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GEOTECHNICAL STUDY
EDWARDS RESIDENCE
426 WOODSIDE AVE
PARK CITY, UTAH

Prepared By:

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Y² JOB NUMBER: 08G-124

Prepared for:

BRUCE & SUSAN EDWARDS
C/O TOMAHAWK BUILDING COMPANY
C/O KEVIN KING DESIGN
PO BOX 1957
PARK CITY, UTAH 84606

November 7, 2008

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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation for proposed residential structure located at 426 Woodside Avenue in Park City, Utah. The general location of the site, with respect to existing roadways, is shown on Figure No. 1, *Vicinity Map*, at the end of this report.

This investigation was done to assist in evaluating the subsurface conditions and engineering characteristics of the foundation soils and in developing our opinions and recommendations concerning appropriate foundation types, floor slabs, and pavements. This report presents the results of our geotechnical investigation including field exploration, laboratory testing, engineering analysis, and our opinions and recommendations. Data from the study is summarized on Figure 3 and in the Laboratory Results.

2.0 PROPOSED CONSTRUCTION

We understand that the proposed construction will consist of a single family home. We anticipate that the structure will be multi-storied with a basement. We estimate that the maximum loads for the proposed structure will not exceed 6 kips per linear foot for bearing walls, 50 kips for columns, and 150 to 200 pounds per square foot for floor slabs. If structural loads are significantly greater than those discussed herein or if the project is substantially different than described above, our office should be notified so that we may review our recommendations, and if necessary, make modifications.

It is anticipated that utilities will be constructed to service the building and that exterior concrete flatwork will be placed in the form of curb and gutter, and sidewalks.

3.0 CONCLUSIONS

The following is a brief summary of our findings and conclusions:

1. The subject site is suitable for the proposed construction provided the recommendations presented in this report are followed.
2. Based upon the test locations evaluated for this investigation and the excavation observation on the lot, this site is currently covered with up to 15 feet of uncontrolled fill. The native soils below the fill generally consisted of a stiff to very stiff lean clay with sand (CL) extending to 30 feet below the top of the lot overlying a completely weathered to moderately weathered bedrock which extended to the maximum depth investigated (35 ft). Water was observed in the bottom of the sewer relocation trench and in the south east corner of the excavation at the time of this investigation.
3. All uncontrolled fill on this site must be removed below any structures. All fill without documentation to show proper placement and compaction is considered uncontrolled.
4. As long as all fill is removed, conventional strip and spread footings may be used for supporting the proposed structures. Footings should be founded either on the undisturbed native gravel and clay soils, or on properly placed and compacted structural fill extending to the undisturbed native soils. Footings may be designed using a maximum bearing capacity of 2,000 psf. More detailed information pertaining to the construction of foundations is provided in Section 10.0, Foundations of this report.
5. The uncontrolled fill should be removed below all floor slabs or the slabs should be structurally suspended over the fill.
6. At the time of our visit, the excavation walls appeared to be stable. If excessive wetting of the walls occurs or if significant sloughing is observed construction staging or shoring of the walls may be required.

4.0 SITE CONDITIONS

The site is a roughly rectangular shaped parcel of land located at 426 Woodside Avenue in Park City, Utah. At the time of our visit demolition of the original structure on the site had been completed and isolated areas had been excavated. The area disturbed by removal of the original structure encompassed the majority of the site and very little of the native grade was visible. Most of the vegetation had been removed from the site; however, a few trees and shrubs were located on the eastern edge of the site. A concrete retaining wall ran along the front edge of the property and continued into the adjacent property to the north. Concrete pavement attached to the wall extended west toward the roadway. The site is bounded to the west by Woodside Avenue, and on all other sides by existing residential structures. No standing water sources were observed on the site at the time of our visit.

5.0 FIELD INVESTIGATION

The field investigation consisted of evaluating test locations within the approximate building excavation. A sewer line relocation trench had been opened at the back of the lot extending approximately 6 feet below the main elevation. The approximate evaluation location is shown on Figure 2 at the end of this report. The soils encountered at the site were continuously logged by a qualified member of our geotechnical staff. Due to the nature of the onsite soils only disturbed samples were obtained and returned to our laboratory for testing.

6.0 LABORATORY TESTING

The samples obtained during the field investigation were sealed and returned to our laboratory where samples were selected for laboratory testing. Laboratory testing included natural moisture determinations, grain size distribution analyses, and Atterberg limits testing. The results of these tests are shown at the end of this report.

7.0 SUBSURFACE CONDITIONS

Based upon the test locations evaluated for this investigation and the excavation observation on the lot, this site is currently covered with up to 15 feet of uncontrolled fill. The native soils below the fill generally consisted of a stiff to very stiff lean clay with sand (CL) extending to 30 feet below the top of the lot overlying a completely weathered to moderately weathered bedrock which extended to the maximum depth investigated (35 ft). Water was observed in the bottom of the sewer relocation trench and in the south east corner of the excavation at the time of this investigation.

Graphical representations of the soil conditions encountered are shown on the Test Pit Log, Figure 3. The stratification lines shown on the log represent the approximate boundaries between soil units; the actual transition may be gradual.

8.0 SITE GRADING

8.1 General Site Grading

Prior to construction unsuitable soils and native vegetation should be removed from below areas which will ultimately support structural loads. This includes areas below foundations, floor slabs, exterior concrete flatwork, and asphaltic concrete paved areas. Unsuitable soils consist of topsoil, organic soils, undocumented fill, soft, loose or disturbed native soils, highly collapsible soils, materials associated with the removal of the original structure, and any other deleterious materials. At the time of our visit much of the site was covered with uncontrolled fill. All topsoil, undocumented fill, or other unsuitable soils should be completely removed.

8.2 Excavations

Due to the nature of the soils at this site temporary construction slopes for excavations into the native soils less than ten feet in depth may be near vertical. Excavations ten to twenty feet maybe be sloped at ¼:1(horizontal:vertical). Excavations deeper twenty feet should be sloped at ½:1 (horizontal:vertical). If unstable conditions or groundwater seepage are encountered, flatter slopes or shoring and bracing may be required. All excavations should meet applicable OSHA[1] Health and Safety Standards for type C soils. At the time of our visit, the excavation walls appeared to be stable.

---

[1] Occupational Safety and Health Administration

If excessive wetting of the walls occurs or if significant sloughing is observed construction staging or shoring of the walls may be required. If shoring is required it should be designed by a qualified shoring contractor. Care should be used not to undermine the footing of the existing concrete retaining wall.

We recommend that all loose soils and other material be removed for a distance of 5 feet back from the top edge of the excavation. Hard hats and other safety gear should be worn at all times when inside the excavation. The excavation should be checked each day it is open for loose rocks, dirt clods, or signs of wall collapse and all loose rocks or dirt clods should be removed prior to anyone entering the excavation. We recommended that the exposed cut face be covered with a chain link fencing, geo-grid, or fabric to prevent rock fall into the excavation. When working within the excavation, where possible, work should be done from the inside of the building layout, preventing as much as possible being between the excavation wall and the building wall. An inspection by an engineer from Y^2 Geotechnical P.C. should take place before construction to assure excavation safety.

8.3 Structural Fill

If fill is needed, all fill placed below the structure should be compacted structural fill. All other fills should be considered as backfill. All structural fill should meet the requirements of the agency under which approval will be granted. Unless a more restrictive criteria is given, structural fill should consist of imported structural material. The native clay soil is too cohesive and the onsite fill is too mixed for use as structural fill and should not be used. Imported structural fill material should consist of well-graded sand to silty sand with a maximum particle size of 0.5 inches and 5 to 20 percent fines (materials passing the No. 200 sieve). The liquid limit of the fines should not exceed 35 and the plasticity index should be below 15. Clean gravel ranging from pea gravel to 6 inches with less than 5 percent fines and sand combined may also be used as structural fill. All fill soils should be free from topsoil, highly organic material, frozen soil, and other deleterious materials.

8.4 Backfill

The native soils and onsite fill, as long as all rubbish, debris, and material larger than 6 inches in size is removed, may be used as backfill in utility trenches and against outside foundation walls. Backfill, not under structural elements, should be placed in lift heights suitable to the compaction equipment used and compacted to at least 90 percent of the maximum dry density (ASTM D-1557).

8.5 Fill Placement and Compaction

The thickness of each lift should be appropriate for the compaction equipment that is used. We recommend a maximum lift thickness of 6 inches for hand operated equipment, 8 inches for most "trench compactors", and 12 inches for larger rollers, unless it can be demonstrated by in-place density tests that the required compaction can be obtained throughout a thicker lift. The full thickness of each lift of structural fill placed should be compacted to at least the percentages of the maximum dry density, shown in Table 1 below, as determined by ASTM D-1557:

TABLE 1: STRUCTURAL FILL COMPACTION

Structural fill	Percent of Maximum Dry Density
Below foundations, flatwork, and pavements:	95%
For fills thicker than 6 feet:	98%
In landscape areas not supporting structural loads:	90%

Generally, placing and compacting fill at a moisture content within 2% of the optimum moisture content, as determined by ASTM D-1557, will facilitate compaction. The further the moisture content is from the optimum, the more difficult it will generally be to achieve the required compaction.

Clean gravel fill used as structural fill may be placed in loose lifts up to 2 feet thick. The gravel will need to be compacted with at least 4 passes of a vibratory plate or slow moving vibratory smooth drum compactor. Typically, the gravel will settle 1 to 3 inches when properly compacted. Gravel compaction should be verified by either an engineer from Y^2 Geotechnical or a materials testing technician trained in proper gravel placement techniques.

We recommend that fill be tested frequently during placement by a qualified materials testing technician. Early testing is recommended to demonstrate that placement and compaction methods are achieving the required compaction for the entire depth of fill. It is the contractor's responsibility to ensure that fill materials and compaction efforts are consistent so that tested areas are representative of the entire fill.

9.0 SEISMIC CONSIDERATIONS

9.1 Faulting

Based on published data, no active faults are known to traverse the site and no faulting was indicated during our field investigation. Although several Quaternary faults are known to exist closer to the site, the nearest known active fault is the Wasatch Fault located about 15 miles west of the property[2].

9.2 Seismic Design Criteria

The structure should be designed in accordance with the IRC building codes. Based on section R301.2.2 of the IRC, this site is classified as a Seismic Design Category D_0.

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[2] Utah Geological Survey, "Plate 1, Quaternary Fault and Folds, Utah", 1993

9.3 Liquefaction

Liquefaction is a phenomenon where soils lose their intergranular strength due to an increase of pore pressures during a dynamic event such as an earthquake. The potential for liquefaction is based on several factors, including 1) the grain size distribution of the soil, 2) the plasticity of the fine fraction of the soil (material passing the No. 200 sieve), 3) relative density of the soil, 4) earthquake strength (magnitude) and duration, and 5) overburden pressures. In addition, the soils must be near saturation for liquefaction to occur. This site is outside the region for which liquefaction hazards have been estimated, however, based upon the geology of the area we estimate the potential for liquefaction to be low.

10.0 FOUNDATIONS

10.1 Footing Design

The native soils at this site are capable of supporting the proposed structure if the recommendations presented in this report are followed. The recommendations presented below should be utilized during design and construction of this project:

1. All uncontrolled fill should be removed from below the structures. Any fill without documentation showing proper placement and compaction is considered uncontrolled.

2. Conventional strip and spread footings are recommended for support of the proposed structure. Footings placed on the native soils may be designed for a maximum allowable soil bearing capacity of 2,000 psf. A one-third increase is allowed for short term transient loads such as wind and seismic events. Footings should be uniformly loaded.

3. Continuous and spot footings should have minimum widths of 18 and 36 inches, respectively.

4. Exterior footings should be placed below frost depth which is determined by local building codes. Generally 42 inches is adequate in this area. Interior footings, not subject to frost, should extend at least 18 inches below the lowest adjacent final grade.

5. Foundation walls on continuous footings should be well reinforced both top and bottom. We suggest a minimum amount of steel equivalent to that required for a simply supported span of 12 feet.

6. Footing excavations should be observed by the geotechnical engineer prior to placement of structural fill and construction of footings to evaluate whether suitable bearing soils have been exposed and verify that excavation bottoms are free of loose or disturbed soils.

10.2 Estimated Settlement

If footings are designed and constructed in accordance with the recommendations presented above, the risk of total settlement exceeding 1 inch and differential settlement exceeding 0.5 inch for a 25-foot span will be low. Additional settlement should be expected during a strong seismic event.

11.0 LATERAL EARTH PRESSURES

Resistance to lateral loads (including those due to wind or seismic loads) on foundations may be achieved by frictional resistance between the foundations and underlying soils, and by passive earth pressures of backfill soils placed against the sides of foundations. Retaining walls and below grade walls acting as soil retaining structures should be designed to resist pressures induced by the backfill soils.

The lateral pressures imposed on a retaining structure are dependant on the rigidity of the structure and its ability to resist rotation. Retaining walls which are free to rotate at least 0.2 percent of the wall height, develop an active lateral soil pressure condition. Structures that are not allowed to rotate or move laterally, develop an at-rest lateral earth pressure condition. Lateral pressures applied to structures may be computed by multiplying the vertical depth of backfill material by the appropriate equivalent fluid density. Any surcharge loads in excess of the soil weight applied to the backfill should be multiplied by the appropriate lateral pressure coefficient and added to the soil pressure. The lateral pressures presented in Table 2 *Lateral Earth Pressures* below, are based on drained, horizontally placed soils as backfill material. For computing lateral forces we recommend the following equivalent fluid densities:

TABLE 2: LATERAL EARTH PRESSURES

Condition	Static Lateral Pressure Coefficient	Static Equivalent Fluid Pressure (pcf)	Seismic Equivalent Fluid Pressure (pcf)
Active	0.33	40	53
At-Rest	0.50	60	73
Passive	3.00	360	347

The friction acting along the base of foundations may be computed by using a coefficient of friction of 0.35 for contact with the native clay soil. The values presented above are based on drained conditions and are ultimate. Standard factors of safety for structural engineering should be used for evaluation of structural values such as overturning and sliding resistance as appropriate.

12.0 FLOOR SLABS AND CONCRETE PADS

The native soils below floor slabs should be proof rolled and a minimum 4 inch thick layer of free draining gravel or imported structural fill should be placed immediately below the floor slab to help distribute floor loads, break the rise of capillary water, and aid in the concrete curing process. For slab design, we recommend a modulus of subgrade reaction of 200 psi/in be used. Floor slabs should be designed by a structural engineer who determines what measures are appropriate to control shrinkage and stress cracking and provide required support.

Special precautions should be taken during placement and curing of concrete slabs and flatwork. Excessive slump (high water-cement ratios) of the concrete and/or improper finishing and curing procedures used during hot or cold weather conditions may lead to excessive shrinkage, cracking, spalling, or curling of slabs. We recommend all concrete placement and curing operations be performed in accordance with American Concrete Institute (ACI) codes and practices.

13.0 SURFACE DRAINAGE

Wetting of the foundation soils may cause some degree of volume change within the soil and should be prevented after construction. We recommend that the following precautions be taken at this site:

1. The ground surface should be graded to drain away from the structures in all directions. We recommend a minimum fall of 6 inches in the first 10 feet for landscaped areas and 1 inch in the first 20 feet for paved surfaces.

2. Roof runoff should be collected in rain gutters with down spouts designed to discharge well outside of the backfill limits.

3. Sprinkler heads, should be aimed away and kept at least 12 inches from foundation walls.

4. Provide adequate compaction of foundation backfill i.e. a minimum of 90% of ASTM D-1557. Water consolidation methods should not be used.

5. Other precautions which may become evident during design and construction should be taken.

14.0 GENERAL CONDITIONS

The exploratory data presented in this report was collected to provide geotechnical design recommendations for this project only and is not intended for application to other sites or buildings. Test location conditions may not be indicative of subsurface conditions outside the study area and thus have limited value in depicting subsurface conditions for contractor bidding. If it is necessary to define subsurface conditions in sufficient detail to allow accurate bidding we recommend an additional study be conducted which is designed for that purpose. An experienced geotechnical engineer or technician should observe fill placement and conduct testing as required to confirm the use of proper structural fill materials and placement procedures.

Variations from the conditions portrayed at the test locations may occur and can only be confirmed during earthwork and foundation construction. The fill condition indicated in this report represents what was encountered during the site investigation. Subsequent changes to the site may result in fill or topsoil amounts varying from what is represented in this report. If fill, topsoil, or subsurface conditions are found to be different than those presented in this report, we should be notified immediately to determine if changes in the recommendations are required. If Y^2 Geotechnical, P.C. is not contacted about variations in the soil conditions we can not be responsible for the impact of those conditions on the performance of the project.

It should be remembered that geotechnical engineering conclusions and recommendations are generated through analytical methods which are not an exact science. Conclusions and recommendations presented in a geotechnical engineering report are not based only on the analytical empirical tools generally used but rely on engineering judgment in conjunction with the tools. The fact that professional judgments must be used in making recommendations means that the conclusions, solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the soils and the proposed structure will perform as planned. The conclusions and recommendations presented in this report represent the Y^2 Geotechnical, P.C. professional findings regarding the proposed structures on this project based on the information generated and referenced during this evaluation and Y^2 Geotechnical, P.C.'s experience in working with these conditions.

The geotechnical investigation as presented in this report was conducted within the limits prescribed by our client. The findings and recommendations which have been presented in this report have been made in accordance with generally accepted professional geotechnical engineering practice in the area at the time of report preparation. Standards of practice are subject to change with time. No other warranty or representation, either expressed or implied is intended in our proposals, contracts or report.

This geotechnical report has been prepared for Bruce & Susan Edwards and Tomahawk Building Company for use in the design and construction of the Edwards Residence. This report is site specific and should not be relied upon for use in other investigations and is not for the use or benefit of, nor may it be relied upon by any other person or entity, for any purpose without the advance and express written consent of Bruce or Susan Edwards and/or Tomahawk Building Company and Y^2 Geotechnical, P.C.; therefore, any use or reliance upon this geotechnical evaluation by a party other than the Client shall be solely at the risk of such third party and without legal recourse against Y^2 Geotechnical, P.C., its employees, officers, or directors, regardless of whether the action in which recovery of damages is brought is based upon contract, tort, statue, or otherwise. The client has the responsibility to see that all parties to the project including the designer, contractor, subcontractor, and building official, etc., are aware of the geotechnical report in its complete form. Y^2 Geotechnical, P.C., assumes no responsibility or liability for work or testing performed by others.

We appreciate the opportunity of providing our services on this project. If we can answer questions or be of further service, please call.

Respectfully;
Y^2 GEOTECHNICAL, P.C.
Not Official Unless Stamped and dated.

Lori

LICENSED PROFESSIONAL ENGINEER
LORI S YAHNE
No. 334257
LICENSED
STATE OF UTAH

11/7/08

Lori S. Yahne, P.E.
Principal Geotechnical Engineer

Reviewed by,

M. Jared Burgess, P.E.
Project Geotechnical Engineer

3 copies sent

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NORTH

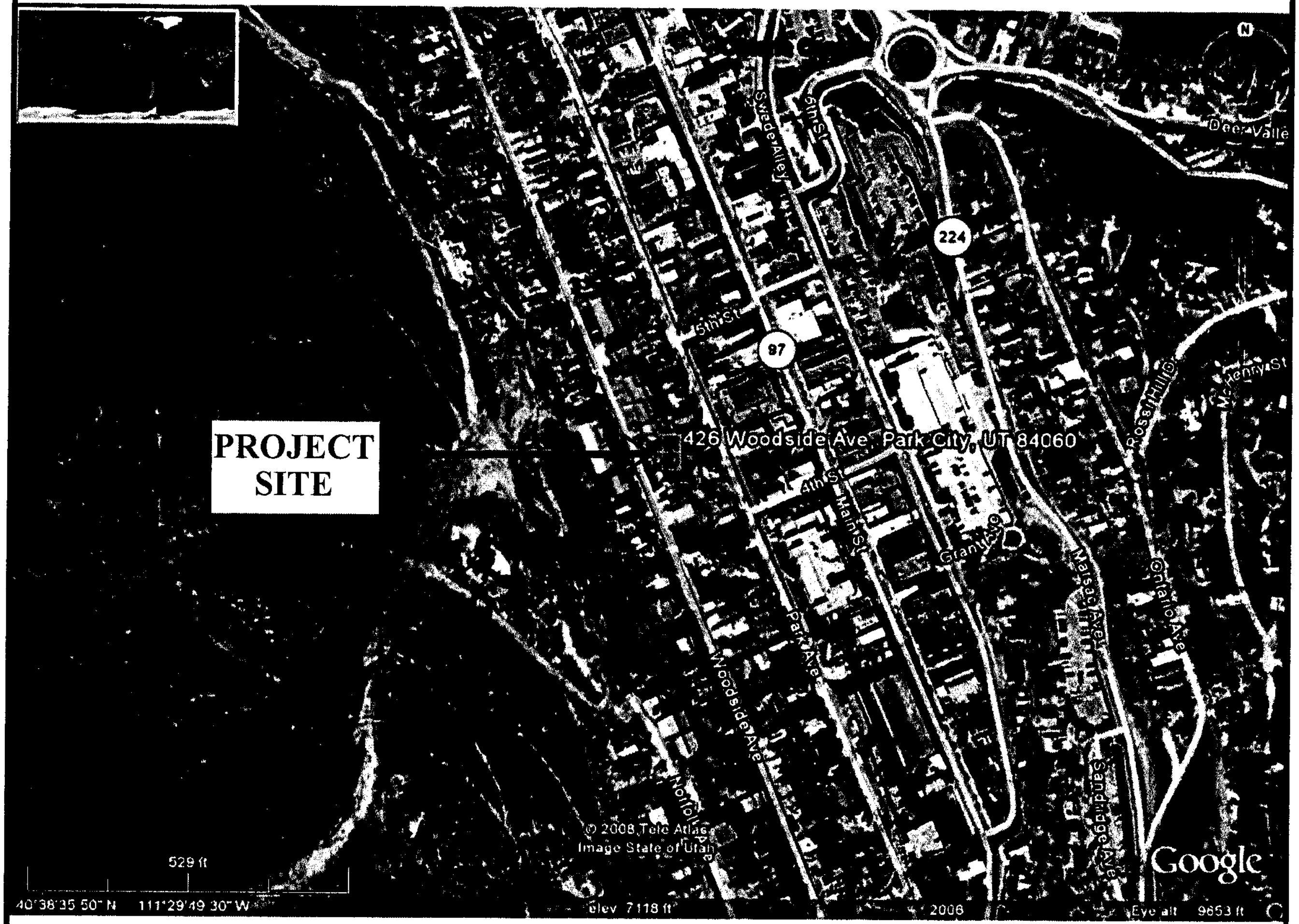

Figure 1: VICINITY MAP

GEOTECHNICAL STUDY
Edwards Residence
Park City, Summit County, Utah

Y^2 Job No. 08G-124

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NORTH

Building Demolished at time of visit

Figure 2: TEST HOLE LOCATIONS

GEOTECHNICAL STUDY
Edwards Residence
Park City, Summit County, Utah

Y^2 Job No. 08G-124

Project No. 08G-124

LOG OF BOREHOLE NO. TL-1

Figure 3

PROJECT **Edwards Residence**	CLIENT **Tomohawk Building**
LOCATION **426 Woodside Ave Park City, UT**	Surface Elev.:

✋ Grab Sample

Depth in Feet	Graphic Log	Sample Type	SOIL DESCRIPTION	Moisture Content, %	Liquid Limit, %	Plasticity Index, %	Gravel, %	Sand, %	Fines, %
	▩		18 Feet Fill - Mixed debris, clay and sand, some topsoil, building debris.						
	▨	✋	Lean Clay with Sand (CL) - with gravel, stiff to very stiff, slightly moist to moist, red brown, to Clayey Gravel with Sand (GC), medium dense, slightly moist, red brown.	17.7	40	24	15.0	45.9	39.1
30	▩		Bedrock - completely weathered into Lean Clay with Sand (CL) with gravel to slightly weathered, moderately fractured, weak to strong. ▽ Wet Below 33 feet.						
35			Bottom of excavation at 35 feet						

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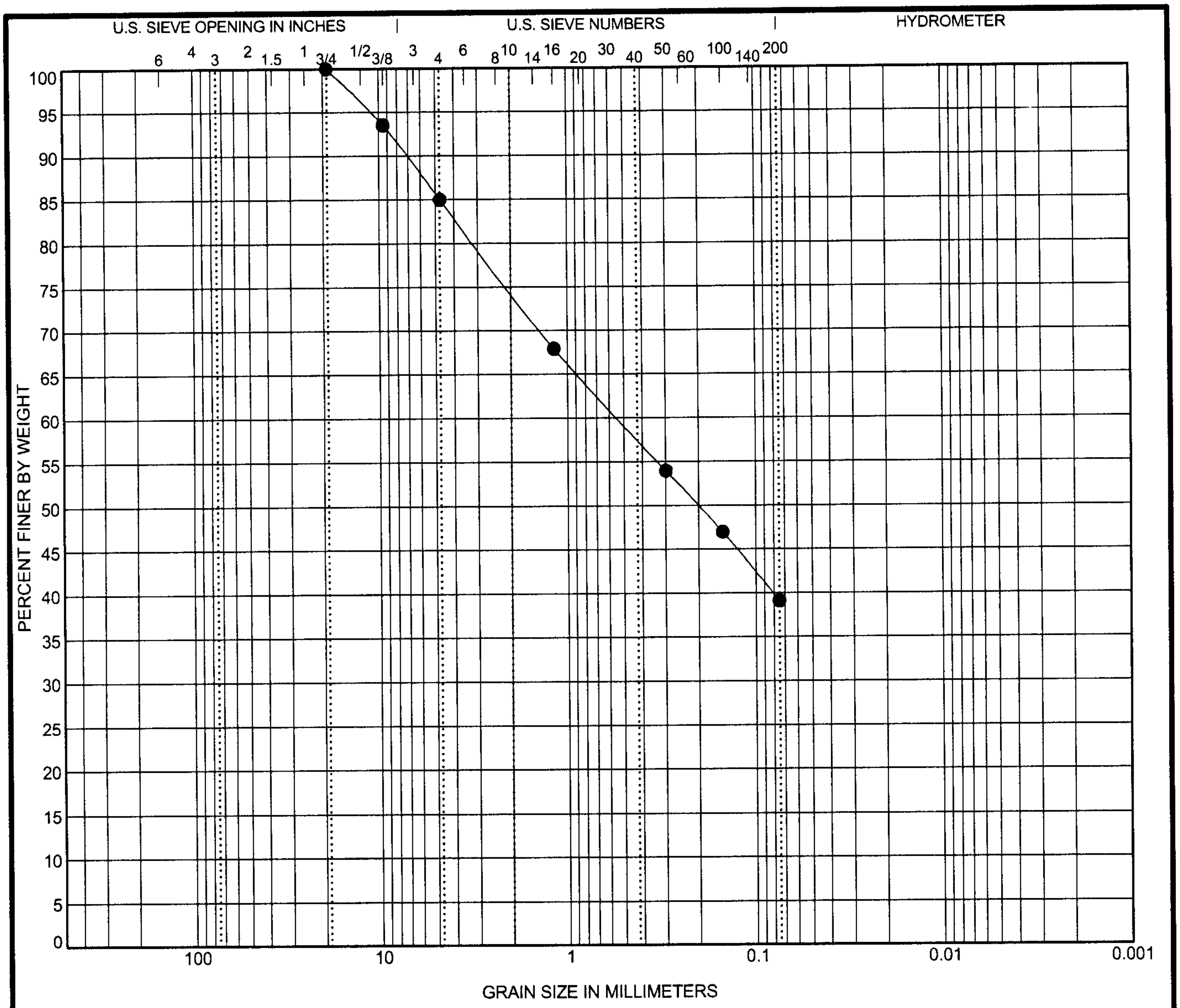
WATER LEVELS				
▽ 33 10/28/08	STARTED 10/28/08	FINISHED 10/28/08		
	DRILL CO. Owner	DRILL RIG Trackhoe		
	DRILL TYPE Excavation			
	LOGGED BY Lori S. Yahne, P.E.			



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**TL-1**	**18.0**	**LEAN CLAY with SAND (CL)**	**40**	**16**	**24**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TL-1**	**18.0**	**19.1**	**0.54**			**15.0**	**45.9**	**39.1**	

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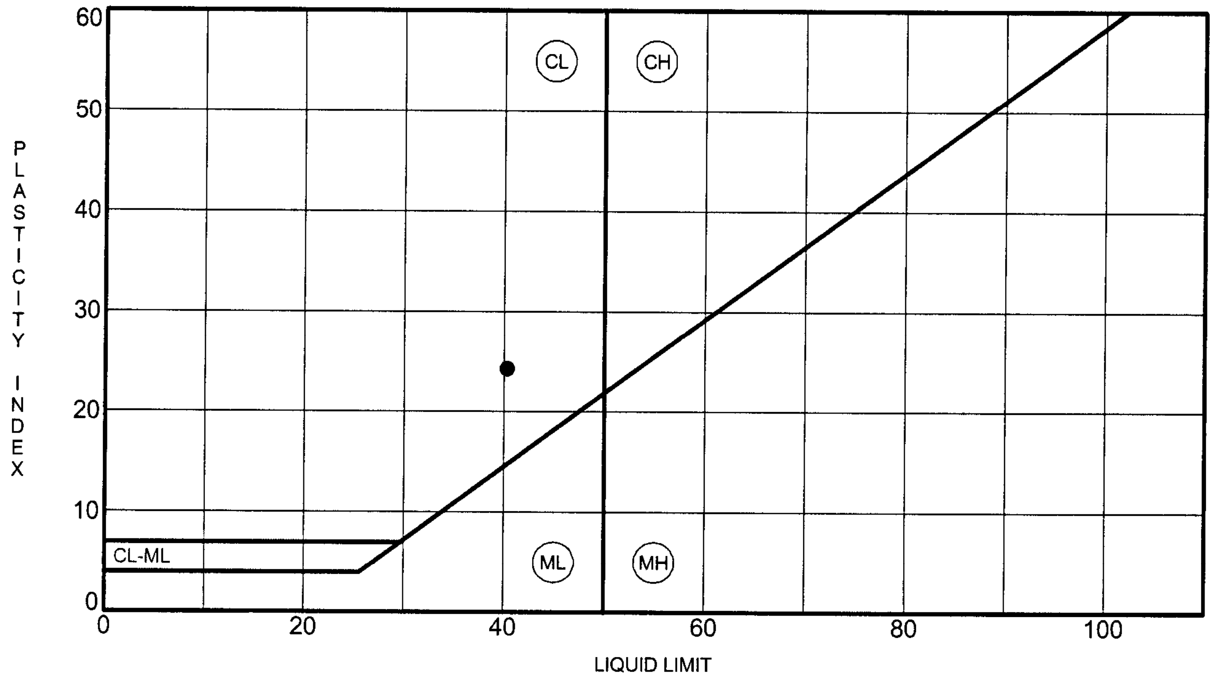
GRAIN SIZE DISTRIBUTION

Project: Edwards Residence

Location: 426 Woodside Ave Park City, UT

Number: 08G-124



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**TL-1**	**18.0**	**40**	**16**	**24**	**39**	**LEAN CLAY with SAND (CL)**

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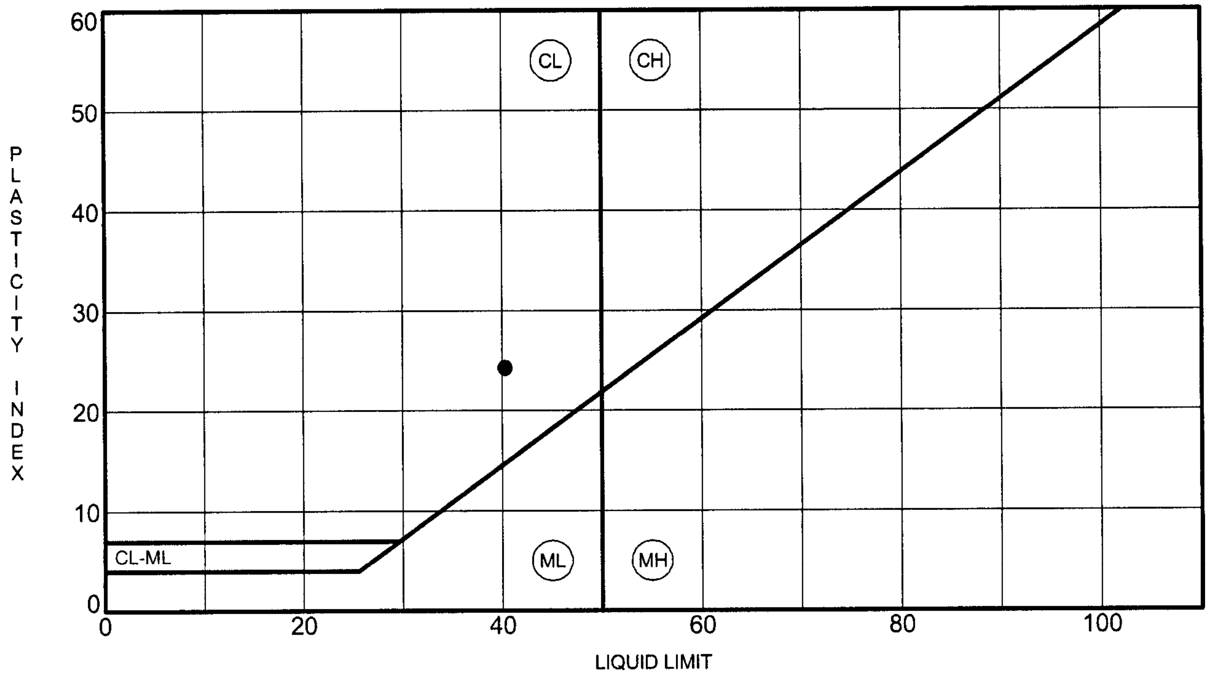
ATTERBERG LIMITS' RESULTS

Project: Edwards Residence
Location: 426 Woodside Ave Park City, UT
Number: 08G-124



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**TL-1**	**18.0**	**40**	**16**	**24**	**39**	**LEAN CLAY with SAND (CL)**

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ATTERBERG LIMITS' RESULTS

Project: Edwards Residence
Location: 426 Woodside Ave Park City, UT
Number: 08G-124

US ATTERBERG LIMITS 08G-124 EDWARDS RESIDENCE GINT.GPJ Y2 GEOTECH.GDT 11/7/08

Sheet 1 of 1

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
TL-1	18.0	40	16	24	19.1	39	SC	17.7			

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Summary of Laboratory Results

Project: Edwards Residence
Location: 426 Woodside Ave Park City, UT
Number: 08G-124