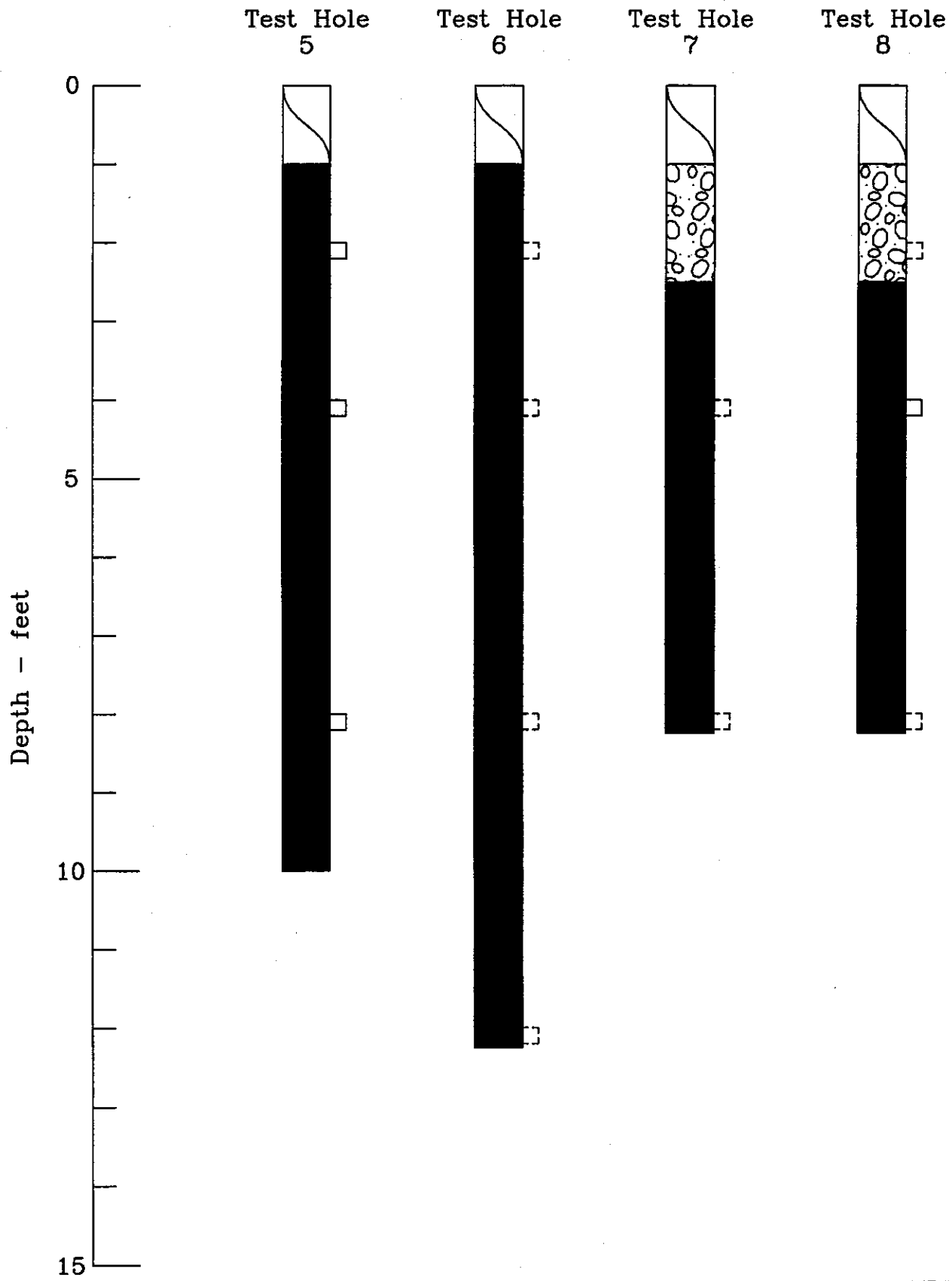
Test Hole
2

Test Hole
3

Test Hole
4



GROUND ENGINEERING CONSULTANTS	
LOGS OF TEST HOLES	
JOB NO. 99-1123	DRAWN BY: HN
FIGURE: 4	APPROVED BY: JN
CADFILE NAME: 1123LOG1.DWG	



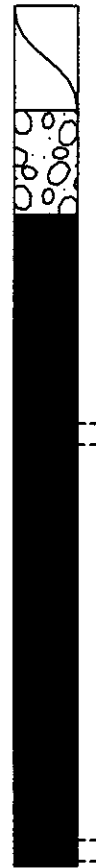
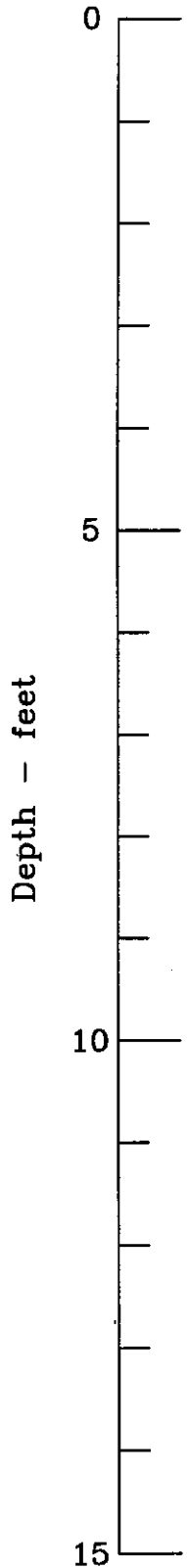
GROUND ENGINEERING CONSULTANTS	
LOGS OF TEST HOLES	
JOB NO.99-1123	DRAWN BY: HN
FIGURE:5	APPROVED BY: JN
CADFILE NAME: 1123LOG2.DWG	

Test Hole
9

Test Hole
10

Test Hole
11

Test Hole
12



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LOGS OF TEST HOLES

JOB NO. 99-1123

DRAWN BY: HN

FIGURE: 6

APPROVED BY: JN

CADFILE NAME: 1123LOG3.DWG

LEGEND:



Topsoil: Brown to black, moist, humic.



Clay: Silty to sandy to gravelly with occasional gravels, cobbles and boulders of sandstone, medium to highly plastic, stiff to hard, slightly moist, brown to gray.



Gravel: Sandy to silty to clayey with occasional cobbles and boulders of sandstone, non to medium plastic, medium dense to dense, slightly moist, brown.



Claystone Bedrock: Sandy to very sandy with interbedded sandstone lenses and occasional near surface sandstone cobbles and boulders, medium plastic, hard to very hard, slightly moist, green to gray to brown.



Small disturbed sample



Drive sample, 2-inch I.D. California liner sample

NOTES:

- 1) Test holes were drilled on 11/19/99 with 4-inch diameter continuous flight power augers.
- 2) Locations of the test holes were measured approximately by pacing from features shown on the site plan provided.
- 3) Elevations of the test holes were not measured and the logs of the test holes are drawn to depth.
- 4) The test hole locations and elevations should be considered accurate only to the degree implied by the method used.
- 5) The lines between materials shown on the test hole logs represent the approximate boundaries between material types and the transitions may be gradual.
- 6) Groundwater was not encountered during drilling. Groundwater levels can fluctuate seasonally and in response to landscape irrigation.

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LEGEND AND NOTES

JOB NO. 99-1123

DRAWN BY: HB

FIGURE: 7

APPROVED BY: JN

CADFILE NAME: 1123LEG.DWG

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TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

Test Hole No.	Sample Location Depth (feet)	Natural Moisture Content (%)	Natural Dry Density (pcf)	Gradation			Atterberg Limit		Percent Swell (1000 psf Surcharge)	Soil or Bedrock Type
				Gravel (%)	Sand (%)	Passing No. 200 (%)	Liquid Limit (%)	Plasticity Index (%)		
1	2	9.4		56	15	29	43	16		Clayey Sandy Gravel
1	4	12.2		6	29	65	42	22		Sandy Claystone
1	8	9.2				45	35	20		Sandstone/Claystone
1	12	6.8				53	37	21		Sandstone/Claystone
2	2	9.0				70	35	17	0.0	Sandy Claystone
2	4	8.0				57	34	18		Sandstone/Claystone
2	12	9.8		13	38	49	41	20		Sandy Claystone
3	2	10.4				70	41	26		Sandy Claystone
3	4	11.8				82	46	27	1.4	Sandy Claystone
3	10	4.5		75	5	20	37	0		Sandstone Conglomerate
4	4	10.2		22	30	48	43	24		Sandy Gravelly Claystone
4	8	8.5		15	44	41	26	0		Silty Sandstone
4	15	10.5		21	25	54	46	27		Sandy Gravelly Claystone
5	2	9.9				43	38	21		Clayey Sandstone
5	4	12.2				49	41	24		Sandstone/Claystone
5	8	9.0				82	32	17		Sandy Claystone
6	2	7.0				60	29	18		Sandy Claystone
6	4	12.1	83.2			78	52	32	2.6	Sandy Claystone
6	8	7.4		2	30	68	35	24		Sandy Claystone

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TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

Test Hole No.	Sample Location Depth (feet)	Natural Moisture Content (%)	Natural Dry Density (pcf)	Gradation			Atterberg Limit		Percent Swell (1000 psf Surcharge)	Soil or Bedrock Type
				Gravel (%)	Sand (%)	Passing No. 200 (%)	Liquid Limit (%)	Plasticity Index (%)		
6	12	6.0		0	63	37	30	19		Clayey Sandstone
7	4	7.7		26	21	53	30	10		Gravelly Sandy Claystone
8	2	3.0		82	9	9	28	9		Gravel
8	4	12.2				69	40	23		Sandy Claystone
8	8	14.1				71	40	24		Sandy Claystone
8	10	11.2				73	31	14		Sandy Claystone
9	4	7.6				37	39	22		Gravelly Clayey Sandstone
9	8	8.7		27	17	56	33	18		Gravelly Sandy Claystone
10	2	12.4				82	48	32		Sandy Claystone
10	4	13.8				79	43	26		Sandy Claystone
10	8	13.5				77	42	25	0.0	Sandy Claystone
10	15	16.4				72	62	44		Sandy Claystone

APPENDIX A
REFERENCES

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