

Geotechnical
Environmental
Materials Engineers

Gregg A. Creaser, P.E.
Brett P. Creaser, P.E.
Donald L. Cornelison, P.E.
Steven A. Griess, P.E.
Prabhakar (Peter) Rupal, P.E.
Timothy J. Rheinschmidt, R.G.
James A. Speedie, P.E.

**REPORT ON GEOTECHNICAL
INVESTIGATION**

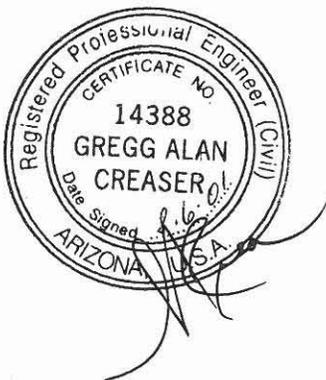
DESIGNATION: Ellsworth Road

LOCATION: Germann Rd. to ½ Km N/o Elliot Rd
Mesa, Arizona

CLIENT: CH2MHILL

PROJECT NO: 010034SA

DRAFT DATE: August 6, 2001



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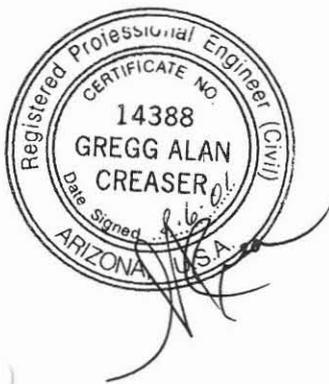
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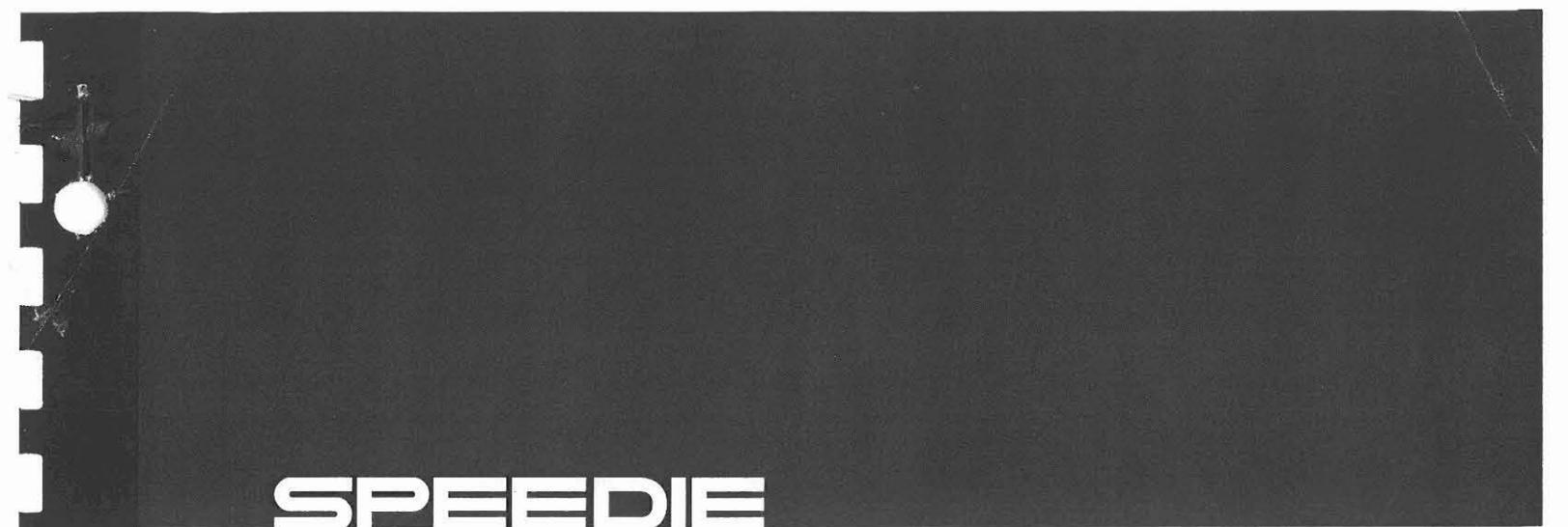
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**SPEEDIE
AND ASSOCIATES**

Geotechnical ▪ Environmental ▪ Materials Engineers

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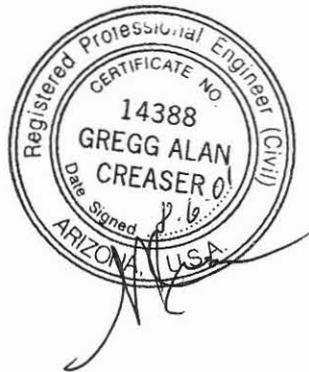
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1.0 INTRODUCTION

This report presents the results of a subsoil investigation carried out at the site of the proposed Ellsworth Road improvements, from Germann to ½ kilometer north of Elliot Road in Mesa, Arizona.

Preliminary information calls for the construction of approximately 10 km (5.5 mi.) of roadway improvements, 5.5 km (3 mi.) of open channel, 5 new RCBC's, extension of an existing RCBC and storm drain pipeline connecting catch basins to the channels. The roadway will be widened from two lanes to four or six lanes with either raised median or center turn lane. The alignment and grade changes will likely make salvaging the existing pavement not possible. The investigation and design will include recommendations to salvage and include this pavement into the new structural sections where economical.

Information from three borings drilled in 1999 for another drainage project has been included, along with the current work of 28 boring drilled in February 2001. Borings drilled in 1999 are designated with a 1999 suffix (i.e. B-1, 1999).

2.0 GENERAL SITE AND SOIL CONDITIONS

2.1 Site Conditions

This section of Ellsworth Road is currently a paved two-lane rural collector roadway with dirt shoulders. The surrounding land usage appears to be, or have been mainly agricultural with large industrial facilities such as the GM proving grounds and Williams Gateway Airport.

2.2 Geological Conditions

The subject site is underlain by a thick sequence of Cenozoic sedimentary deposits that form the major aquifer units of the Salt River Valley Basin. The sedimentary deposits primarily consist of unconsolidated to semi-consolidated silts, sands and gravels that yield substantial quantities of groundwater. The site is located within an area that has undergone considerable subsidence due to groundwater removal. Total subsidence of several feet has been recorded in the valley. Recent investigations have indicated that the rate of subsidence is decreasing due to reduced groundwater withdrawal as a result of urbanization and subsequent lowered agricultural demand for groundwater. Fissure gullies form over subsurface irregularities such as soil-rock contacts which cause tensional stresses and differential subsidence. Where such anomalies are not present, subsidence tends to be uniform over a wide area, this having no effect on surficial structures. Unfortunately, this particular area is shown to have had differential rates of subsidence along the alignment. A 1974 subsidence map (Land Subsidence and Earth Fissures in Alluvial Deposits in the Phoenix Area,

Arizona, H.H. Schumann) shows a 0 to 1 foot drop over a 19 year period near station 3+200 and elevation drops from 1 to 3 feet on the north and south ends of the alignment over the same period. Recent satellite imagery of the area immediately to the north of the site (University of Texas, S. Buckley, 1995-1998) and preliminary survey data (Arizona Department of Water Resources, M. Tatlow) north of the site shows current rates of subsidence at 1 to 2 cm per year. The University of Texas is currently processing satellite imagery for the subject area, although the results will not be known for approximately six months. Historic data and current data surrounding the site suggest that 1 to 2 cm of differential settlement along the alignment is possible. Subsidence is a basin wide phenomenon that can result in differential elevation changes over long distances that may affect drainage patterns proposed for this site. There could be a negative effect on long flatly sloped channels if the trend of basin tilt goes against the channel flow direction. Additional information may be obtained from Bob Phillips of GPS Services (480) 963-0254.

A field reconnaissance and study of aerial photographs revealed that drainage in the area of station 9+600 maybe a concern. This area was observed to have flood erosion from east to west over a depressed section of roadway. Fill material is proposed for this area and allowances for drainage should be addressed unless it has already been accounted for.

2.3 General Subsurface Conditions

Subsoil conditions consist of interbedded composites of clays, silts and sands with rare subordinate amounts of gravel and with varying degrees of calcareous cementation to depths of up to 6.5 meters (21.5 feet) below existing grade. Twelve borings drilled in Ellsworth Road revealed a pavement structure made up of 150 to 175mm(6 to 7 inches) of asphaltic concrete, and 0 to 75mm (0 to 3 inches) of aggregate base. Standard Penetration Test values generally range from 4 to 50+ blows per 300mm (foot), generally increasing with depth. No groundwater was encountered during this investigation. Based on visual and tactile observation, the soils were in a 'dry' to 'moist' state at the time of investigation.

Laboratory testing indicates in-situ dry densities of the upper soils ranging from 1390 to 1770 kg/m³ (87 to 110 pcf) at 8 to 22 percent moisture, at the time of investigation. Liquid limits of the clays are in the 21 to 39 percent range with plasticity indices ranging from 2 to 21 percent. The sands and silts are expected to be low to non-plastic. The upper clayey soils exhibit volume increase due to wetting of approximately 3 to 4 percent when re-compacted to moistures and densities normally expected during construction. An undisturbed sample displayed compression during increasing loading up to a maximum load of 105 kPa (2,200 psf) and additional compression after inundation. Laboratory measured minimum resistivities range from 1,200 ohm-cm to 3,000 ohm-cm while soil pH ranged from 7.6 to 9.0.

CORROSIVE

3.0 ANALYSIS AND RECOMMENDATIONS

3.1 Analysis

Analysis of the field and laboratory data indicates that subsoils at the site are generally favorable for the support of pavements subject to remedial earthwork. They also appear to be suitable for construction of the culverts and channels to the intended depths and side slopes. The presence of cemented or very dense/hard soils may impede excavation progress within culvert and channel areas and require the use of heavier equipment.

With respect to cast-in-place concrete pipe, sloughing within sandier zones may require removal and replacement or laying back of side slopes and result in concrete quantities higher than neat dimension calculations. Bedding should be selected per the requirements of the pipe materials used and the trench loading conditions.

Laboratory-measured, minimum soil resistivity measurements indicate a severe degree of corrosiveness. Suitable and adequate protection to buried metal pipe and/or increased wall thickness per the American Iron and Steel Institute Handbook of Steel Drainage & Highway Construction Products will be essential for long term performance. Suitable pipe wall thickness and corrosion protection should be selected per the trench/traffic load and lifetime requirements of the project. Subsurface concrete should use Type I or II cement, readily available and used in the area.

Ground water is not expected to be a factor in the design or construction of shallow foundations and underground utilities. Depending on the time of year, flow in the existing channel may have to be diverted. If the soils are still wet when construction begins, the exposed grade may become unstable under excavating equipment. Additional time may be required to allow the soils to dry when exposed, or alternative methods such as chemical stabilization or rock fill may be required to stabilize the exposed grade.

The swell potential of the upper clayey soils is a concern. The potential is usually strong enough to cause differential movements of slabs-on-grade such as floors and sidewalks but not enough to cause damage to structures unless lightly loaded. Accordingly, it will be critical to pay attention to providing **proper drainage to limit the potential for water infiltrating under pavement systems and/or slabs.** A minimum slope of at least 5 percent for a distance of 3 meters (10 feet) is recommended for unpaved landscaped areas.

3.2 Site Preparation

The entire area to be occupied by the proposed construction should be stripped of all vegetation, debris, rubble and obviously loose surface soils. Depending on the proposed grades, additional native soil should be removed as necessary to provide space for the 300mm (12 inches) of non-expansive import below any minor slab on grade structures that may be anticipated.

If grading plans require placing structural fill below footing bottom elevation, the exposed grade should be scarified to a depth of 200mm (8 inches), moisture-conditioned to optimum (± 2 percent) and compacted to at least 95 percent of maximum dry density as determined by ASTM D-698.

All cut areas and areas above footing bottom elevation that are to receive slab on grade only fill (i.e. sidewalks) that expose clayey soils (CL or SC classification) should be scarified 200mm (8 inches), moisture-conditioned to at least optimum to 3 percent above optimum, and uniformly compacted to at least 85 but not more than 92 percent of maximum dry density as determined by ASTM D-698.

The silts and fine sands may be sensitive to excessive moisture content and could become unstable at elevated moisture content. Accordingly, it may be necessary to compact these soils on the dry side of optimum, especially in asphalt pavement areas. The reduced moisture content under slabs-on-grade should only be used upon approval of the engineer in the field.

3.3 Excavation And Temporary Cut Slopes

Excavation operations should be relatively straightforward using conventional equipment. The presence of cemented or very dense/hard soils may impede progress and could require the use of heavier equipment. The fact that a boring was advanced to a particular depth does not mean that the soil may be readily excavated. Variable cementation may require more aggressive methods to excavate. The contractors should make their own determination as to excavatability. All excavations must comply with current governmental regulations including the current OSHA Excavation and Trench Safety Standards. Side slopes for open-cut excavation in the sandy clays and clayey sands (CL or SC classification) should be cut back at 1:1 (horizontal to vertical). Steeper slope may be possible on a case-by-case basis. Side slopes within the silts and sands (SM, ML, SW/SP classification) should be cut back at 1.5:1. The slopes should be protected from erosion due to run-off or long term surcharge at the slope crest. Construction equipment, building materials, excavated soil and vehicular traffic should not be allowed within 3 meters (10 feet) or 1/3 the slope height, whichever is greater, from the top of slope. All cut slopes should be observed by the Soils Engineer during excavation. Adjustments to the recommended slopes may be necessary due to wet zones, loose strata and other conditions not observed in the borings. Localized shoring may also be required.

Shotcrete or soil stabilizer on the slope face may be useful in preventing erosion due to run-off and/or drying of the slope.

3.4 Earthwork Factors

The recommendations are based on the information obtained from the subgrade investigation and subsequent laboratory testing. The earthwork factors are based on samples obtained from the subgrade investigation with the assumption that the subsurface conditions are consistent with those found at the exploration locations. Earthwork factors were calculated based on in-situ density test values recompacted to 97 percent maximum dry density. Maximum dry density values were assigned to in-situ density tests based on gradation and Atterburg limits. Based on this evaluation, values ranged from zero to 23 percent with an average value of 12 percent. It is recommended to use a shrinkage value of 15 percent. A ground compaction factor of 60 to 90 mm (0.2 to 0.3 feet) should be used for the entire alignment outside the current pavement prism.

3.5 Foundation Design - Culverts

It is recommended that the culvert structures be founded on the standard mat type floor foundation bearing on dense native soil, or properly compacted fill if dictated by grading plans, at a minimum depth of 600mm (24 inches) below lowest, finished exterior grade within 1.5 meters (5 feet) of the structure. For structures in channel areas, the up stream and down stream edges should have turn-down cut off walls that extend at least 900mm (36 inches) below the design scour and/or stream bed degradation elevation. If site preparation is carried out as set forth herein, a recommended maximum allowable bearing capacity of 120 kPa (2,500 psf) can be utilized for design. These bearing capacities refer to the total of all loads, dead and live, and are net pressures. They may be increased one-third for wind, seismic or other loads of short duration. All footing excavations should be level and cleaned of all loose or disturbed materials.

Estimated settlements under design loads are on the order of 12 to 25 mm (½ to 1-inch), virtually all of which will occur during construction. Post-construction differential settlements will be negligible, under existing and compacted moisture contents. Additional localized settlements of the same magnitude could occur if native supporting soils were to experience a significant increase in moisture content.

3.6 Lateral Pressures

The following lateral pressure values may be utilized for the proposed construction when backfilled with a clean granular soil:

Active Pressures

Unrestrained Walls	5.5 kPa/m (35 pcf)
Restrained Walls	9.5 kPa/m (60 pcf)

Passive Pressures

Continuous Footings	55 kPa/m (350 pcf)
Spread Footings or Drilled Piers	63 kPa/m (400 pcf)

Coefficient of Friction (w/ passive pressure) 0.35

Coefficient of Friction (w/out passive pressure) 0.45

All backfill must be compacted to not less than 95 percent (ASTM D-698) to mobilize these passive values at low strain. Expansive native soils should not be used as retaining wall backfill, except as a surface seal to limit infiltration of storm/irrigation water. The expansive pressures could greatly increase active pressures.

3.7 Fill And Backfill

Native soils are considered suitable for use in general grading fills depending on classification and location. Clayey soils should **not** be used in the top 300mm (foot) of any building pad fill or as retaining wall backfill. The top foot of fill under any small building should be completed with an approved low or non-expansive soil, either approved imported common borrow, selectively stockpiled site-available materials or select granular soil. If select granular is used, the 4 inches of under slab A.B.C. may be included as part of the 300mm (12 inches). Otherwise, a full 300mm (12 inches) of common borrow should be used in addition to the normal 100mm (4 inches) of A.B.C. Below grade structural backfill should consist of Aggregate Base per MAG Section 702.

If imported common fill for use in site grading is required, it should be examined by a Soils Engineer to ensure that it is of low swell potential and free of organic or otherwise deleterious material. The borrow requirements should be adjusted to meet the R-value used for pavement design. In general, the fill should be equal to or better than the native soils and have 100 percent passing the 75mm (3-inch) sieve and no more than 60 percent passing the 0.075mm (200) sieve. For the fine fraction (passing the 40 sieve), the

liquid limit and plasticity index should not exceed 30 percent and 10 percent, respectively. It should exhibit less than 1.5 percent swell potential when compacted to 95 percent of maximum dry density (ASTM D-698) at a moisture content of 2 percent below optimum, confined under a 4.8 kPa (100 psf) surcharge, and inundated.

Fill should be placed on subgrade, which has been properly prepared and approved by a Soils Engineer. Fill must be wetted and thoroughly mixed to achieve optimum moisture content, ± 2 percent (optimum to +3 percent for underslab fill). Fill should be placed in horizontal lifts of 200mm (8-inch) thickness (or as dictated by compaction equipment) and compacted to the percent of maximum dry density per ASTM D-698 set forth as follows:

A.	Structural Areas	
1.	Below footing level/box culverts	95
2.	Below slabs-on-grade (expansive soils)	90-95 max
B.	Pavement Subgrade or Fill	
1.	Under sidewalks	85
C.	Utility Trench Backfill	
1.	More than 600mm (2.0') below finish S/G	95
2.	Within 600 (2.0') of finish S/G (non-granular)	95
3.	Within 600 (2.0') of finish S/G (granular)	100
D.	Aggregate Base Course	
1.	Below asphalt paving	100
E.	Landscape Areas	
1.	Miscellaneous fill	90
2.	Utility trench - more than 300mm (1.0') below F/G	85
3.	Utility trench - within 300mm (1.0') of F/G	90

3.8 Asphalt Pavement

The scope of work for this investigation does not include pavement design.

Tables 1 and 2 present the results of the R-value calculating the resilient moduli for the soils through out the roadway section.

TABLE 2 - R-Value Analysis – Ellsworth Road - Sta 1+000 to 10+200

	No. Of Samples	Average R-value	Std. Dev
Correlated Values	21	31	8
Lab Values	12	34	13

A Seasonal Variation Factor of 1.0 was selected from data provided by ADOT Materials Section Pavement Group for this area. Using the formulas from the ADOT MPE&D manual to calculate the design R_{MEAN} and M_R results in the following table:

Table 3 – Subgrade Soil Profile

Street	R_{mean}	M_r
Ellsworth Sta-1+000 to 10+200	32	18,820

Notes:

1. Designs are based on AASHTO design equations, laboratory-determined and ADOT correlated R-values.

This assumes that all subgrades are prepared in accordance with the recommendations contained in the "Site Preparation" and "Fill and Backfill" sections of this report, and paving operations carried out in a proper manner. If pavement subgrade preparation is not carried out immediately prior to paving, the entire area should be proof-rolled at that time with a heavy pneumatic-tired roller to identify locally unstable areas for repair.

The clay subgrade soils are considered suitable candidate for lime stabilization. There can be a substantial reduction in aggregate base thickness (up to full replacement) for a given traffic volume when the subgrade is stabilized. Correspondingly, the capacity can be greatly increased. A minimum of 200mm (8 inches) of subgrade should be stabilized with lime slurry. All stabilization work should be carried out in accordance with M.A.G. Section 309 Specifications. If this option is seriously considered, it is recommended that several trial mixes be tested using the native, subgrade soils and varying amounts of lime to determine an optimum amount. Typically, lime on the order of 4½ to 6 percent by weight can be used, depending on strength requirements, for preliminary estimating purposes. A minimum 5-day lab cured compressive strength of 1100 kPa (160 psi) is recommended.

Soil stabilization should be carried out by a contractor experienced in this type of work. Consideration may be given to use of a slurry rather than dry application since dusting is a concern. Use of a slurry will also reduce the amount of loss, provide consistent coverage and ensure proper hydration.

3.9 Utilities Installation

Trench excavations for utilities can be accomplished by conventional trenching equipment. Cemented soils may impede progress and could require the use of heavier equipment. See 'Analysis' and 'Excavation and Temporary Cut Slopes' sections above. Adequate precautions must be taken to protect workmen in accordance with all current governmental regulations.

Backfill of trenches may be carried out with native excavated material (<75mm [3 inches] in diameter). This material should be moisture-conditioned, placed in 200 mm (8-inch) lifts and mechanically compacted. Water settling is not recommended. Compaction requirements are summarized in the "Fill And Backfill" section of this report.

4.0 GENERAL

The scope of this investigation and report does not include regional considerations such as seismic activity and ground fissures resulting from subsidence due to groundwater withdrawal, nor any considerations of hazardous releases or toxic contamination of any type.

Our analysis of data and the recommendations presented herein are based on the assumption that soil conditions do not vary significantly from those found at specific sample locations. Our work has been performed in accordance with generally accepted engineering principles and practice; this warranty is in lieu of all other warranties expressed or implied.

We recommend that a representative of the Soils Engineer observe and test the earthwork and foundation portions of this project to ensure compliance to project specifications and the field applicability of subsurface conditions which are the basis of the recommendations presented in this report. If any significant changes are made in the scope of work or type of construction that was assumed in this report, we must review such revised conditions to confirm our findings if the conclusions and recommendations presented herein are to apply.

Respectfully submitted,
SPEEDIE & ASSOCIATES, INC.



Timothy J. Rheinschmidt
Timothy J. Rheinschmidt, R.G.



Gregg A. Creaser
Gregg A. Creaser, P.E.

APPENDIX

FIELD AND LABORATORY INVESTIGATION

SOIL BORING LOCATION PLANS

SOIL LEGEND

LOG OF TEST BORINGS

TABULATION OF TEST DATA

CONSOLIDATION TEST

MOISTURE-DENSITY RELATIONS

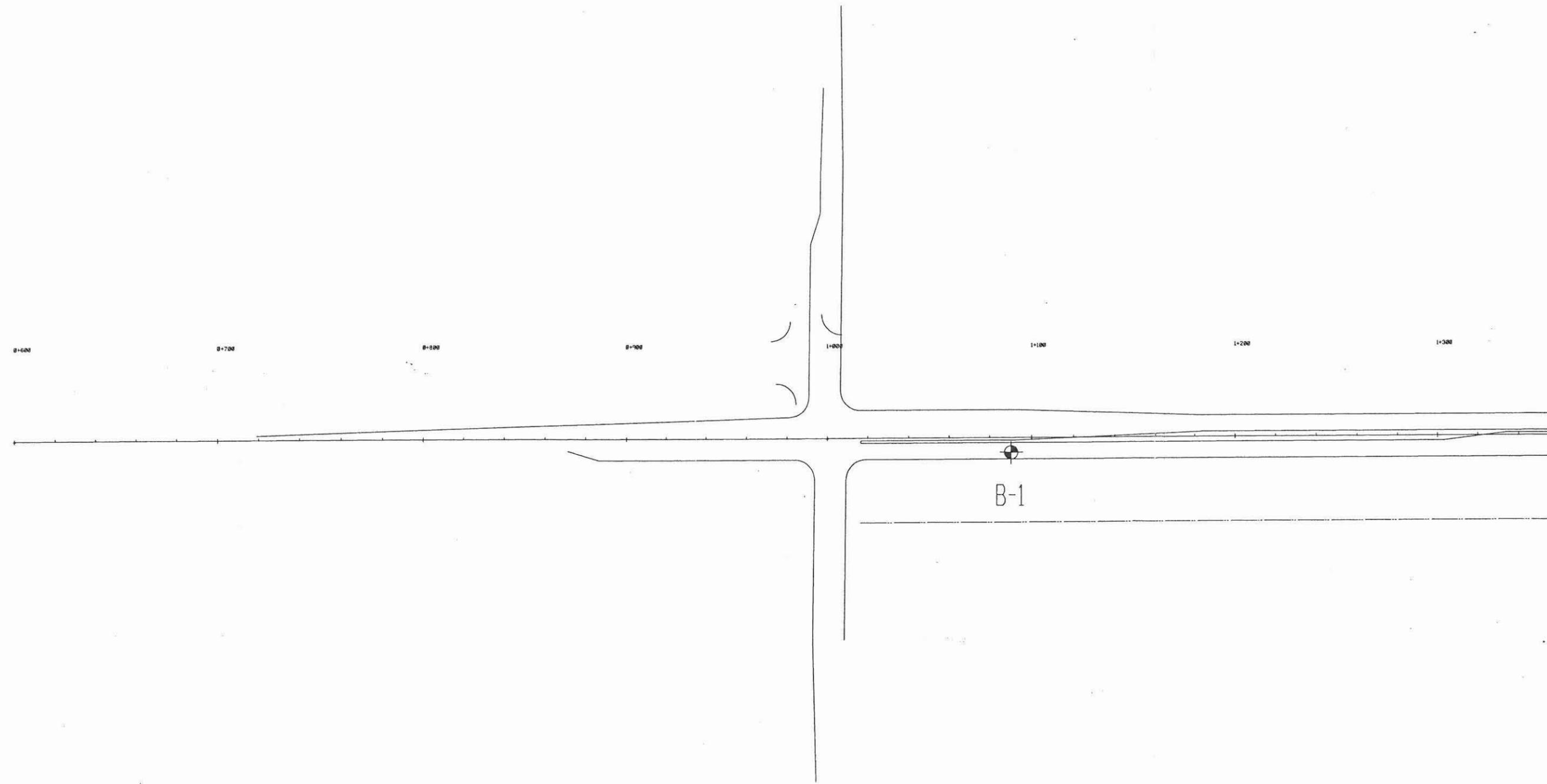
SHEAR TEST DIAGRAM

TABULATION OF CORRELATED R-VALUES

FIELD AND LABORATORY INVESTIGATION

On February 12, 13, 2001, soil test borings were drilled at the approximate locations shown on the attached Soil Boring Location Plan. All exploration work was carried out under the full-time supervision of our staff geologist, who recorded subsurface conditions and obtained samples for laboratory testing. The soil borings were advanced with a truck-mounted CME-55 drill rig utilizing 7-inch diameter hollow stem flight augers. Detailed information regarding the borings and samples obtained can be found on an individual Log of Test Boring prepared for each drilling location.

Laboratory testing consisted of moisture content, dry density, grain-size distribution and plasticity (Atterberg Limits) tests, pH, resistivity and agronomic tests for classification and design parameters. Remolded swell tests were performed on samples compacted to densities and moisture contents expected during construction. Compression tests were performed on a selected ring sample in order to estimate settlements and determine effects of inundation. All field and laboratory data is presented in this appendix.

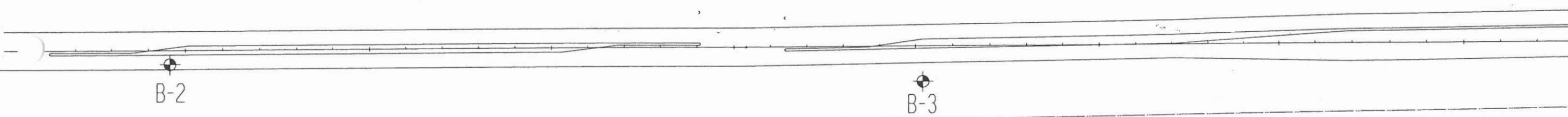


⊕ - APPROXIMATE SOIL BORING LOCATION

SOIL BORING LOCATION PLAN			
MARICOPA COUNTY DOT ELLSWORTH RD., GERMANN TO ELLIOT MESA, ARIZONA		SPEEDIE AND ASSOCIATES <small>GEOTECHNICAL/ENVIRONMENTAL/MATERIALS ENGINEERS 11029 N. 24TH AVE., SUITE 805 PHOENIX, ARIZONA 85029 (602) 937-6391</small>	
DES:	DR: CMW	CHK: TR	DATE: 07-24-01 PROJ. NO.: 010034SA



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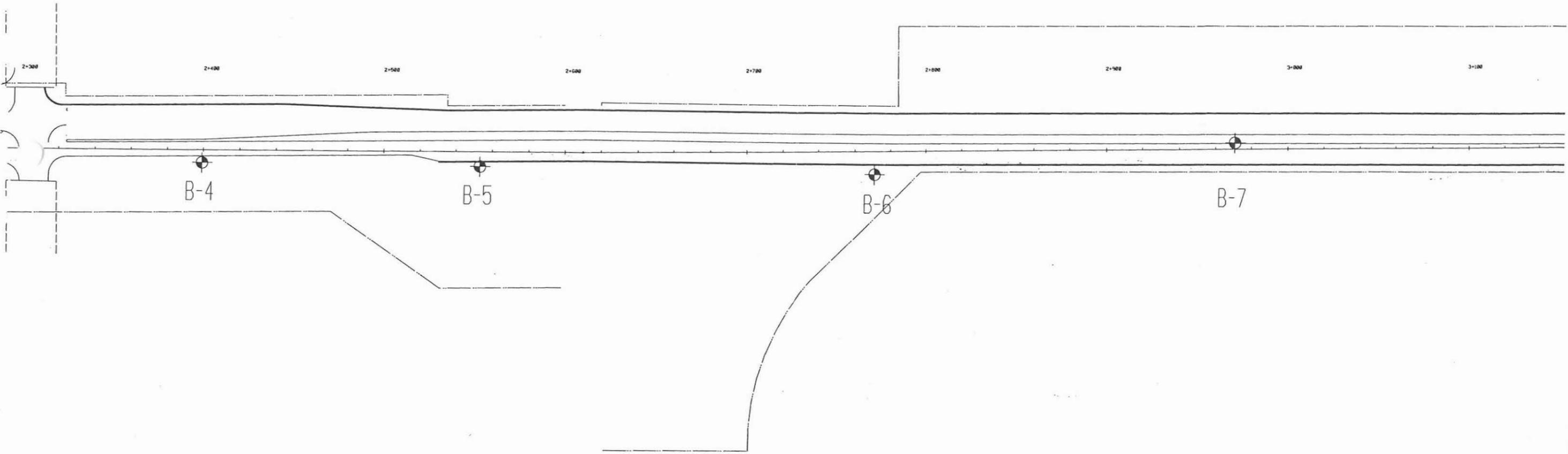
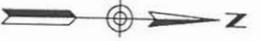


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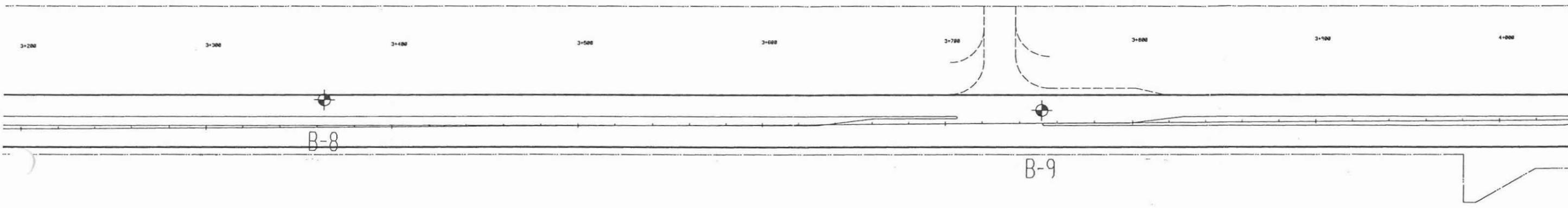
 - APPROXIMATE SOIL BORING LOCATION

SOIL BORING LOCATION PLAN					
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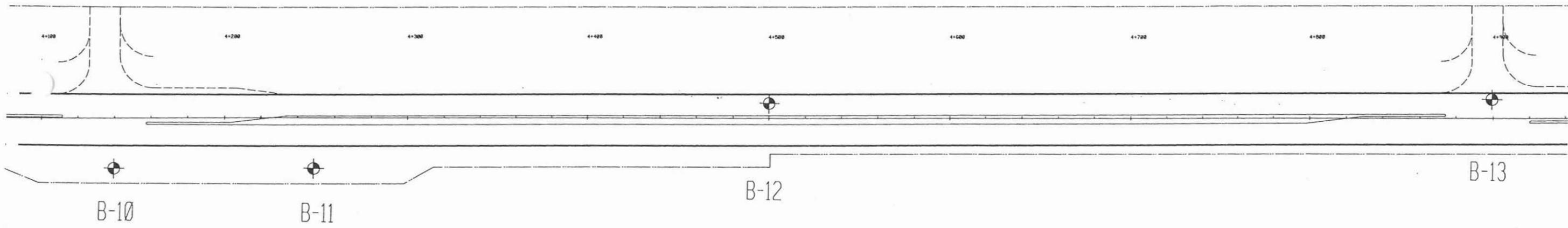
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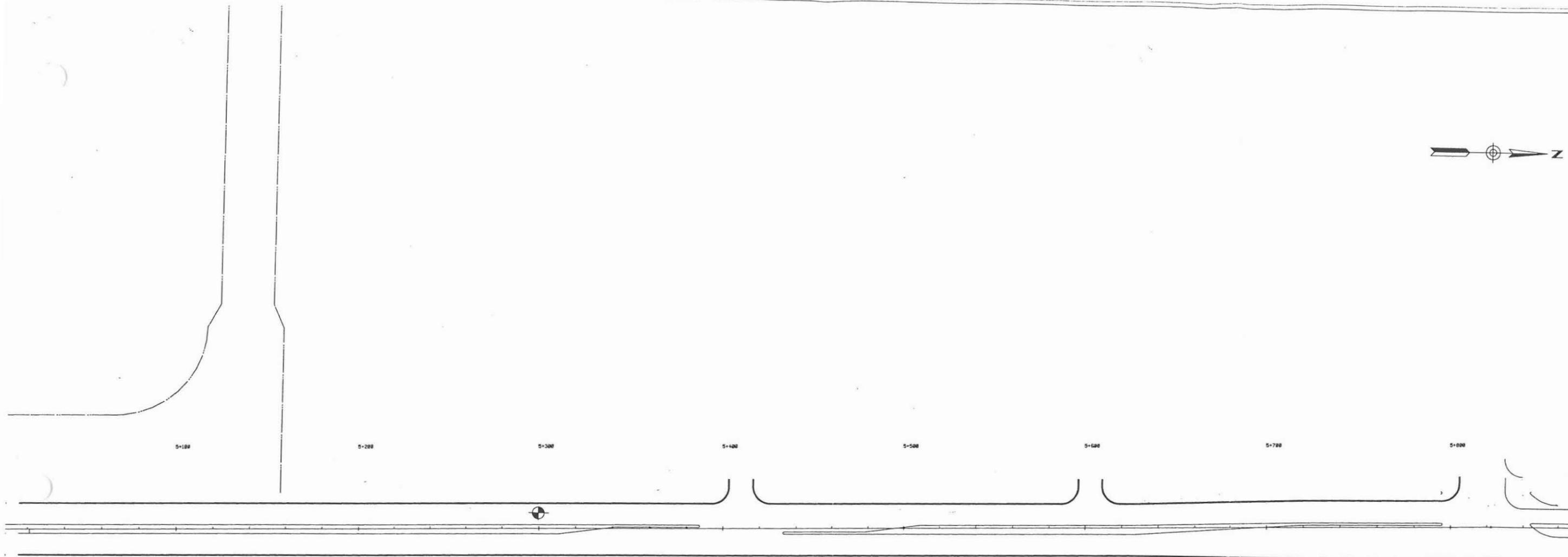
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⊕ - APPROXIMATE SOIL BORING LOCATION

SOIL BORING LOCATION PLAN			
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ELLSWORTH RD., GERMANN TO ELLIOT MESA, ARIZONA			
DES:	DR: TR	CHK: PR	DATE: 03-05-01
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6+000 6+100 6+200 6+300 6+400 6+500 6+600 6+700 6+800

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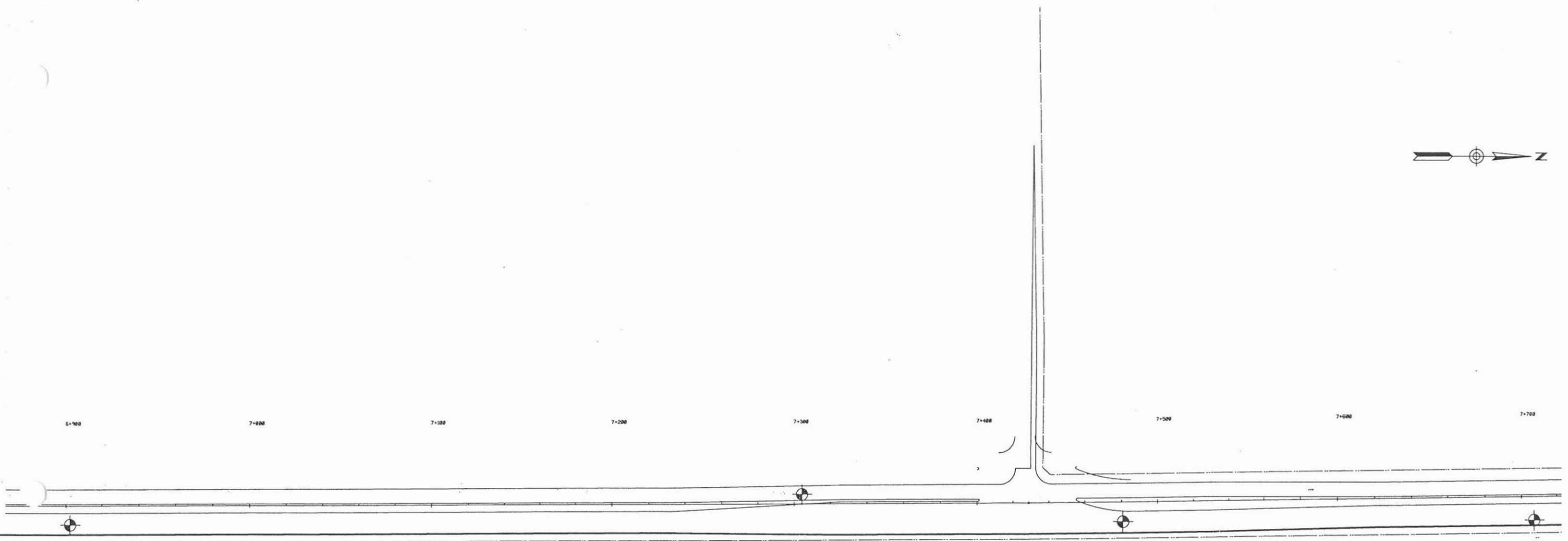
⊕ - APPROXIMATE SOIL BORING LOCATION

SOIL BORING LOCATION PLAN

MARICOPA COUNTY DOT
ELLSWORTH RD., GERMANN TO ELLIOT
MESA, ARIZONA

**SPEEDIE
AND ASSOCIATES**
GEOTECHNICAL/ENVIRONMENTAL/MATERIALS ENGINEERS
11029 N. 24th AVE., SUITE 805 PHOENIX, ARIZONA 85029 (602) 997-6391

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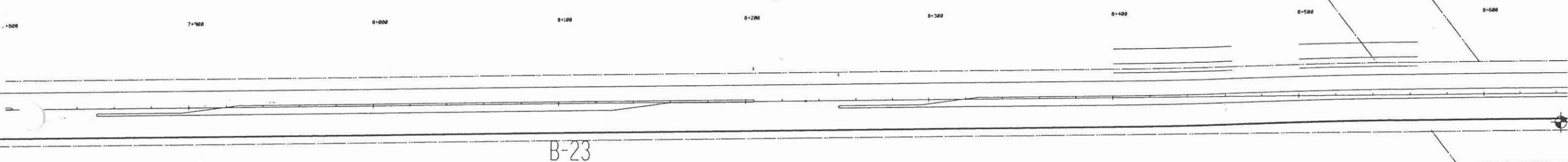
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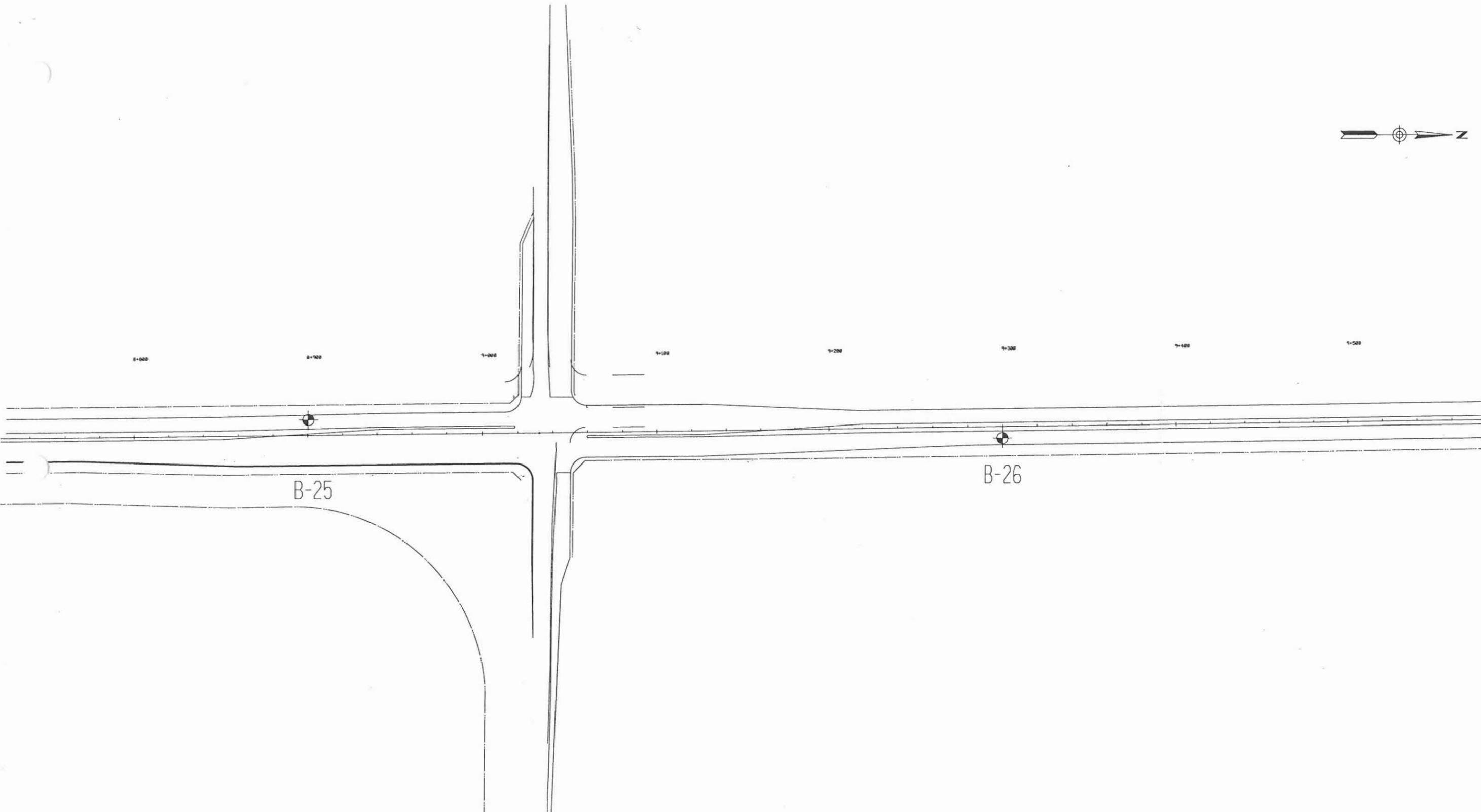
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MARICOPA COUNTY DOT ELLSWORTH RD., GERMANN TO ELLIOT MESA, ARIZONA			SPEEDIE AND ASSOCIATES <small>GEOTECHNICAL/ENVIRONMENTAL/MATERIALS ENGINEERS 11029 N. 24TH AVE., SUITE 805 PHOENIX, ARIZONA 85029 (602) 937-6391</small>	
DES:	DR: CMW	CHK: TR	DATE: 07-24-01	PROJ. NO.: 010034SA



⊕ - APPROXIMATE SOIL BORING LOCATION

SOIL BORING LOCATION PLAN				
MARICOPA COUNTY DOT ELLSWORTH RD., GERMANN TO ELLIOT MESA, ARIZONA			SPEEDIE AND ASSOCIATES <small>GEOTECHNICAL/ENVIRONMENTAL/MATERIALS ENGINEERS 11029 N. 24TH AVE., SUITE 805 PHOENIX, ARIZONA 85029 (602) 997-6391</small>	
DES:	DR: CMW	CHK: TR	DATE: 07-24-01	PROJ. NO.: 010034SA

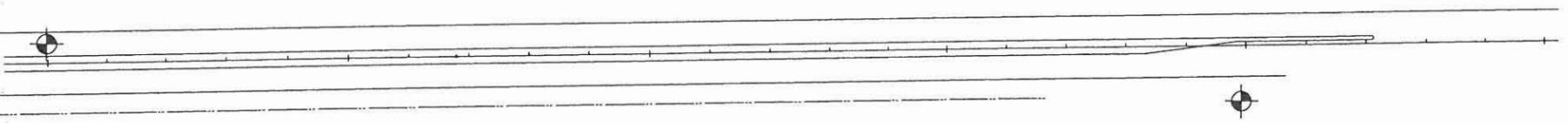


⊕ - APPROXIMATE SOIL BORING LOCATION

SOIL BORING LOCATION PLAN					
MARICOPA COUNTY DOT ELLSWORTH RD., GERMANN TO ELLIOT MESA, ARIZONA			SPEEDIE AND ASSOCIATES <small>GEOTECHNICAL/ENVIRONMENTAL/MATERIALS ENGINEERS 11029 N. 24th AVE., SUITE 805 PHOENIX, ARIZONA 85029 (602) 997-6391</small>		
DES:	DR: CMW	CHK: TR	DATE: 07-24-01	PROJ. NO.: 010034SA	



9+700 9+800 9+900 10+000 10+100 10+200



5 27

B-28

 - APPROXIMATE SOIL BORING LOCATION

SOIL BORING LOCATION PLAN					
MARICOPA COUNTY DOT ELLSWORTH RD., GERMANN TO ELLIOT MESA, ARIZONA			SPEEDIE AND ASSOCIATES <small>GEOTECHNICAL/ENVIRONMENTAL/MATERIALS ENGINEERS 11029 N. 24th AVE., SUITE 805 PHOENIX, ARIZONA 85029 (602) 997-6391</small>		
DES:	DR: CNW	CHK: TR	DATE: 07-24-01	PROJ. NO.:	010034SA

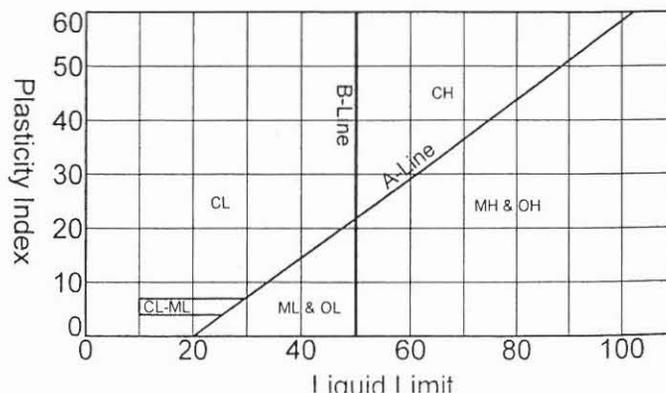
SOIL LEGEND

SAMPLE DESIGNATION	DESCRIPTION	
AS	Auger Sample	A grab sample taken directly from auger flights.
BS	Large Bulk Sample	A grab sample taken from auger spoils or from bucket of backhoe.
S	Spoon Sample	Standard Penetration Test (ASTM D-1586) Driving a 2.0 inch outside diameter split spoon sampler into undisturbed soil for three successive 6-inch increments by means of a 140 lb. weight free falling through a distance of 30 inches. The cumulative number of blows for the final 12 inches of penetration is the Standard Penetration Resistance.
RS	Ring Sample	Driving a 3.0 inch outside diameter spoon equipped with a series of 2.42-inch inside diameter, 1-inch long brass rings, into undisturbed soil for one 12-inch increment by the same means of the Spoon Sample. The blows required for the 12 inches of penetration are recorded.
LS	Liner Sample	Standard Penetration Test driving a 2.0-inch outside diameter split spoon equipped with two 3-inch long, 3/8-inch inside diameter brass liners, separated by a 1-inch long spacer, into undisturbed soil by the same means of the Spoon Sample.
ST	Shelby Tube	A 3.0-inch outside diameter thin-walled tube continuously pushed into the undisturbed soil by a rapid motion, without impact or twisting (ASTM D-1587).
--	Continuous Penetration Resistance	Driving a 2.0-inch outside diameter "Bullnose Penetrometer" continuously into undisturbed soil by the same means of the spoon sample. The blows for each successive 12-inch increment are recorded.

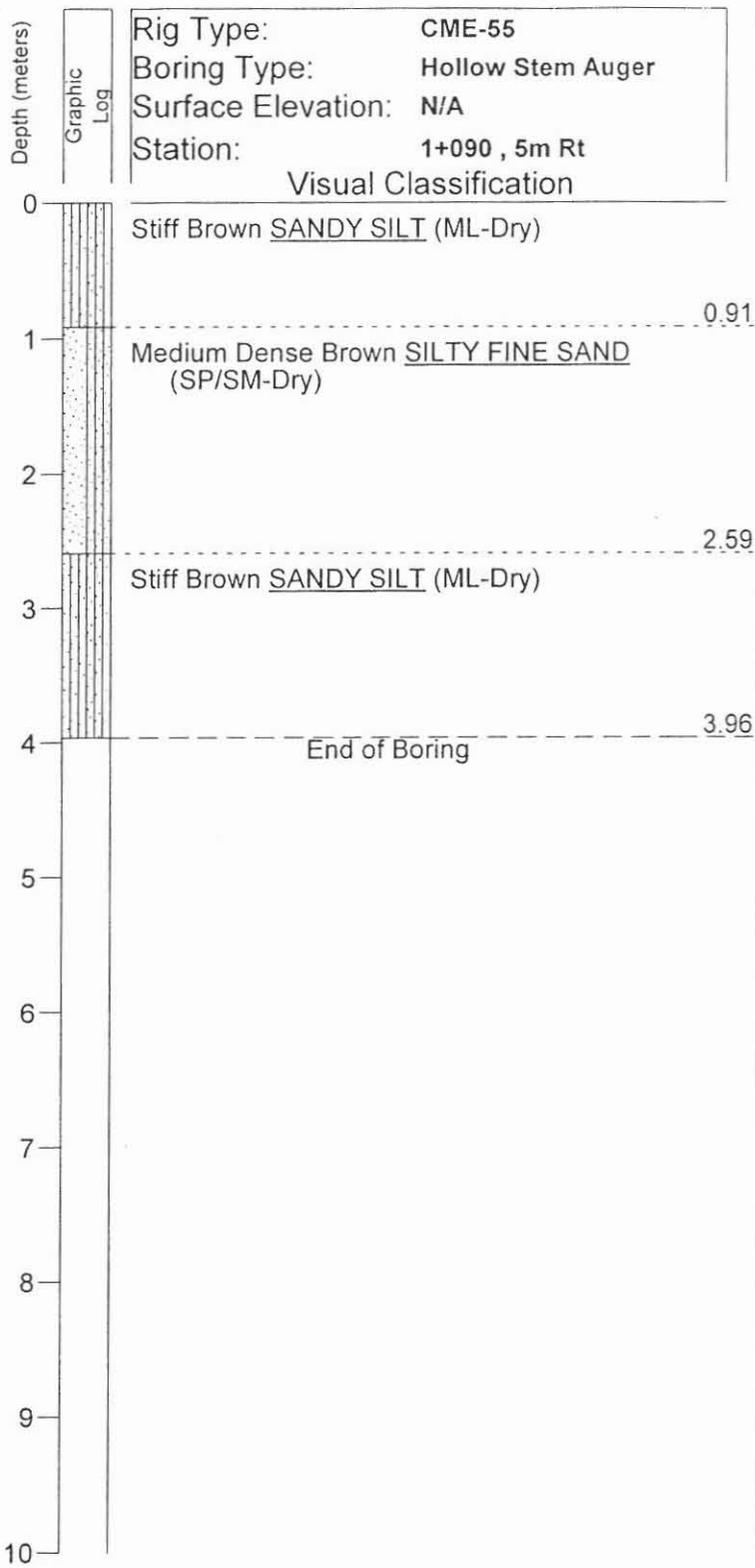
CONSISTENCY			RELATIVE DENSITY	
Clays & Silts	Blows/Foot	Strength (tons/sq ft)	Sands & Gravels	Blows/Foot
Very Soft	0 - 2	0 - 0.25	Very Loose	0 - 4
Soft	2 - 4	0.25 - 0.5	Loose	5 - 10
Firm	5 - 8	0.5 - 1.0	Medium Dense	11 - 30
Stiff	9 - 15	1 - 2	Dense	31 - 50
Very Stiff	16 - 30	2 - 4	Very Dense	> 50
Hard	> 30	> 4		

MAJOR DIVISIONS		SYMBOLS		TYPICAL DESCRIPTIONS
		GRAPH	LETTER	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS <small>(LITTLE OR NO FINES)</small>	GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES <small>(APPRECIABLE AMOUNT OF FINES)</small>	GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
			GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
	SAND AND SANDY SOILS	CLEAN SANDS <small>(LITTLE OR NO FINES)</small>	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES <small>(APPRECIABLE AMOUNT OF FINES)</small>	SM	SILTY SANDS, SAND - SILT MIXTURES
			SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	Liquid Limit LESS THAN 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	Liquid Limit GREATER THAN 50	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY / ORGANIC SILTS		
HIGHLY ORGANIC SOILS		PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS	

MATERIAL SIZE	PARTICLE SIZE				
	Lower Limit		Upper Limit		
	mm	Sieve Size ♦	mm	Sieve Size ♦	
SANDS	Fine	0.075	#200	0.42	#40
	Medium	0.420	#40	2.00	#10
	Coarse	2.000	#10	4.75	#4
GRAVELS	Fine	4.75	#4	19	0.75" x
	Coarse	19	0.75" x	75	3" x
COBBLES	75	3" x	300	12" x	
BOULDERS	300	12" x	900	36" x	
♦U.S. Standard		xClear Square Openings			



NOTE: DUAL OR MODIFIED SYMBOLS MAY BE USED TO INDICATE BORDERLINE SOIL



Rig Type: CME-55
 Boring Type: Hollow Stem Auger
 Surface Elevation: N/A
 Station: 1+090, 5m Rt
 Visual Classification

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	0.76	NT	NT	
RS-2	1.83	17.8	1460.9	
BS-3	2.44	NT	NT	
S-4	3.51	NT	NT	

Boring Date: 2-13-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level

Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

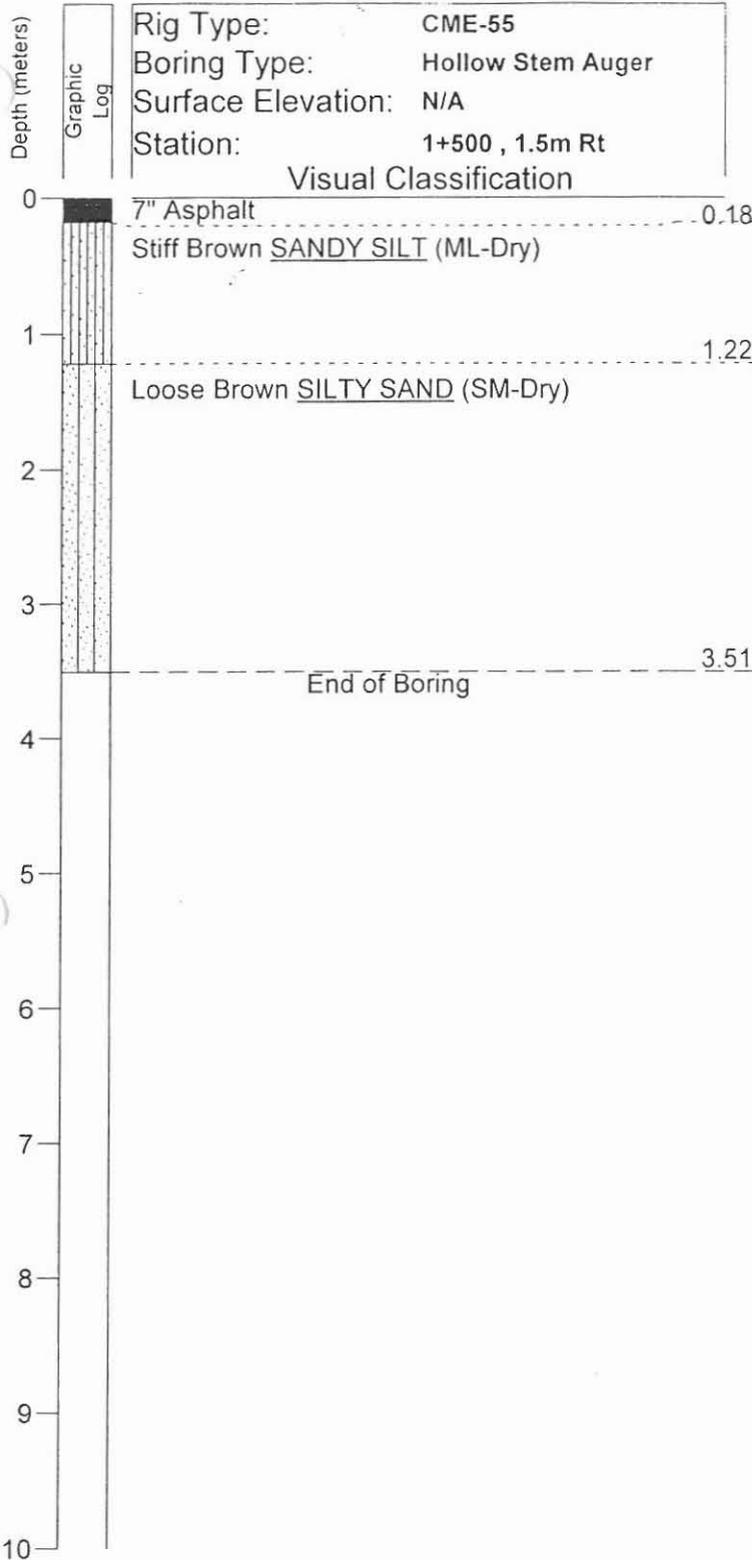
SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B-1

Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona

Project No.: 010034SA

METRIC SPEEDIE 010034SA GPJ GENGE0 GDT B/6/01



Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	0.76	NT	NT	
BS-2 RS-3	1.83	NT	NT	
S-4	3.51	NT	NT	

Boring Date: 2-12-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level		
Depth (m)	Hour	Date
Free Water was Not Encountered		

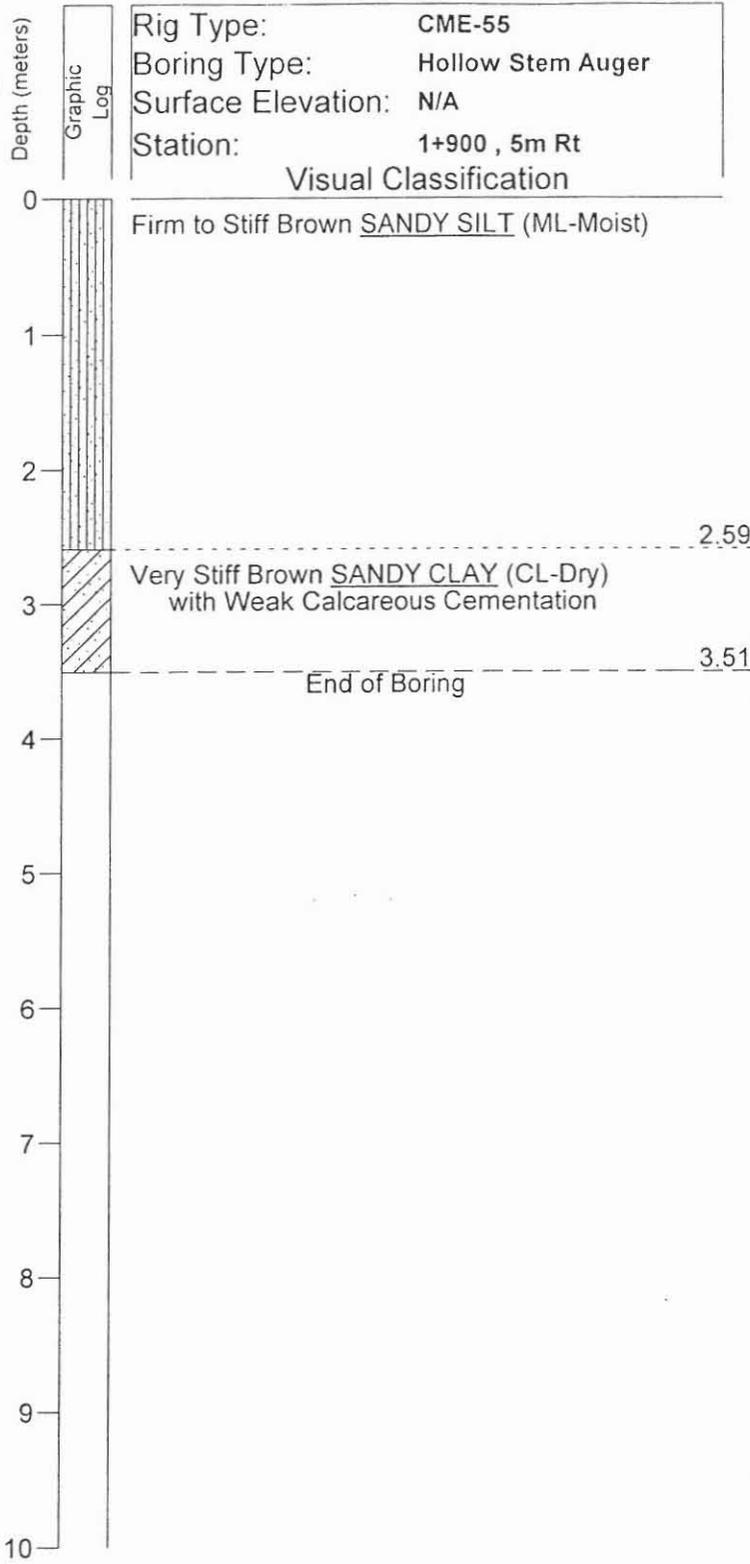
NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B-2

Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona

Project No.: 010034SA



Rig Type: CME-55
 Boring Type: Hollow Stem Auger
 Surface Elevation: N/A
 Station: 1+900 , 5m Rt
 Visual Classification

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	0.76	NT	NT	
RS-2	1.83	22.4	1390.4	
BS-3	3.05	NT	NT	
S-4	3.51	NT	NT	

Boring Date: 2-13-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level

Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

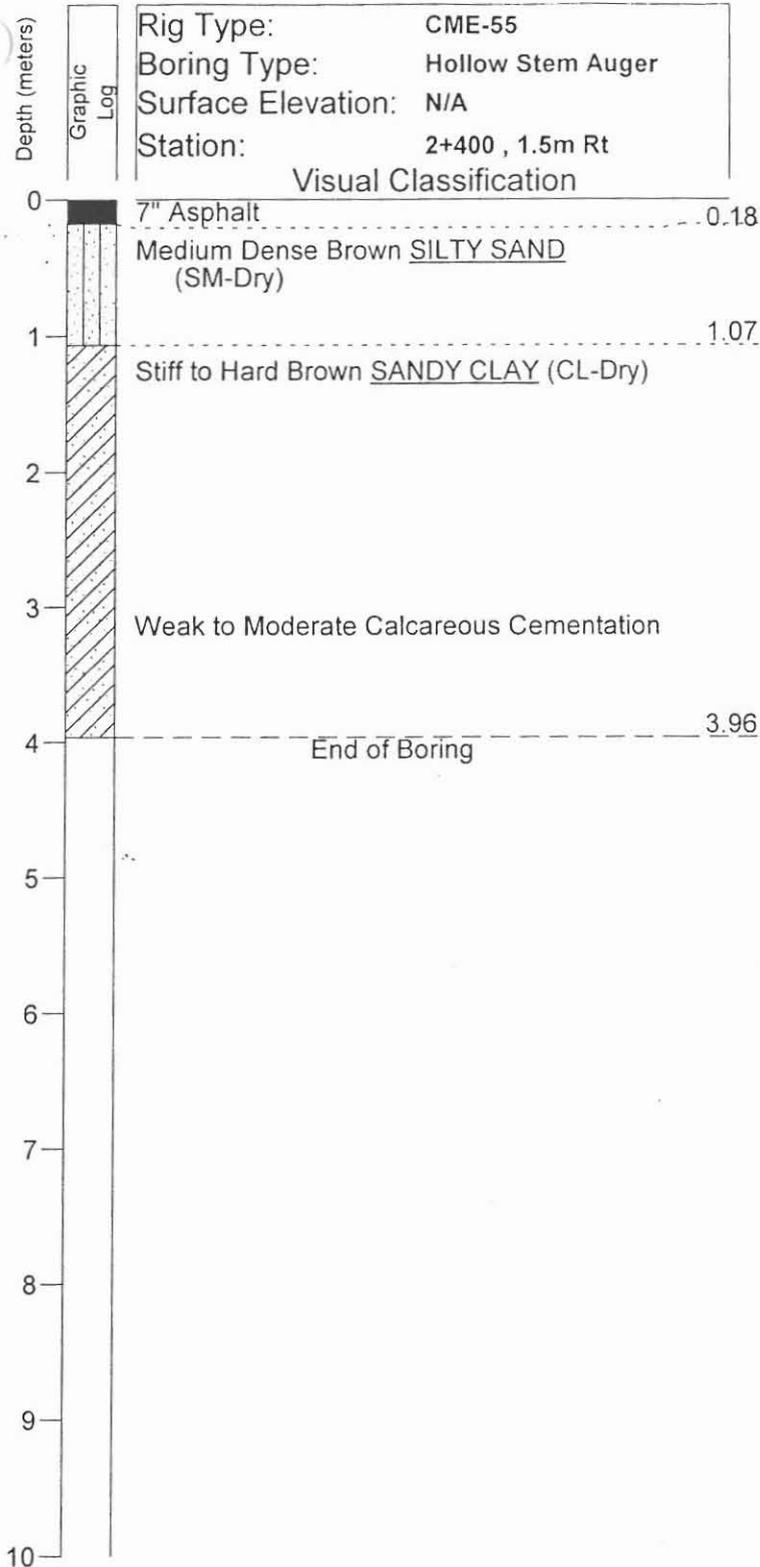
SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B-3

Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona

Project No.: 010034SA

-METRIC SPEEDIE 010034SA.GPJ GENGE0.CDT 8/8/01



Rig Type: CME-55
 Boring Type: Hollow Stem Auger
 Surface Elevation: N/A
 Station: 2+400, 1.5m Rt
 Visual Classification

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	0.76	NT	NT	
RS-2	1.83	NT	NT	
BS-3	3.05	NT	NT	
S-4	3.51	NT	NT	

Boring Date: 2-12-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level		
Depth (m)	Hour	Date
Free Water was Not Encountered		

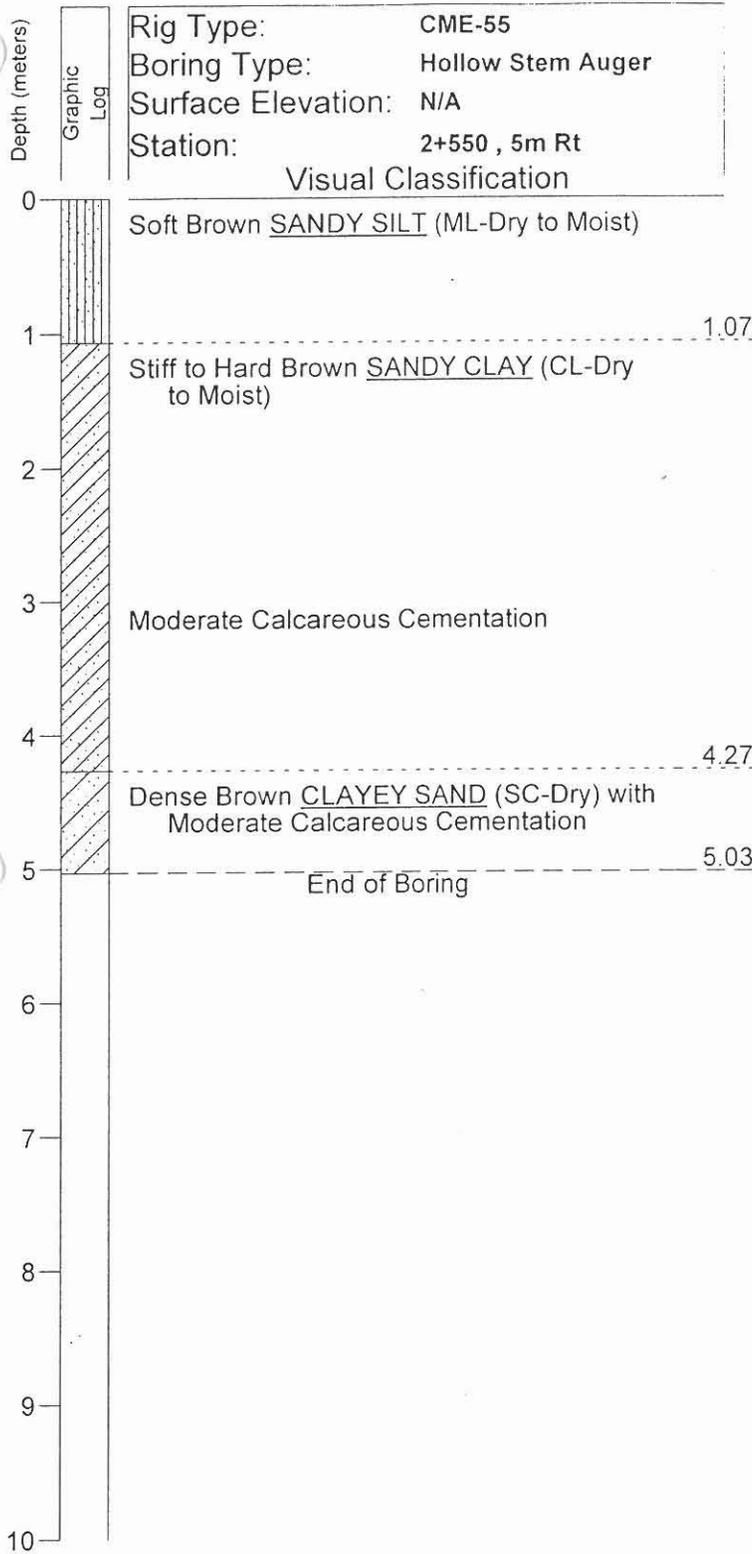
NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-4**

Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona

Project No.: 010034SA



Rig Type: CME-55
 Boring Type: Hollow Stem Auger
 Surface Elevation: N/A
 Station: 2+550 , 5m Rt
 Visual Classification

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	0.76	NT	NT	
S-2	1.98	NT	NT	
RS-3	3.20	14.6	1552.2	50/6"
BS-4	4.57	NT	NT	
S-5	5.03	NT	NT	

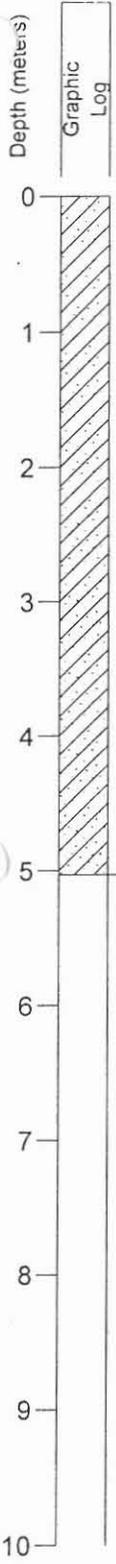
Boring Date: 2-13-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level		
Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES
 Log of Test Boring Number: B-5
 Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona
 Project No.: 010034SA

METRIC SPEEDIE 010034SA.GPJ GENGE0.GDT 8/6/01



Rig Type: CME-55
 Boring Type: Hollow Stem Auger
 Surface Elevation: N/A
 Station: 2+770 , 5m Rt
 Visual Classification

Firm to Hard Brown SANDY CLAY (CL-Dry to Moist) with Weak Calcareous Cementation

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	0.76	NT	NT	
S-2	1.98	NT	NT	
RS-3	3.35	NT	NT	53/12"
BS-4	4.57	NT	NT	
S-5	5.03	NT	NT	

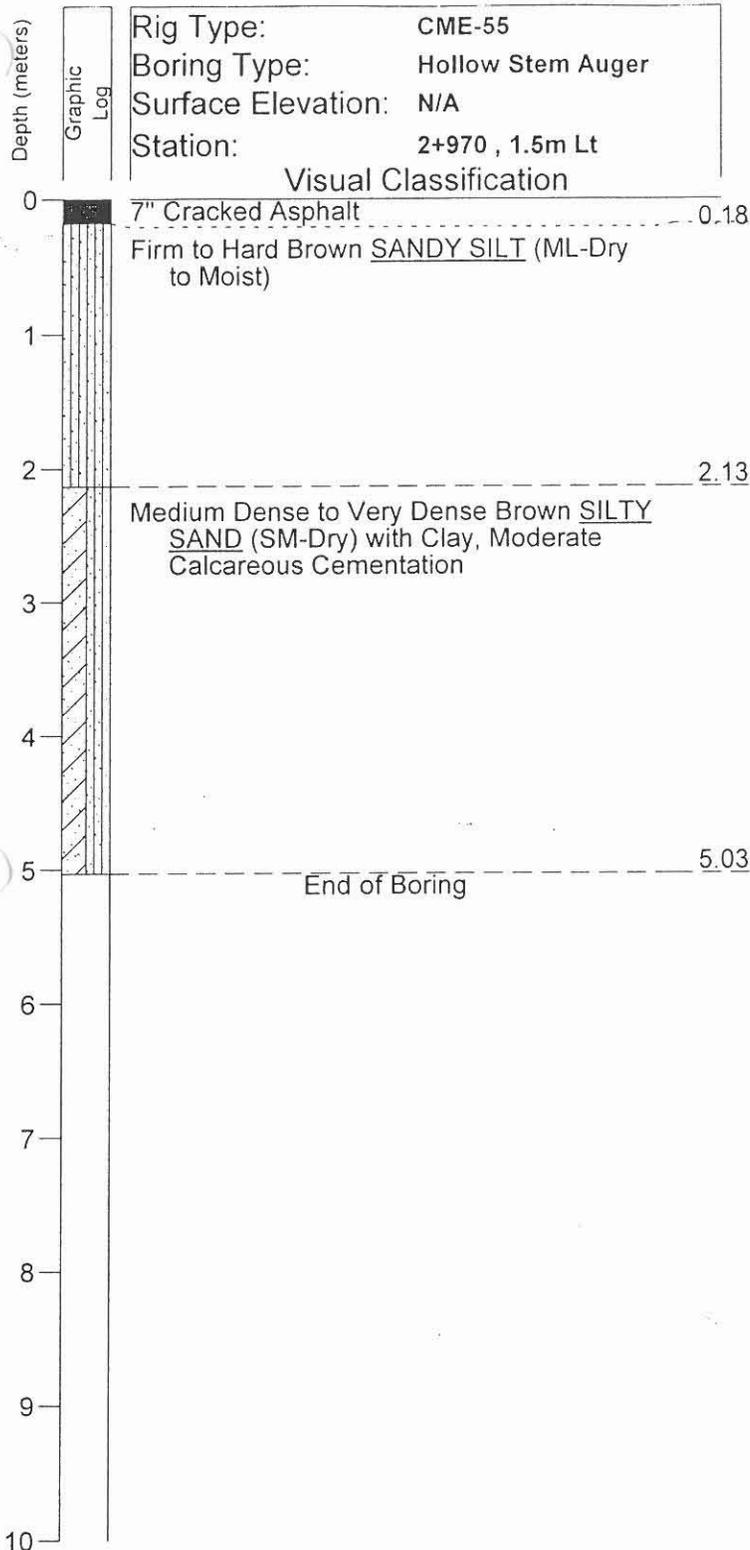
Boring Date: 2-13-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level		
Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES
 Log of Test Boring Number: B-6
 Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona
 Project No.: 010034SA

_METRIC SPEEDIE 010034SA.GPJ GENGE0.GDT 8/6/01



Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	0.76	NT	NT	
S-2	1.98	NT	NT	
RS-4	3.35	15.0	1486.5	53/12"
BS-3	3.66	NT	NT	
S-5	5.03	NT	NT	

Boring Date: 2-12-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level		
Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

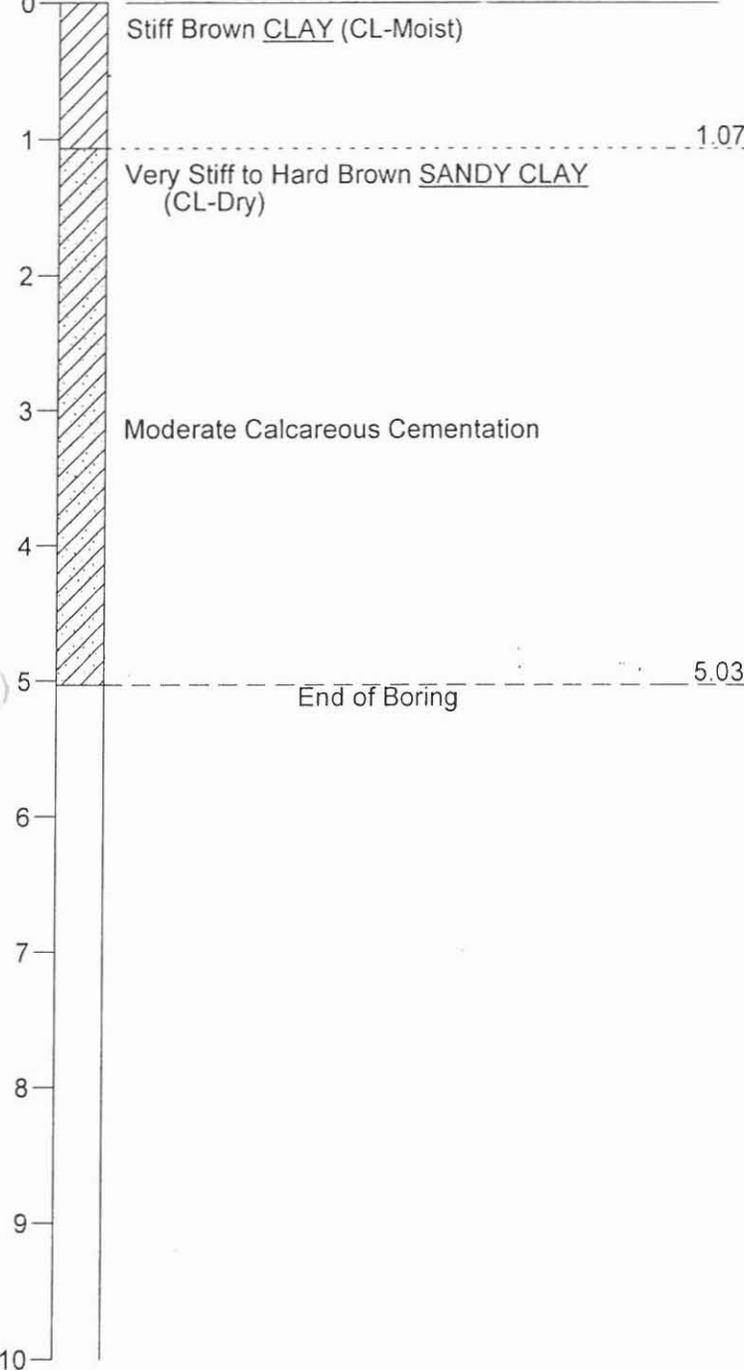
Log of Test Boring Number: B-7

Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona

Project No.: 010034SA

METRIC SPEEDIE 010034SA.GPJ GENGE0.GDT 8/6/01

Rig Type: CME-55
 Boring Type: Hollow Stem Auger
 Surface Elevation: N/A
 Station: 3+360 , 5m Rt
 Visual Classification



Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	0.76	NT	NT	
S-2	1.98	NT	NT	51/12"
RS-3	3.35	14.0	1611.5	
BS-4	4.57	NT	NT	
S-5	5.03	NT	NT	

Boring Date: 2-13-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level		
Depth (m)	Hour	Date
Free Water was Not Encountered		

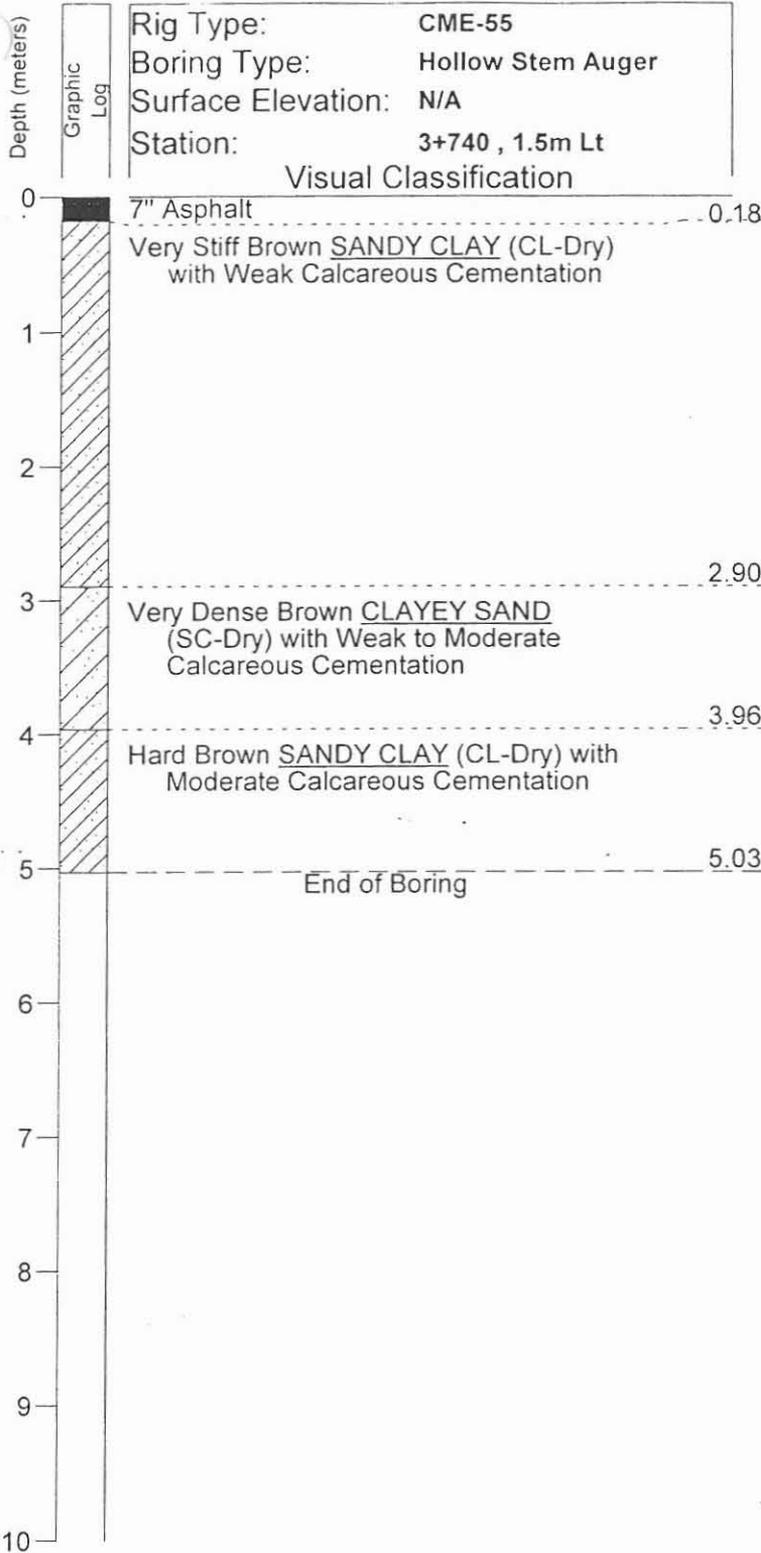
NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B-8

Ellsworth Road
Germann to 1/2 Mile N/o Elliot
Mesa, Arizona

Project No.: 010034SA



Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	0.76	NT	NT	
RS-2	1.83	NT	NT	
S-4	3.51	NT	NT	59/12"
BS-3	3.66	NT	NT	
S-5	5.03	NT	NT	51/12"

Boring Date: 2-12-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level		
Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

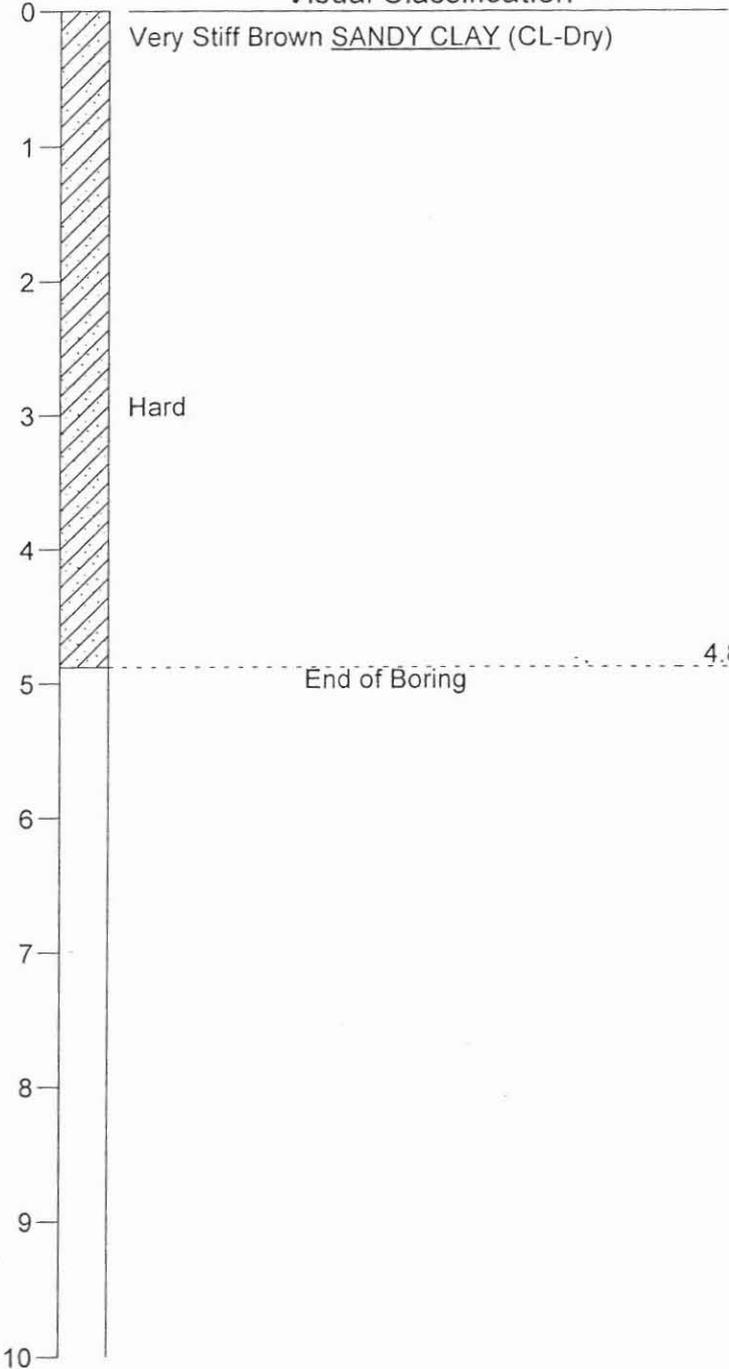
SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B-9

Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona

Project No.: 010034SA

Rig Type: CME-55
 Boring Type: Hollow Stem Auger
 Surface Elevation: N/A
 Station: 4+140, 5m Rt
 Visual Classification



Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	0.76	NT	NT	
S-2	1.98	NT	NT	
RS-3	3.20	NT	NT	50/6"
BS-4	4.57	NT	NT	
S-5	4.88	NT	NT	50/6"

Boring Date: 2-13-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level		
Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES
 Log of Test Boring Number: B-10
 Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona
 Project No.: 010034SA

METRIC SPEEDIE 010034SA.GPJ GENGEODT 8/6/01

Depth (meters)
Graphic Log

Rig Type: CME-55
 Boring Type: Hollow Stem Auger
 Surface Elevation: N/A
 Station: 4+250, 5m Rt
 Visual Classification

0 Very Stiff Brown SANDY CLAY (CL-Dry)
 1 Weak Calcareous Cementation
 2
 2.74
 3 Dense to Very Dense Brown CLAYEY SAND (SC-Dry) with Moderate Calcareous Cementation
 4
 5.03
 5 End of Boring
 6
 7
 8
 9
 10

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	0.76	NT	NT	
S-2	1.98	NT	NT	
RS-3	3.17	NT	NT	50/4"
S-4	5.03	NT	NT	

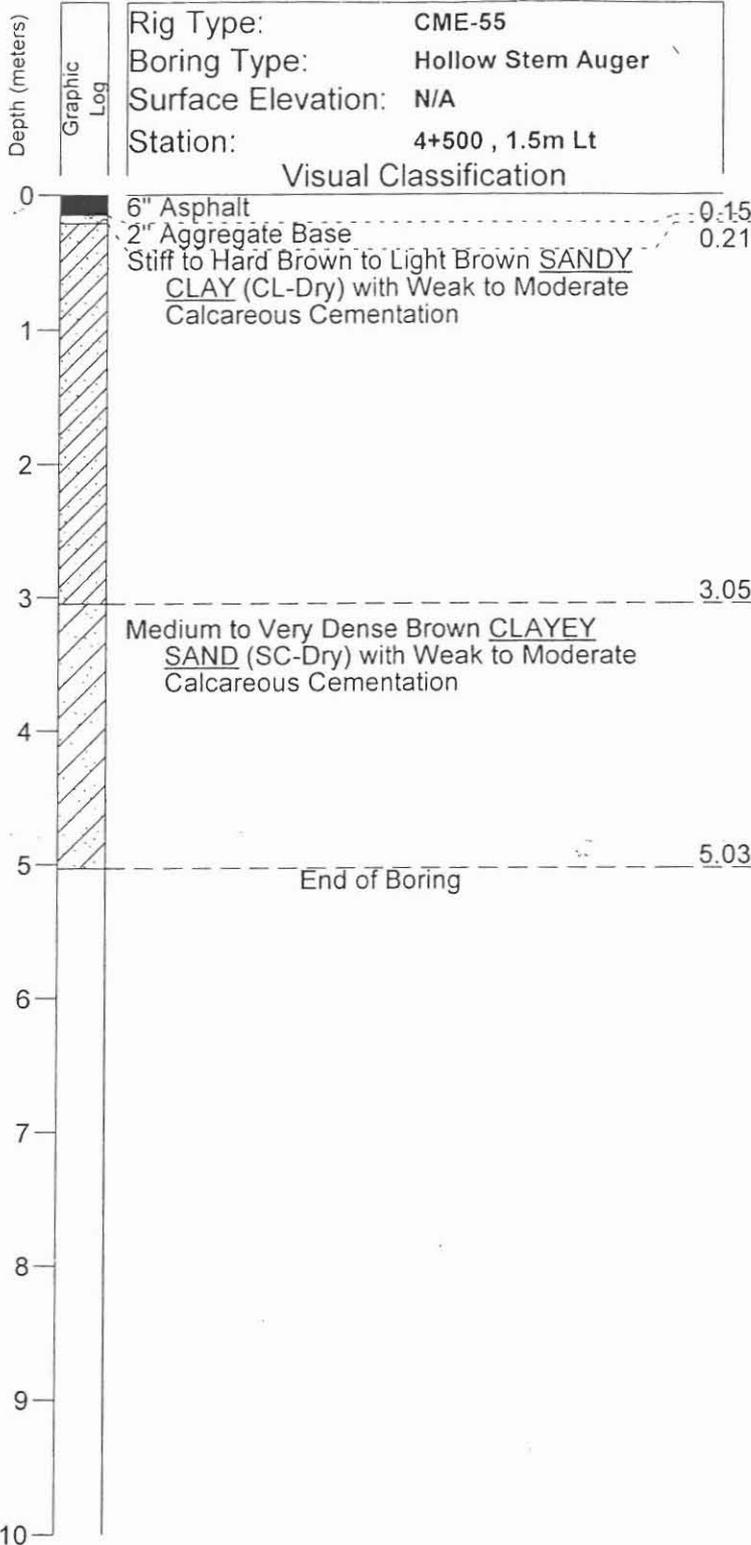
Boring Date: 2-13-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level		
Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES
 Log of Test Boring Number: B-11
 Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona
 Project No.: 010034SA

SPEEDIE AND ASSOCIATES 010034SA GPJ GENGEO GDT 8/6/01



Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	0.76	NT	NT	
S-2	1.98	NT	NT	
RS-3	3.20	10.1	1467.3	50/6"
BS-4	4.57	NT	NT	
S-5	5.03	NT	NT	

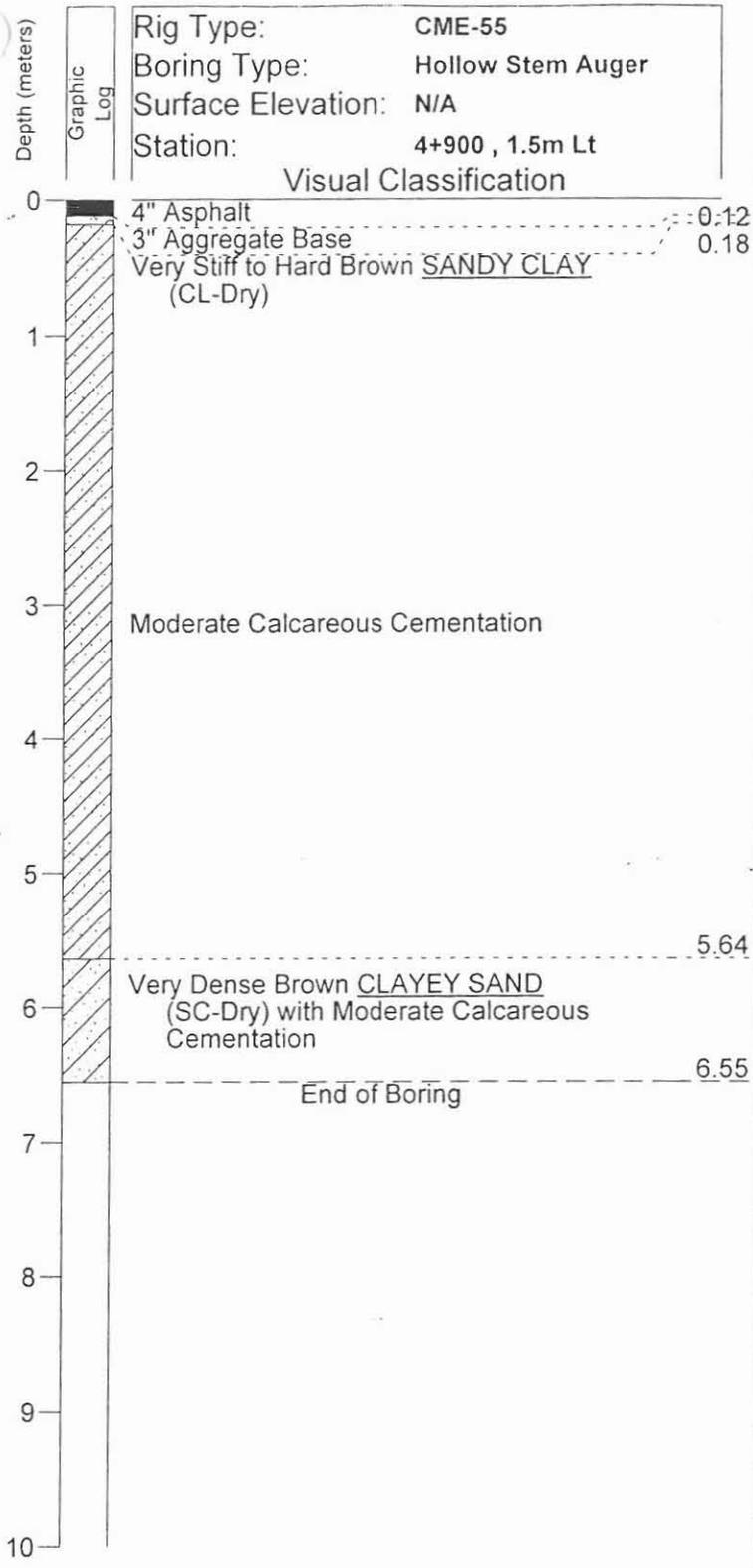
Boring Date: 2-12-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level		
Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES
 Log of Test Boring Number: B-12
 Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona
 Project No.: 010034SA

METRIC SPEEDIE 010034SA.GPJ GENGE0.GDT 8/6/01



Rig Type: CME-55
 Boring Type: Hollow Stem Auger
 Surface Elevation: N/A
 Station: 4+900 , 1.5m Lt
 Visual Classification

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	0.76	NT	NT	
S-2	1.98	NT	NT	
RS-3	3.35	NT	NT	53/12"
BS-4	4.57	NT	NT	
S-5	5.03	NT	NT	
S-6	6.55	NT	NT	52/12"

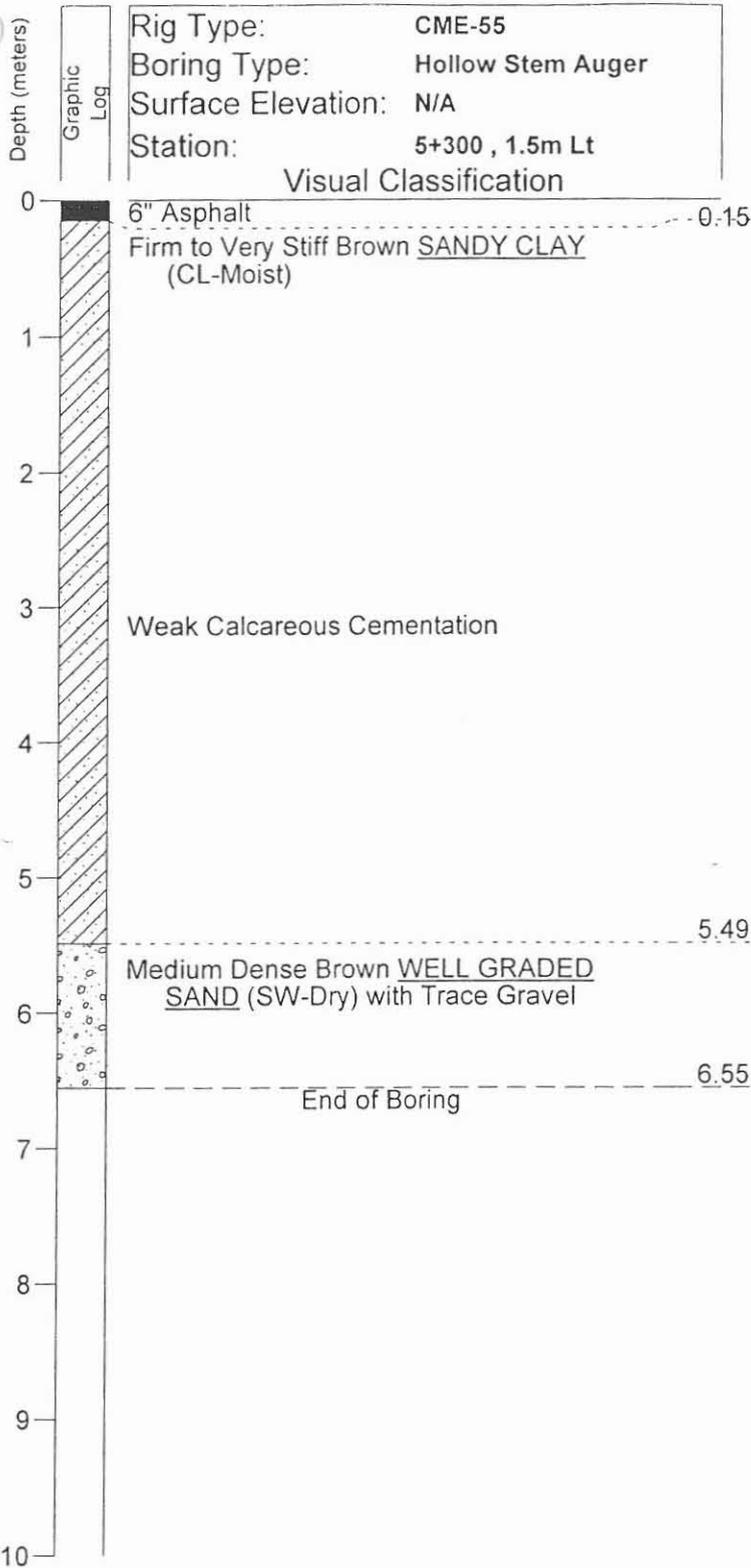
Boring Date: 2-13-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level		
Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES
 Log of Test Boring Number: B-13
 Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona
 Project No.: 010034SA

METRIC SPEEDIE 010034SA.GPJ GENGE0.GDT 8/6/01



Rig Type: CME-55
 Boring Type: Hollow Stem Auger
 Surface Elevation: N/A
 Station: 5+300 , 1.5m Lt
 Visual Classification

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	0.76	NT	NT	
BS-2	1.83	NT	NT	
S-3	1.98	NT	NT	
RS-4	3.35	14.5	1563.4	
S-5	5.03	NT	NT	
S-6	6.55	NT	NT	

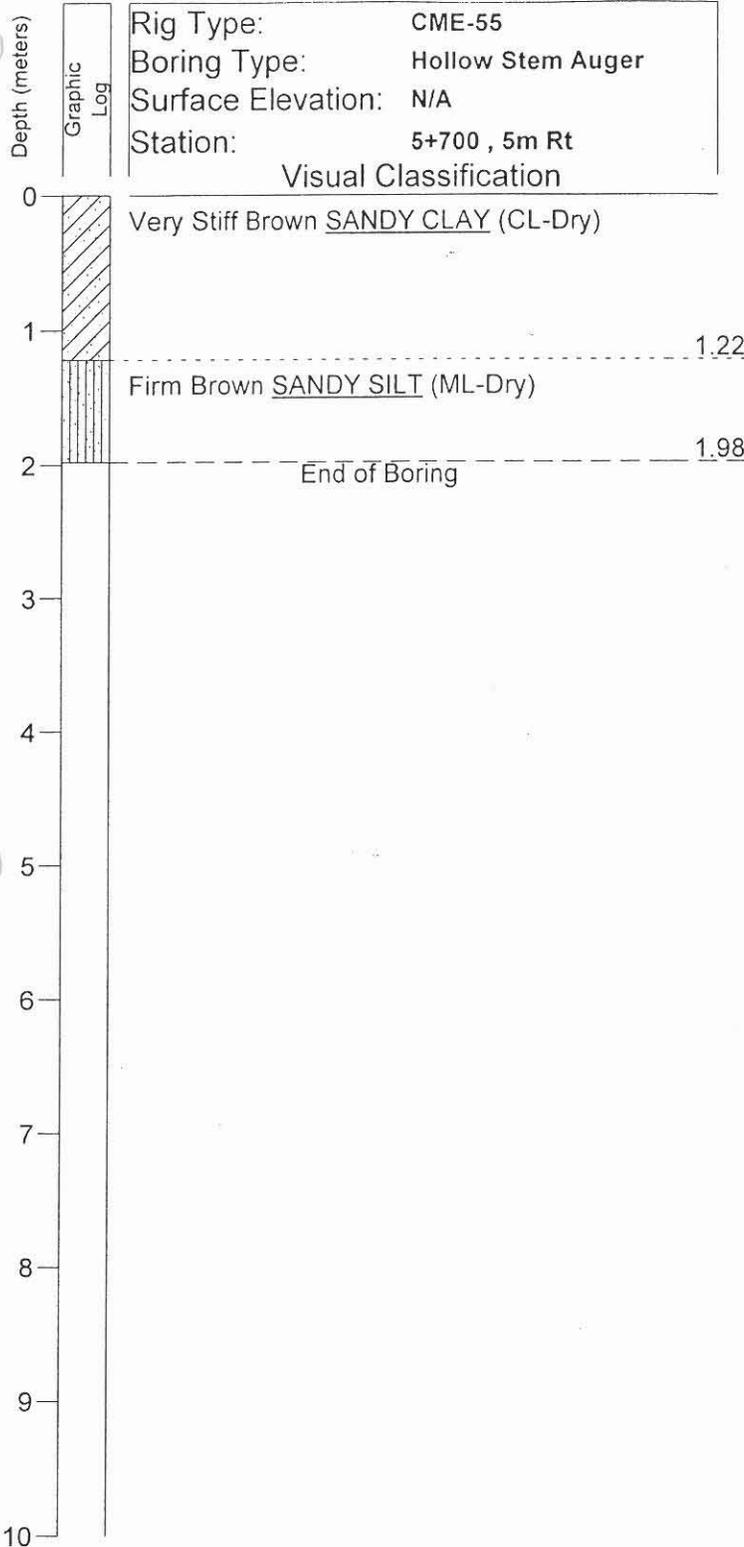
Boring Date: 2-12-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level		
Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES
 Log of Test Boring Number: B-14
 Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona
 Project No.: 010034SA

_METRIC SPEEDIE 010034SA.GPJ GENGEQ.GDT 8/6/01



Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
RS-1	0.61	NT	NT	
BS-2	1.52	NT	NT	
S-3	1.98	NT	NT	

Boring Date: 2-13-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level		
Depth (m)	Hour	Date
Free Water was Not Encountered		

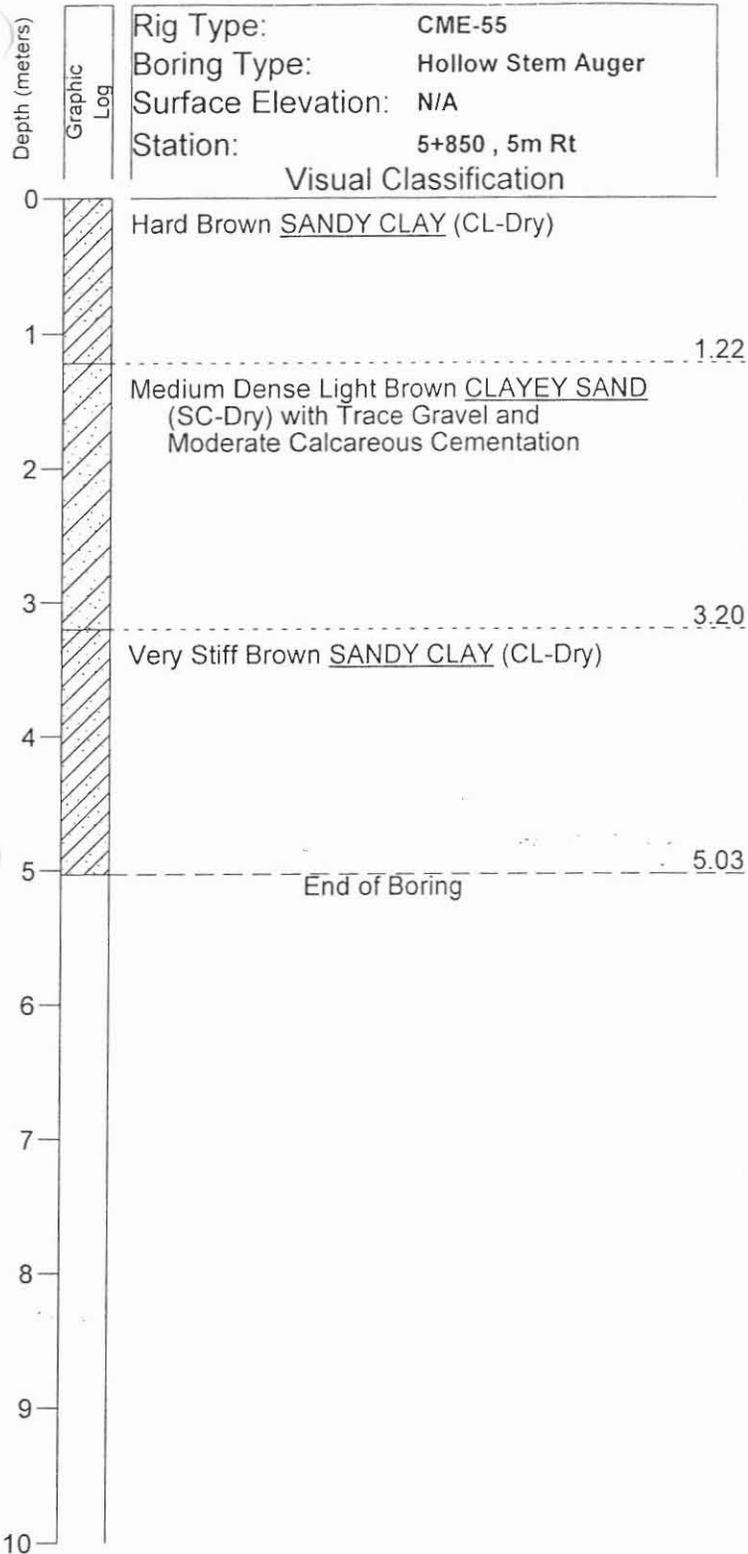
NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-15**

Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona

Project No.: 010034SA



Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	0.76	NT	NT	
S-2	1.98	NT	NT	
BS-3	3.05	NT	NT	
RS-4	3.35	10.6	1673.9	
S-5	5.03	NT	NT	

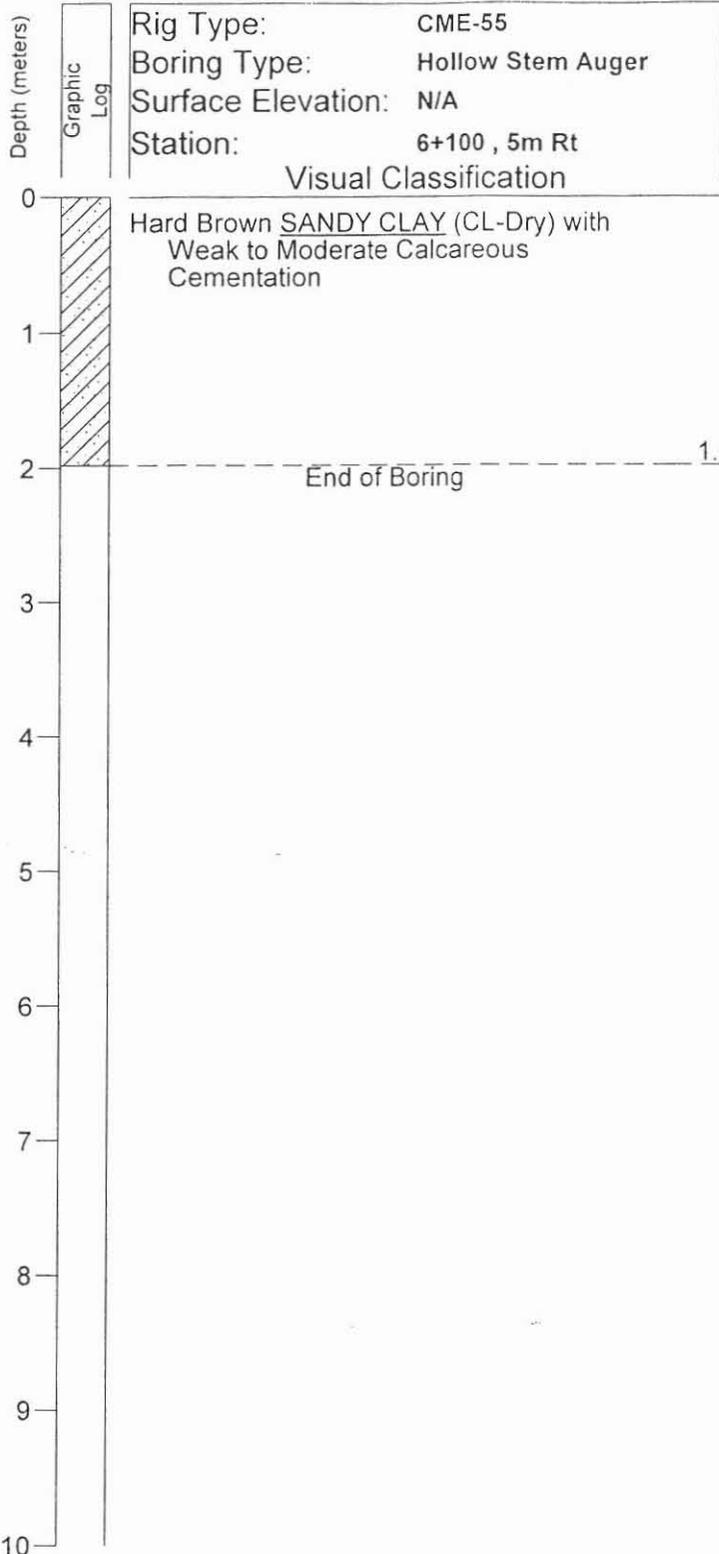
Boring Date: 2-13-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level		
Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES
 Log of Test Boring Number: B-16
 Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona
 Project No.: 010034SA

METRIC SPEEDIE 010034SA.GPJ GENGEO.GDT 8/6/01



Rig Type: CME-55
 Boring Type: Hollow Stem Auger
 Surface Elevation: N/A
 Station: 6+100, 5m Rt
 Visual Classification

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
RS-1	0.61	NT	NT	
BS-2	1.52	NT	NT	
S-3	1.98	NT	NT	61/12"

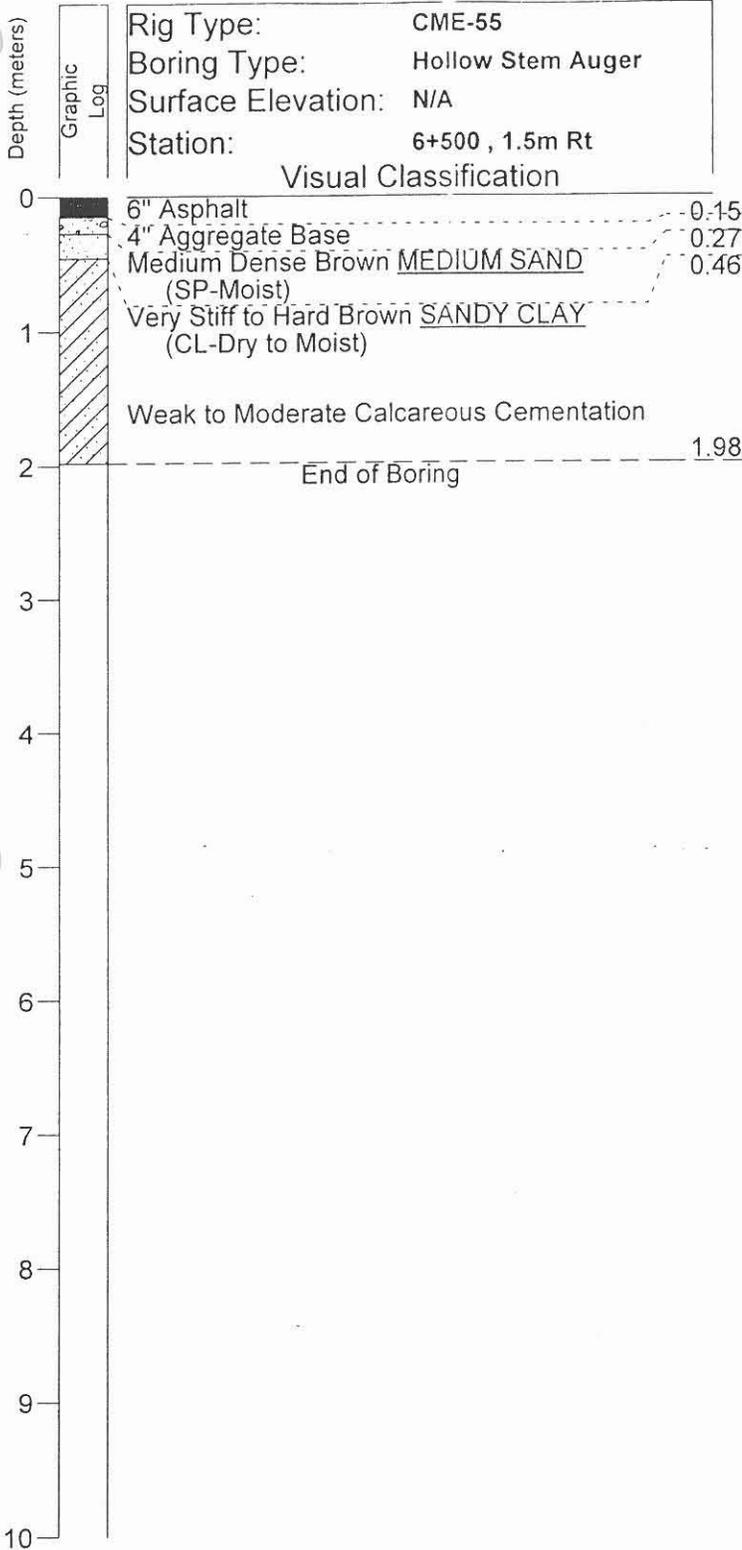
Boring Date: 2-13-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level

Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES
 Log of Test Boring Number: B-17
 Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona
 Project No.: 010034SA



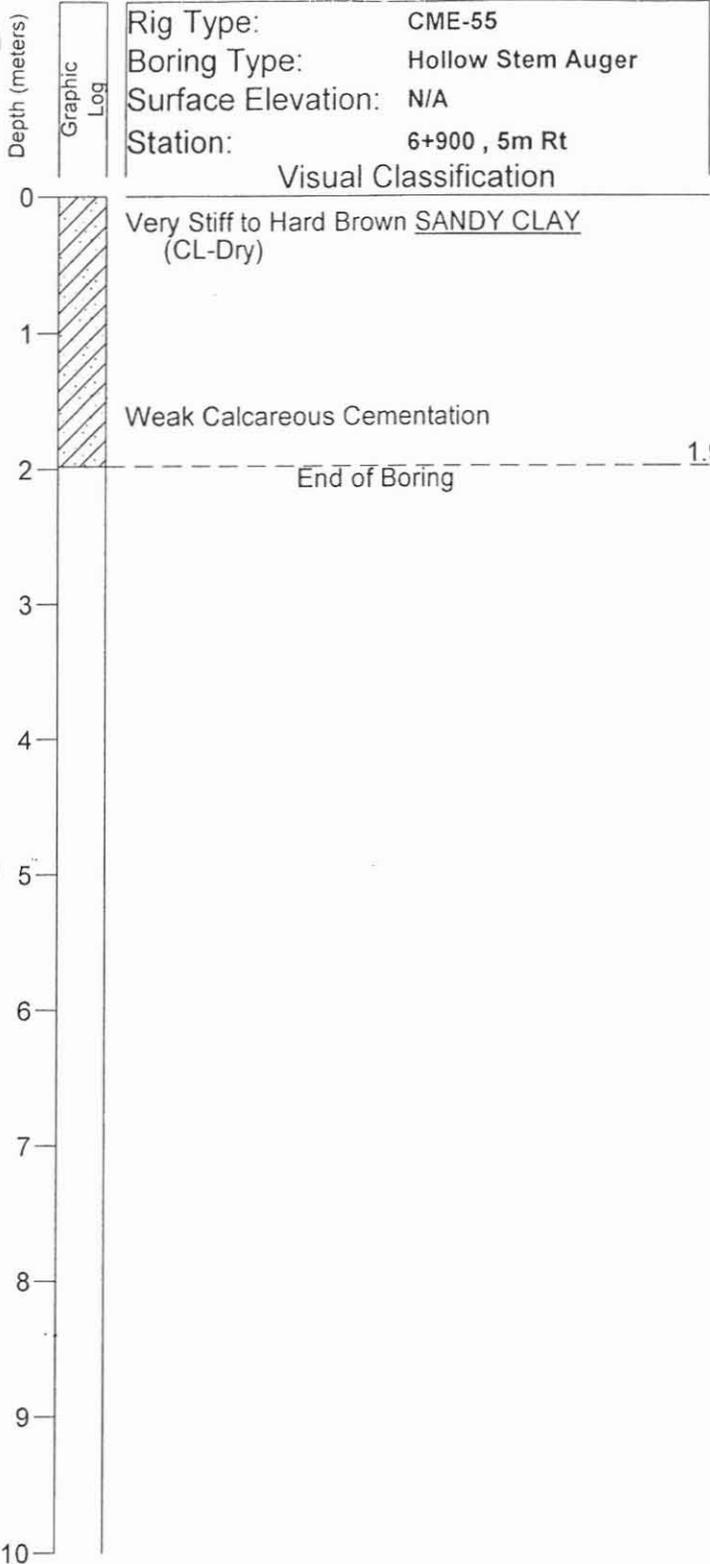
Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
RS-1	0.61	12.6	1768.4	
BS-2	1.52	NT	NT	
S-3	1.98	NT	NT	

Boring Date: 2-12-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level		
Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES
 Log of Test Boring Number: B-18
 Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona
 Project No.: 010034SA



Rig Type: CME-55
 Boring Type: Hollow Stem Auger
 Surface Elevation: N/A
 Station: 6+900 , 5m Rt
 Visual Classification

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
RS-1	0.61	NT	NT	~10
BS-2	1.52	NT	NT	~25
S-3	1.98	NT	NT	~45

Boring Date: 2-13-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level		
Depth (m)	Hour	Date
<i>Free Water was Not Encountered</i>		

NT = Not Tested

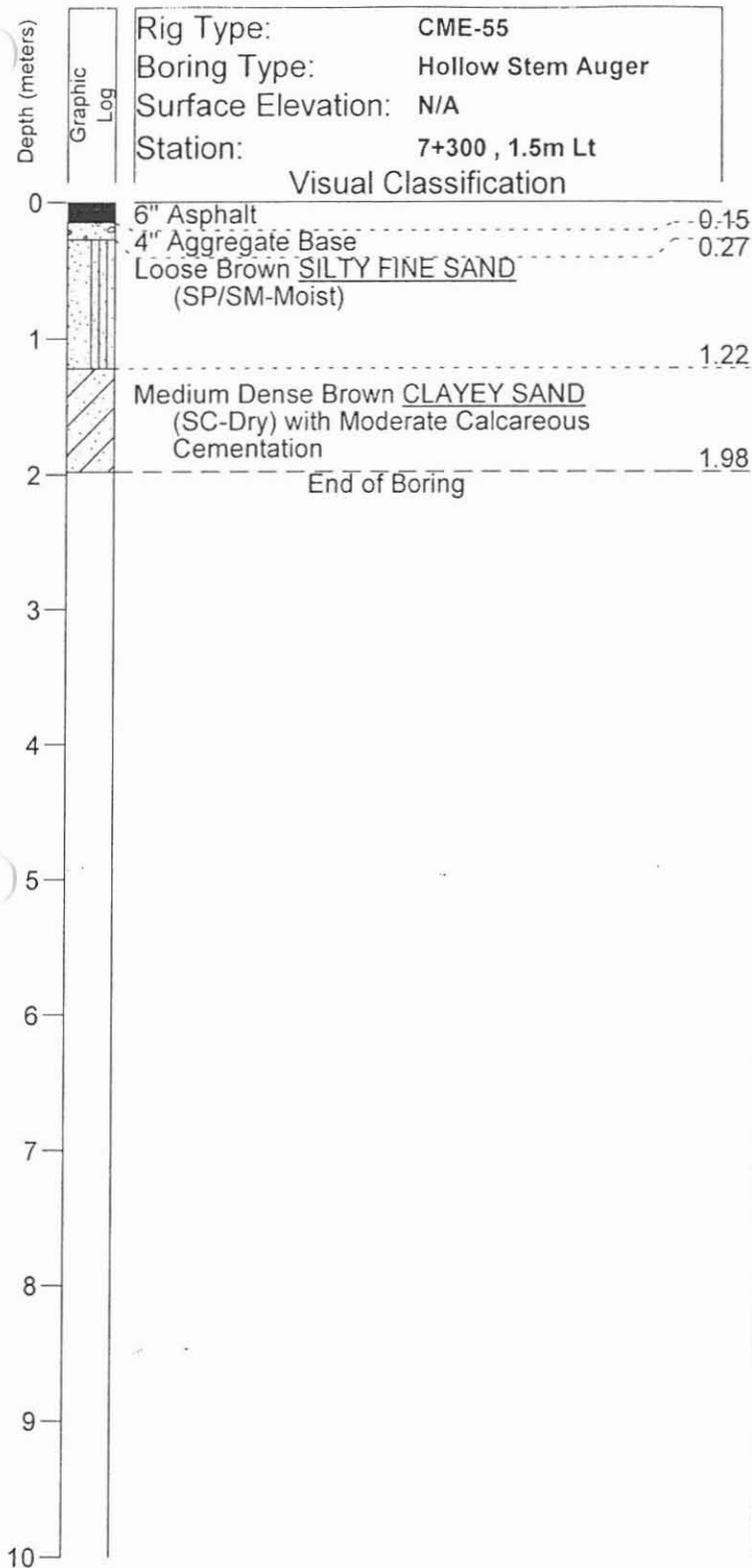
SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-19**

Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona

Project No.: 010034SA

METRIC SPEEDIE 010034SA.GPJ GENGE0.GDT B/6/01



Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
RS-1	0.61	11.9	1557.0	
BS-2	1.52	NT	NT	
S-3	1.98	NT	NT	

Boring Date: 2-12-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level

Depth (m)	Hour	Date
<i>Free Water was Not Encountered</i>		

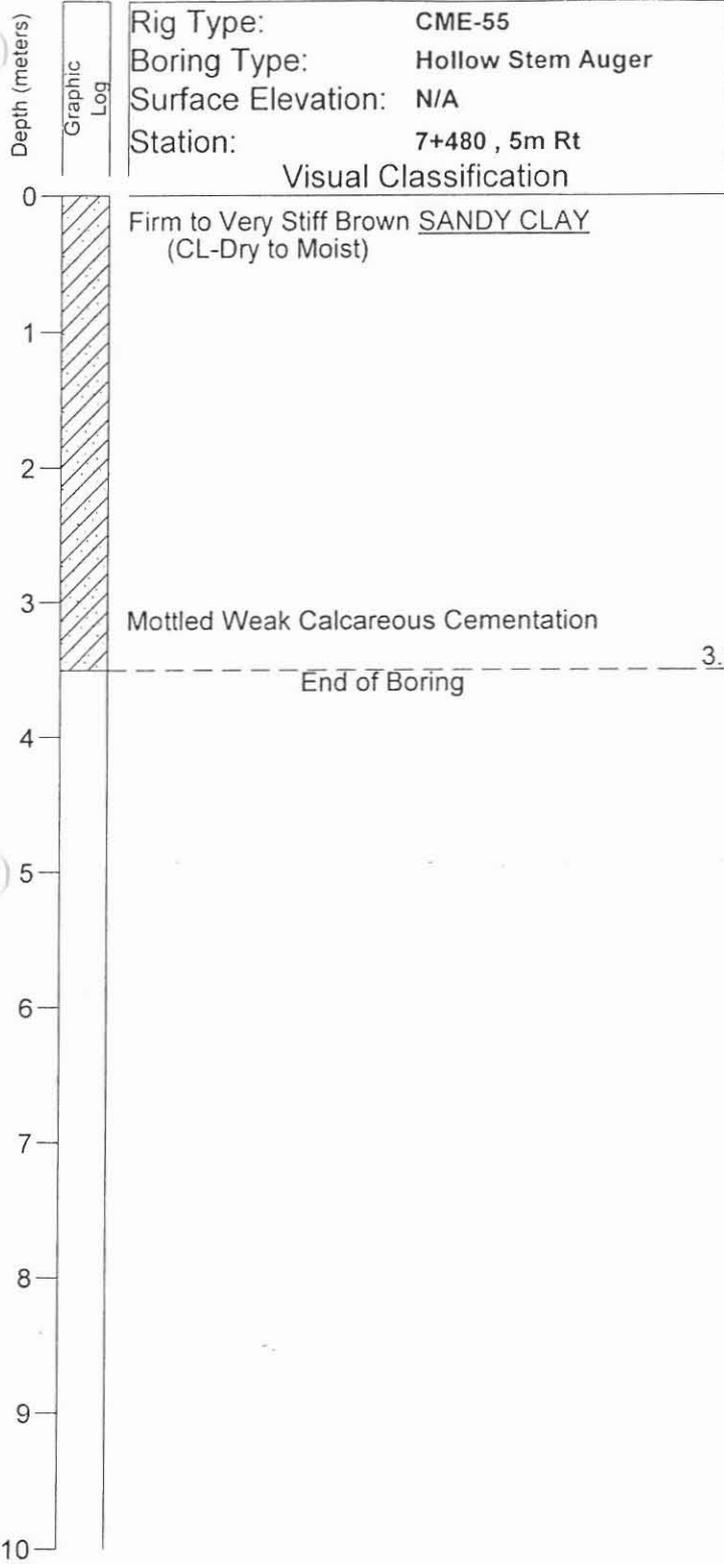
NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B-20

Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona

Project No.: 010034SA



Rig Type: CME-55
 Boring Type: Hollow Stem Auger
 Surface Elevation: N/A
 Station: 7+480 , 5m Rt
 Visual Classification

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	0.76	NT	NT	
BS-2	1.52	NT	NT	
RS-3	1.83	NT	NT	
S-4	3.51	NT	NT	

Boring Date: 2-12-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

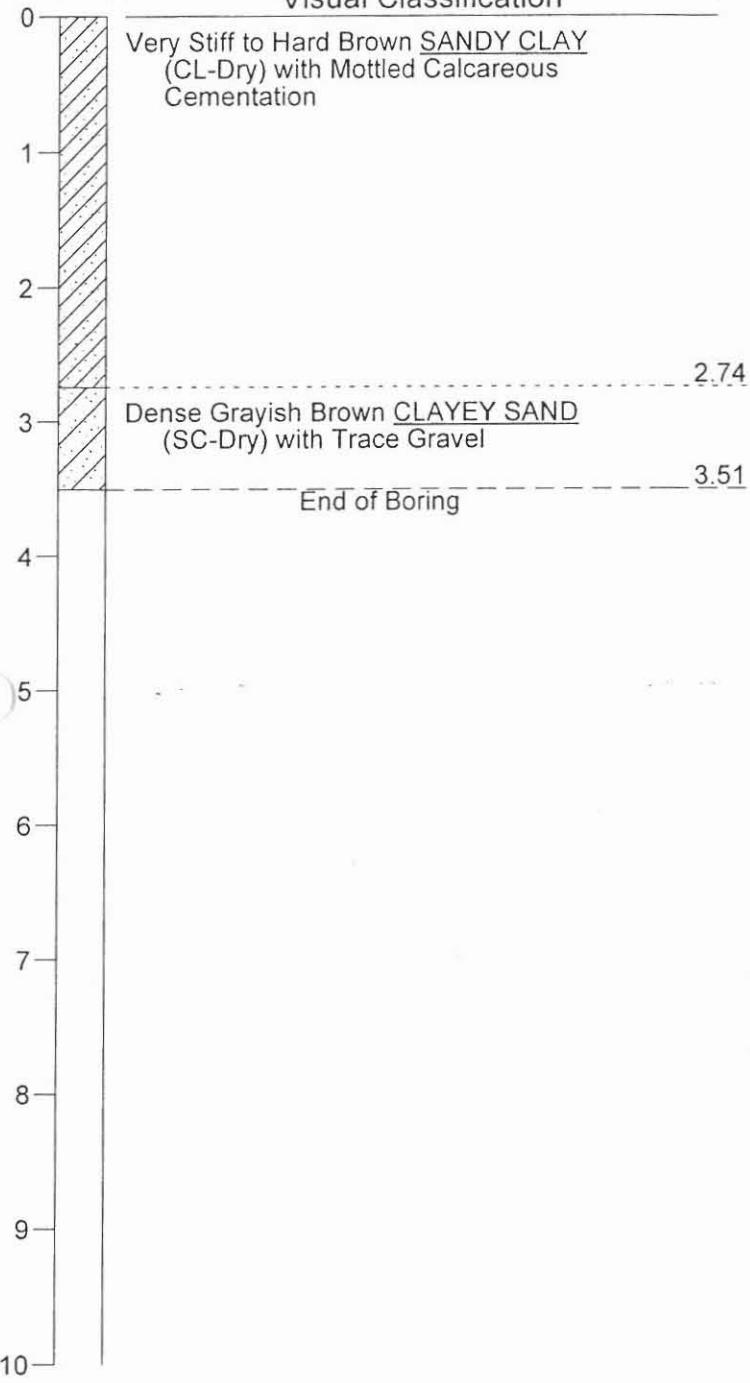
Water Level		
Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES
 Log of Test Boring Number: B-21
 Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona
 Project No.: 010034SA

METRIC SPEEDIE 010034SA.GPJ GENGE0.GDT 8/6/01

Rig Type: CME-55
 Boring Type: Hollow Stem Auger
 Surface Elevation: N/A
 Station: 7+700, CL
 Visual Classification



Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	0.76	NT	NT	53/12"
RS-2	1.83	11.8	1492.9	
BS-3	3.05	NT	NT	
S-4	3.51	NT	NT	

Boring Date: 2-12-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level		
Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

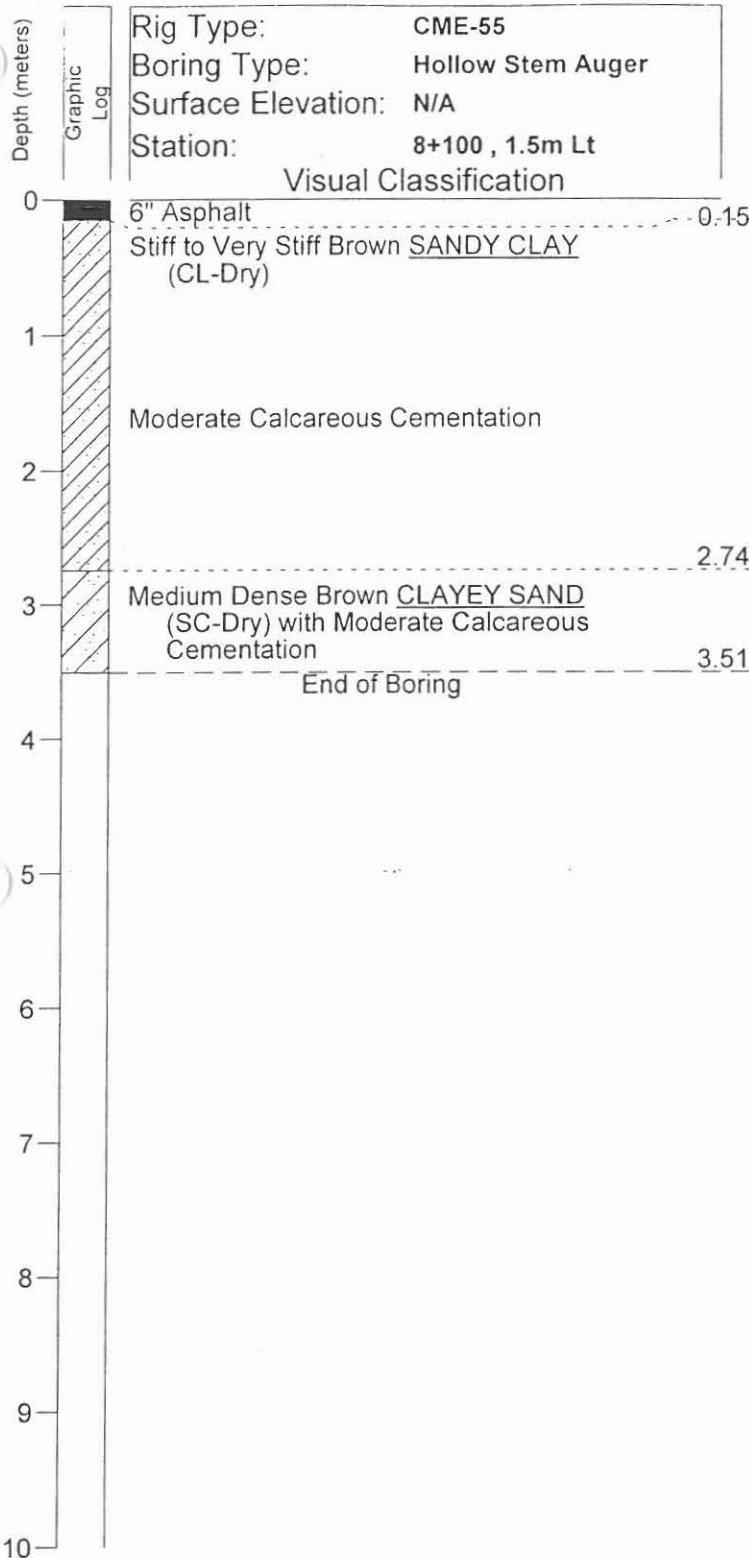
SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-22**

Ellsworth Road
Germann to 1/2 Mile N/o Elliot
Mesa, Arizona

Project No.: 010034SA

METRIC SPEEDIE 010034SA.GPJ GENGE0.GDT 8/6/01



Rig Type: CME-55
 Boring Type: Hollow Stem Auger
 Surface Elevation: N/A
 Station: 8+100, 1.5m Lt
 Visual Classification

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	0.76	NT	NT	
RS-2	1.83	NT	NT	
BS-3	3.05	NT	NT	
S-4	3.51	NT	NT	

Boring Date: 2-13-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level		
Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B-23

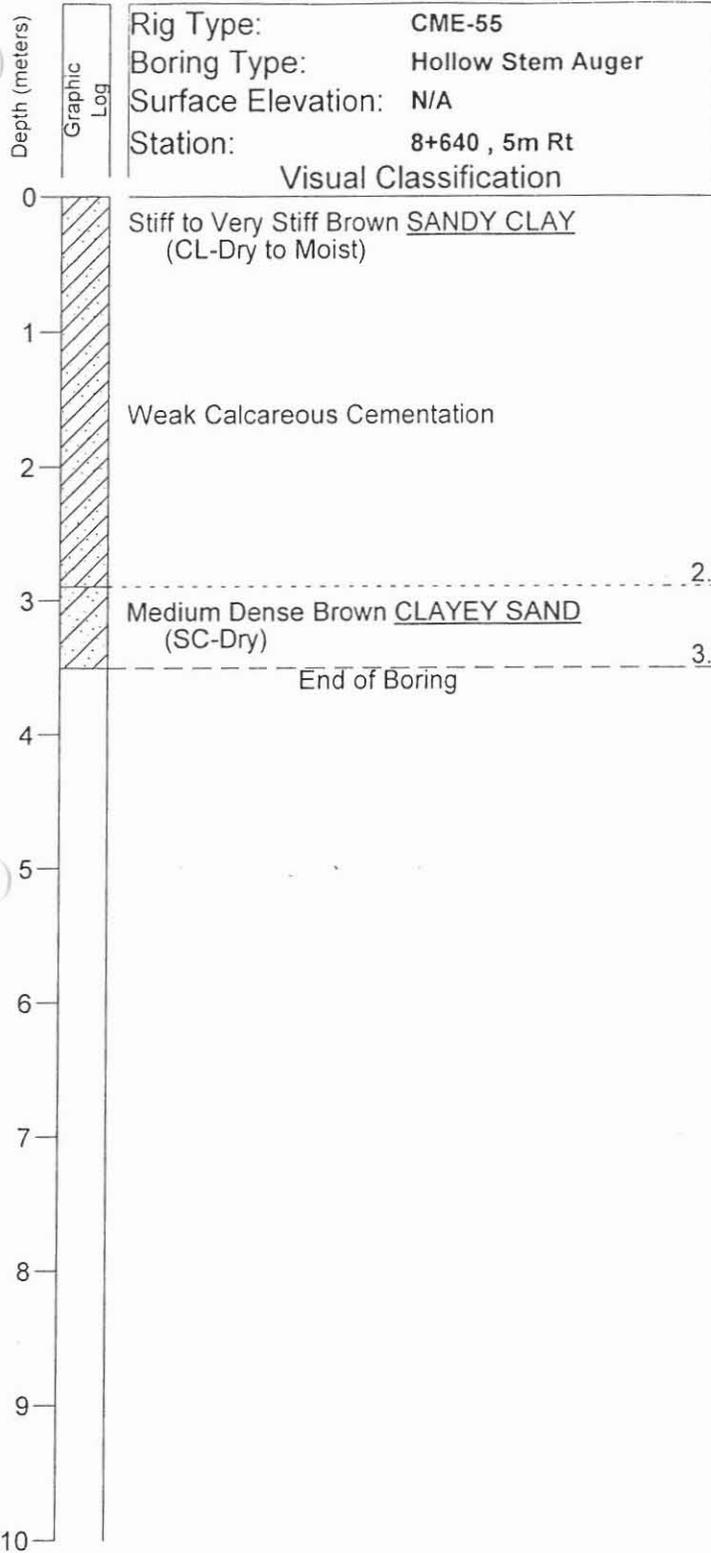
Ellsworth Road

Germann to 1/2 Mile N/o Elliot

Mesa, Arizona

Project No.: 010034SA

METRIC SPEEDIE 010034SA GPJ GENGE0 GDT 8/6/01



Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	0.76	NT	NT	
RS-2	1.83	17.1	1659.5	
BS-3	3.05	NT	NT	
S-4	3.51	NT	NT	

Boring Date: 2-12-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level

Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

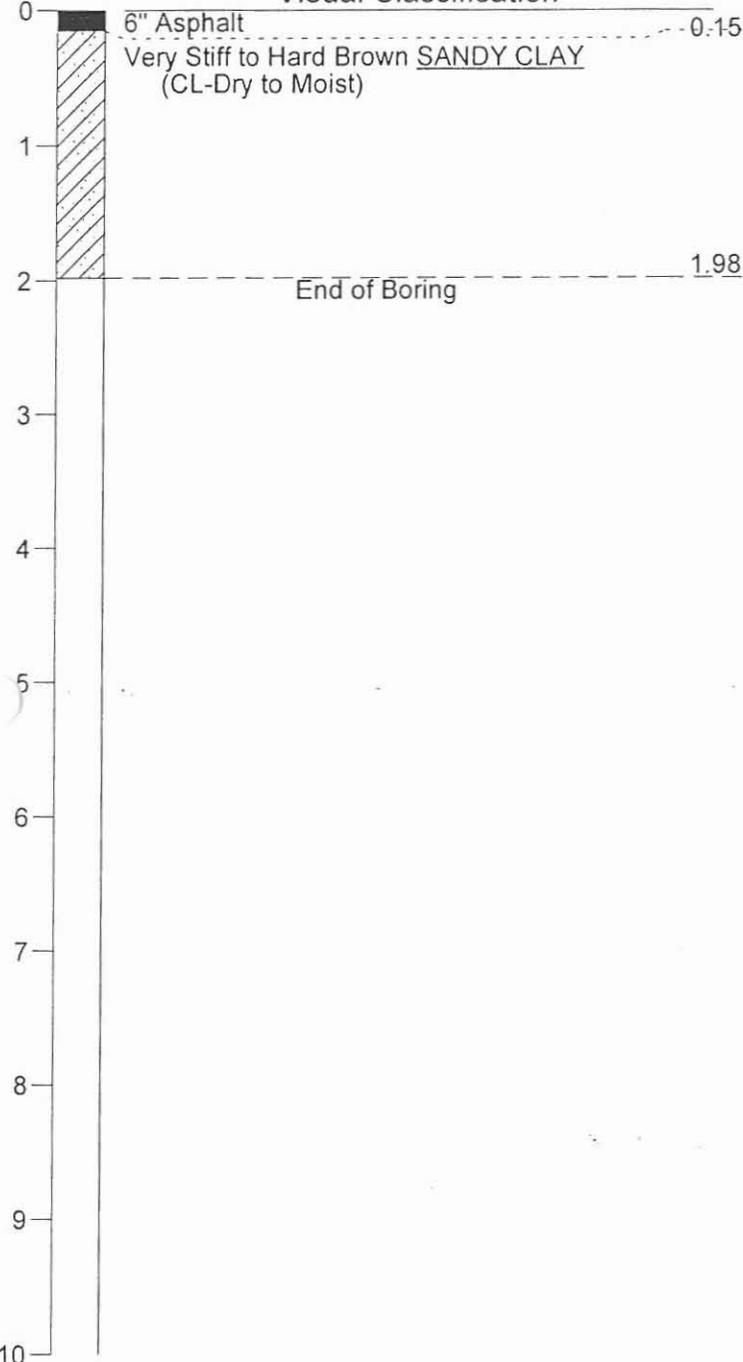
Log of Test Boring Number: B-24

Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona

Project No.: 010034SA

METRIC SPEEDIE 010034SA.GPJ GENBEO.GDT 8/6/01

Rig Type: CME-55
 Boring Type: Hollow Stem Auger
 Surface Elevation: N/A
 Station: 8+900 , 1.5m Lt
 Visual Classification



Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
RS-1	0.61	NT	NT	
BS-2	1.52	NT	NT	
S-3	1.98	NT	NT	

Boring Date: 2-13-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level

Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

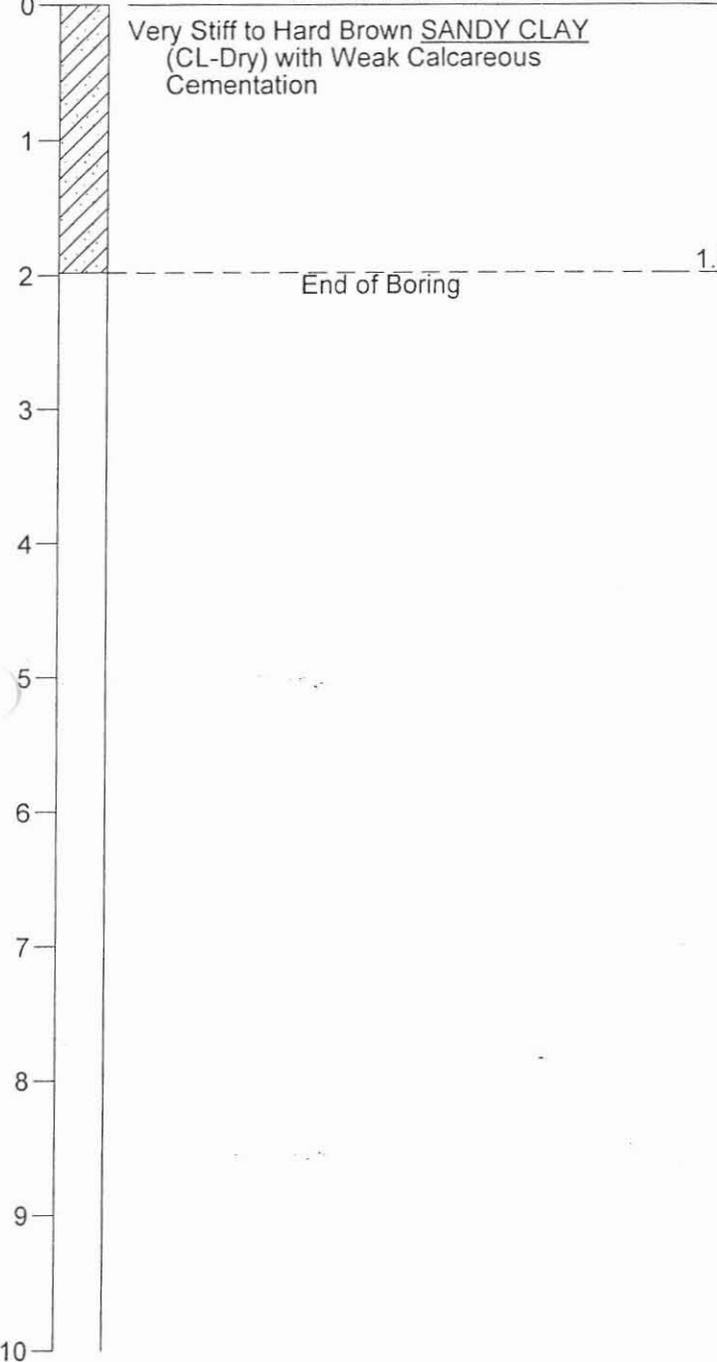
SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B-25

Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona

Project No.: 010034SA

Rig Type: CME-55
 Boring Type: Hollow Stem Auger
 Surface Elevation: N/A
 Station: 9+300, 5m Rt
 Visual Classification



Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
RS-1	0.61	7.8	1457.7	
BS-2	1.52	NT	NT	
S-3	1.98	NT	NT	

Boring Date: 2-12-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level		
Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES
 Log of Test Boring Number: **B-26**
 Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona
 Project No.: 010034SA

Depth (meters)

Graphic Log

0

1

2

3

4

5

6

7

8

9

10

Rig Type: CME-55
 Boring Type: Hollow Stem Auger
 Surface Elevation: N/A
 Station: 9+700 , 1.5m Lt

Visual Classification

6" Asphalt 0.15
 3" Aggregate Base 0.21
 Medium to Very Dense Brown CLAYEY SAND (SC-Dry)

End of Boring 1.83

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	0.76	NT	NT	
BS-2	1.52	NT	NT	
RS-3	1.83	NT	NT	

Boring Date: 2-13-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

Water Level

Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B-27

Ellsworth Road

Germann to 1/2 Mile N/o Elliot

Mesa, Arizona

Project No.: 010034SA

METRIC SPEEDIE 010034SA.GPJ GENGEO.GDT 8/6/01

Depth (meters)

Graphic Log

0

1

2

3

4

5

6

7

8

9

10

Rig Type: CME-55
 Boring Type: Hollow Stem Auger
 Surface Elevation: N/A
 Station: 10+100, 5m Rt

Visual Classification
 Medium Dense Brown CLAYEY SAND
 (SC-Dry) with Weak Calcareous
 Cementation

1.98
 End of Boring

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
RS-1	0.61	8.3	1754.0	
BS-2	1.52	NT	NT	
S-3	1.98	NT	NT	

Boring Date: 2-13-01
 Field Engineer/Technician: M. Polsky
 Driller: D. Arwood
 Contractor: Heber Mining

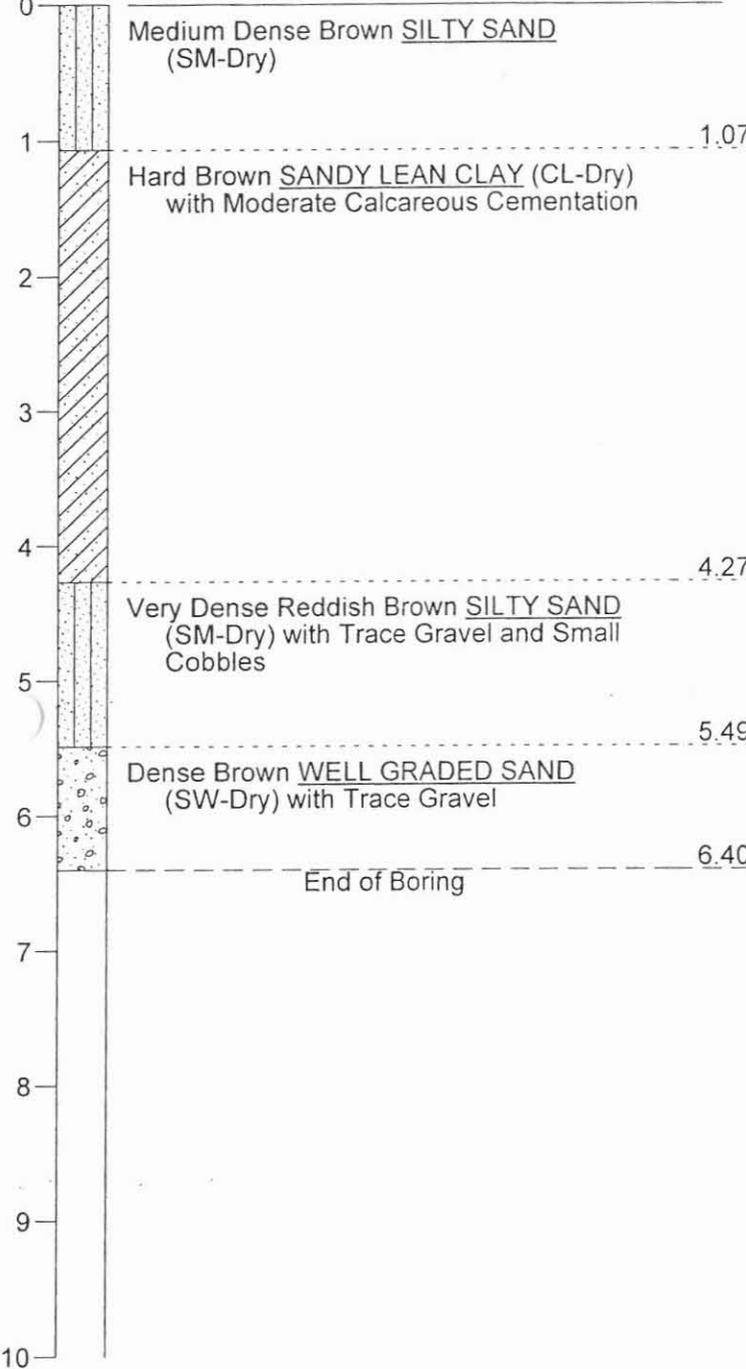
Water Level		
Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES
 Log of Test Boring Number: B-28
 Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona
 Project No.: 010034SA

METRIC SPEEDIE 010034SA GPJ GEN GEO GDT 8/6/01

Rig Type: CME-95
 Boring Type: Hollow Stem Auger
 Surface Elevation: N/A
 Station: 8+920, 5m Rt
 Visual Classification



Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	0.76	NT	NT	
RS-2	1.68	NT	NT	
S-3	3.35	NT	NT	
S-4	4.88	NT	NT	57/12"
S-5	6.40	NT	NT	

Boring Date: 6-17-99
 Field Engineer/Technician: M. Polsky
 Driller: K. Heinrich
 Contractor: Heber Mining

Water Level		
Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

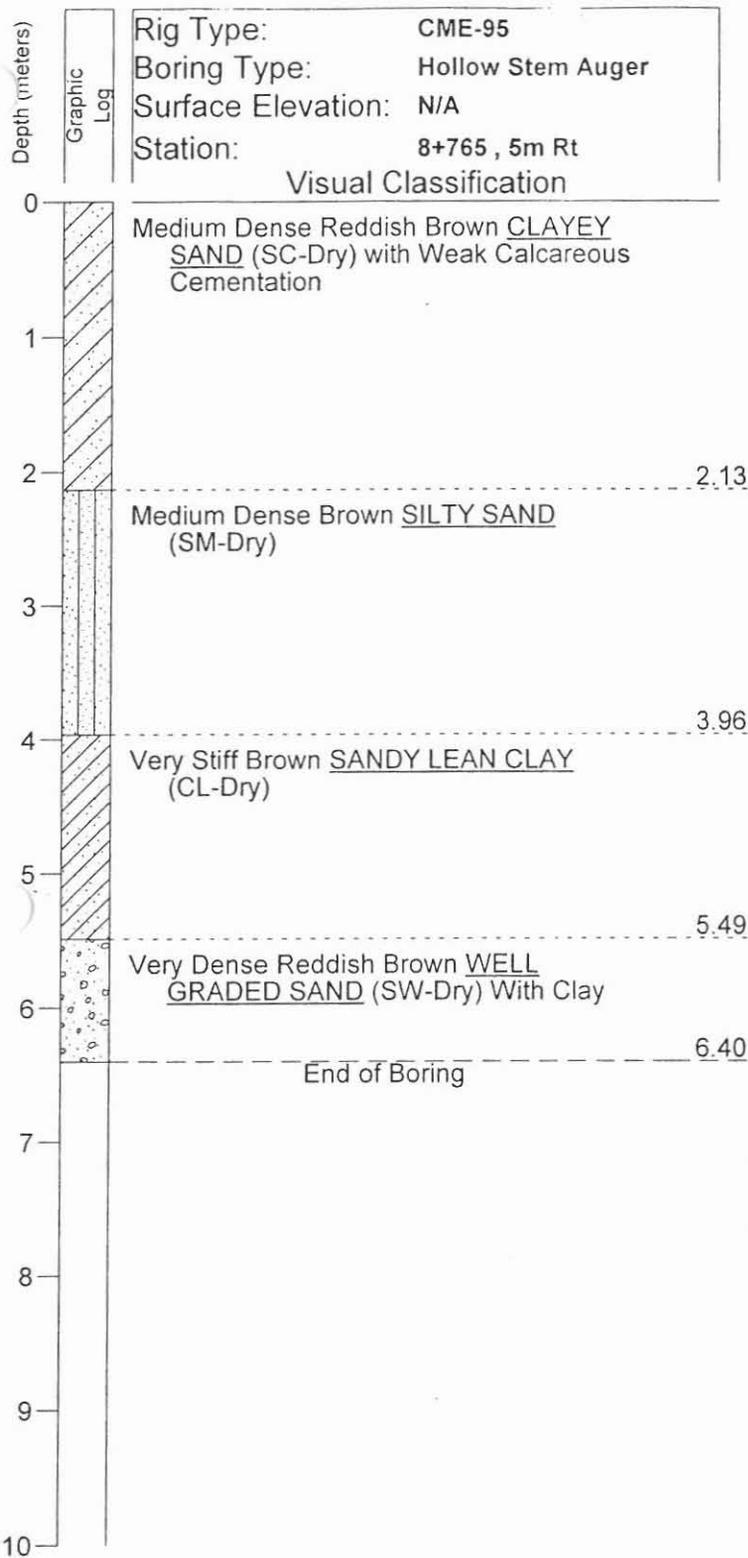
SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 1:1999**

Ellsworth Road
Germann to 1/2 Mile N/o Elliot
Mesa, Arizona

Project No.: 010034SA

_METRIC SPEEDIE 010034SA.GPJ GENGE0.GDT 8/6/01



Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	1.83	NT	NT	
BS-2	3.05	NT	NT	
S-3	3.35	NT	NT	
S-4	4.88	NT	NT	
S-5	6.40	NT	NT	51/12"

Boring Date: 6-17-99
 Field Engineer/Technician: M. Polsky
 Driller: K. Heinrich
 Contractor: Heber Mining

Water Level

Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

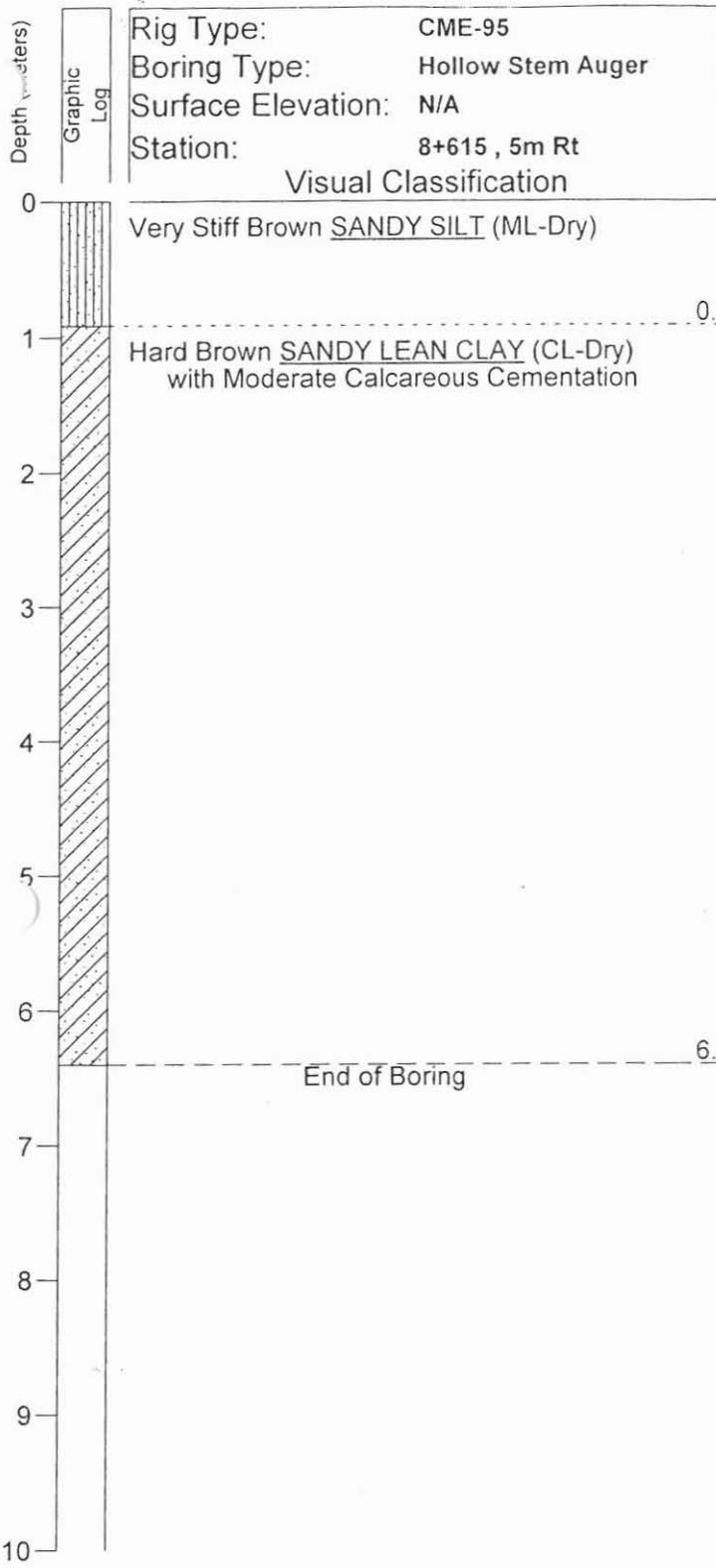
SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B- 2:1999

Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona

Project No.: 010034SA

METRIC SPEEDIE 010034SA.GPJ GENGE0.GDT 8/6/01



Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (kg/cu m)	Penetration Resistance Blows per 300mm
S-1	0.76	NT	NT	
BS-2	1.52	NT	NT	
RS-3	1.68	NT	NT	
S-4	3.35	NT	NT	
S-5	4.88	NT	NT	58/12"
S-6	6.40	NT	NT	

Boring Date: 6-18-99
 Field Engineer/Technician: M. Polsky
 Driller: K. Heinrich
 Contractor: Heber Mining

Water Level

Depth (m)	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: B-17:1999

Ellsworth Road
 Germann to 1/2 Mile N/o Elliot
 Mesa, Arizona

Project No.: 010034SA

METRIC SPEEDIE 010034SA.GPJ GENGE0.GDT 8/6/01

TABULATION OF TEST DATA

SOIL BORING or TEST PIT NUMBER	SAMPLE NUMBER	SAMPLE TYPE	DEPTH OF SAMPLE TIP (m)	NATURAL WATER CONTENT (Percent of Dry Weight)	IN-PLACE DRY DENSITY (Kilograms Per Cubic Meter)	PARTICLE SIZE DISTRIBUTION (Percent Finer)					ATTERBERG LIMITS			R VALUE at 300 PSI	CORRELATED R VALUE	pH	RESISTIVITY (Ohm-Centimeters)	% SULFATE (SO4)	% CHLORIDE (CL)	UNIFIED SOIL CLASSIFICATION
						0.075mm SIEVE	0.425mm SIEVE	2.00mm SIEVE	4.750mm SIEVE	75.00mm SIEVE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX							
						B-1	BS-3	BULK	2.44	NT	NT	44	93							
B-1	RS-2	RING	1.83	17.8	1460.9	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
B-2	BS-2	BULK	1.83	NT	NT	55	94	98	99	100	NP	NP	NP	NT	47	NT	NT	NT	NT	ML
B-3	RS-2	RING	1.83	22.4	1390.4	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
B-3	BS-3	BULK	3.05	NT	NT	65	95	98	99	100	21	18	3	33	35	NT	NT	NT	NT	ML
B-4	BS-3	BULK	3.05	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	7.8	3000	0.0048	0.0031	
B-5	RS-3	RING	3.20	14.6	1552.2	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
B-5	BS-4	BULK	4.57	NT	NT	53	70	82	88	100	34	17	17	40	25	NT	NT	NT	NT	CL
B-6	RS-3	RING	3.35	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
B-6	BS-4	BULK	4.57	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	7.6	1680	0.0062	0.0079	
B-7	BS-3	BULK	3.66	NT	NT	47	65	81	89	100	25	18	7	50	41	NT	NT	NT	NT	SC-SM
B-7	RS-4	RING	3.35	15.0	1486.5	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
B-8	RS-3	RING	3.35	14.0	1611.5	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
B-8	BS-4	BULK	4.57	NT	NT	59	75	85	94	100	34	17	17	NT	23	NT	NT	NT	NT	CL
B-9	RS-2	RING	1.83	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
B-9	BS-3	BULK	3.66	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	8.7	1800	0.0051	0.0034	

Sieve analysis results do not include material greater than 75mm. Refer to the actual boring logs for the possibility of cobble and boulder sized materials.

NT=Not Tested
Sheet 1 of 3

Ellsworth Road
Germann to 1/2 Mile N/o Elliot
Mesa, Arizona
Project No. 010034SA

**SPEEDIE
AND ASSOCIATES**

TABULATION OF TEST DATA

SOIL BORING or TEST PIT NUMBER	SAMPLE NUMBER	SAMPLE TYPE	DEPTH OF SAMPLE TIP (m)	NATURAL WATER CONTENT (Percent of Dry Weight)	IN-PLACE DRY DENSITY (Kilograms Per Cubic Meter)	PARTICLE SIZE DISTRIBUTION (Percent Finer)					ATTERBERG LIMITS			R VALUE at 300 PSI	CORRELATED R VALUE	pH	RESISTIVITY (Ohm-Centimeters)	% SULFATE (SO4)	% CHLORIDE (CL)	UNIFIED SOIL CLASSIFICATION
						0.075mm SIEVE	0.425mm SIEVE	2.00mm SIEVE	4.750mm SIEVE	75.00mm SIEVE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX							
						B-10	BS-4	BULK	4.57	NT	NT	74	90							
B-12	RS-3	RING	3.20	10.1	1467.3	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	CL
B-12	BS-4	BULK	4.57	NT	NT	37	57	74	90	100	30	21	9	NT	41	NT	NT	NT	NT	SC
B-13	RS-3	RING	3.35	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	CL
B-13	BS-4	BULK	4.57	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	9	2880	0.0035	0.0068		
B-14	BS-2	BULK	1.83	NT	NT	51	74	86	94	100	39	18	21	26	22	NT	NT	NT	NT	CL
B-14	RS-4	RING	3.35	14.5	1563.4	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	CL
B-15	BS-2	BULK	1.52	NT	NT	59	83	93	96	100	24	16	8	NT	33	NT	NT	NT	NT	CL
B-16	BS-3	BULK	3.05	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	7.7	1320	0.028	0.0069		
B-16	RS-4	RING	3.35	10.6	1673.9	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	CL
B-17	BS-2	BULK	1.52	NT	NT	59	82	92	94	100	29	15	14	20	26	NT	NT	NT	NT	CL
B-18	BS-2	BULK	1.52	NT	NT	58	83	92	96	100	31	15	16	NT	24	NT	NT	NT	NT	CL
B-18	RS-1	RING	0.61	12.6	1768.4	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	CL
B-19	BS-2	BULK	1.52	NT	NT	53	78	90	94	100	26	16	10	42	32	NT	NT	NT	NT	CL
B-20	BS-2	BULK	1.52	NT	NT	48	73	87	93	100	30	15	15	NT	29	NT	NT	NT	NT	SC
B-20	RS-1	RING	0.61	11.9	1557.0	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	CL

Sieve analysis results do not include material greater than 75mm. Refer to the actual boring logs for the possibility of cobble and boulder sized materials.

NT=Not Tested
Sheet 2 of 3

Ellsworth Road
Germann to 1/2 Mile N/o Elliot
Mesa, Arizona
Project No. 010034SA

**SPEEDIE
AND ASSOCIATES**

TABULATION OF TEST DATA

SOIL BORING or TEST PIT NUMBER	SAMPLE NUMBER	SAMPLE TYPE	DEPTH OF SAMPLE TIP (m)	NATURAL WATER CONTENT (Percent of Dry Weight)	IN-PLACE DRY DENSITY (Kilograms Per Cubic Meter)	PARTICLE SIZE DISTRIBUTION (Percent Finer)					ATTERBERG LIMITS			R VALUE at 300 PSI	CORRELATED R VALUE	pH	RESISTIVITY (Ohm-Centimeters)	% SULFATE (SO4)	% CHOLRIDE (CL)	UNIFIED SOIL CLASSIFICATION
						0.075mm SIEVE	0.425mm SIEVE	2.00mm SIEVE	4.750mm SIEVE	75.00mm SIEVE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX							
						B-21	BS-2	BULK	1.52	NT	NT	56	81							
B-22	RS-2	RING	1.83	11.8	1492.9	NT	NT	NT	NT	NT	NT	NT	NT	NT		NT	NT	NT	NT	
B-22	BS-3	BULK	3.05	NT	NT	66	90	97	99	100	32	16	16	NT	21	NT	NT	NT	NT	CL
B-23	S-1	SPT	0.76	NT	NT	56	79	90	95	100	37	18	19	36	22	NT	NT	NT	NT	CL
B-24	RS-2	RING	1.83	17.1	1659.5	NT	NT	NT	NT	NT	NT	NT	NT	NT		NT	NT	NT	NT	
B-24	BS-3	BULK	3.05	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT		8.2	1200	0.01	0.0078	
B-25	BS-2	BULK	1.52	NT	NT	57	71	83	92	100	29	15	14	NT	26	NT	NT	NT	NT	CL
B-26	BS-2	BULK	1.52	NT	NT	54	84	94	96	100	28	17	11	24	31	NT	NT	NT	NT	CL
B-26	RS-1	RING	0.61	7.8	1457.7	NT	NT	NT	NT	NT	NT	NT	NT	NT		NT	NT	NT	NT	
B-27	BS-2	BULK	1.52	NT	NT	47	70	89	96	100	25	14	11	NT	34	NT	NT	NT	NT	SC
B-28	BS-2	BULK	1.52	NT	NT	45	63	78	87	100	26	15	11	35	35	NT	NT	NT	NT	SC
B-28	RS-1	RING	0.61	8.3	1754.0	NT	NT	NT	NT	NT	NT	NT	NT	NT		NT	NT	NT	NT	

Sieve analysis results do not include material greater than 75mm. Refer to the actual boring logs for the possibility of cobble and boulder sized materials.

NT=Not Tested
Sheet 3 of 3

Ellsworth Road
Germann to 1/2 Mile N/o Elliot
Mesa, Arizona
Project No. 010034SA

**SPEEDIE
AND ASSOCIATES**

TABULATION OF TEST DATA

SOIL BORING or TEST PIT NUMBER	SAMPLE NUMBER	SAMPLE TYPE	DEPTH OF SAMPLE TIP (m)	NATURAL WATER CONTENT (Percent of Dry Weight)	IN-PLACE DRY DENSITY (Kilograms Per Cubic Meter)	PARTICLE SIZE DISTRIBUTION (Percent Finer)					ATTERBERG LIMITS			R VALUE at 300 PSI	CORRELATED R VALUE	pH	RESISTIVITY (Ohm-Centimeters)	% SULFATE (SO4)	% CHLORIDE (CL)	UNIFIED SOIL CLASSIFICATION
						0.075mm SIEVE	0.425mm SIEVE	2.00mm SIEVE	4.750mm SIEVE	75.00mm SIEVE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX							
						B- 2:1999	S-1	SPT	1.83	NT	NT	50	72							
B-17:1999	BS-2	BULK	1.52	NT	NT	63	88	98	100	100	30	18	12	NT	26	NT	NT	NT	NT	CL

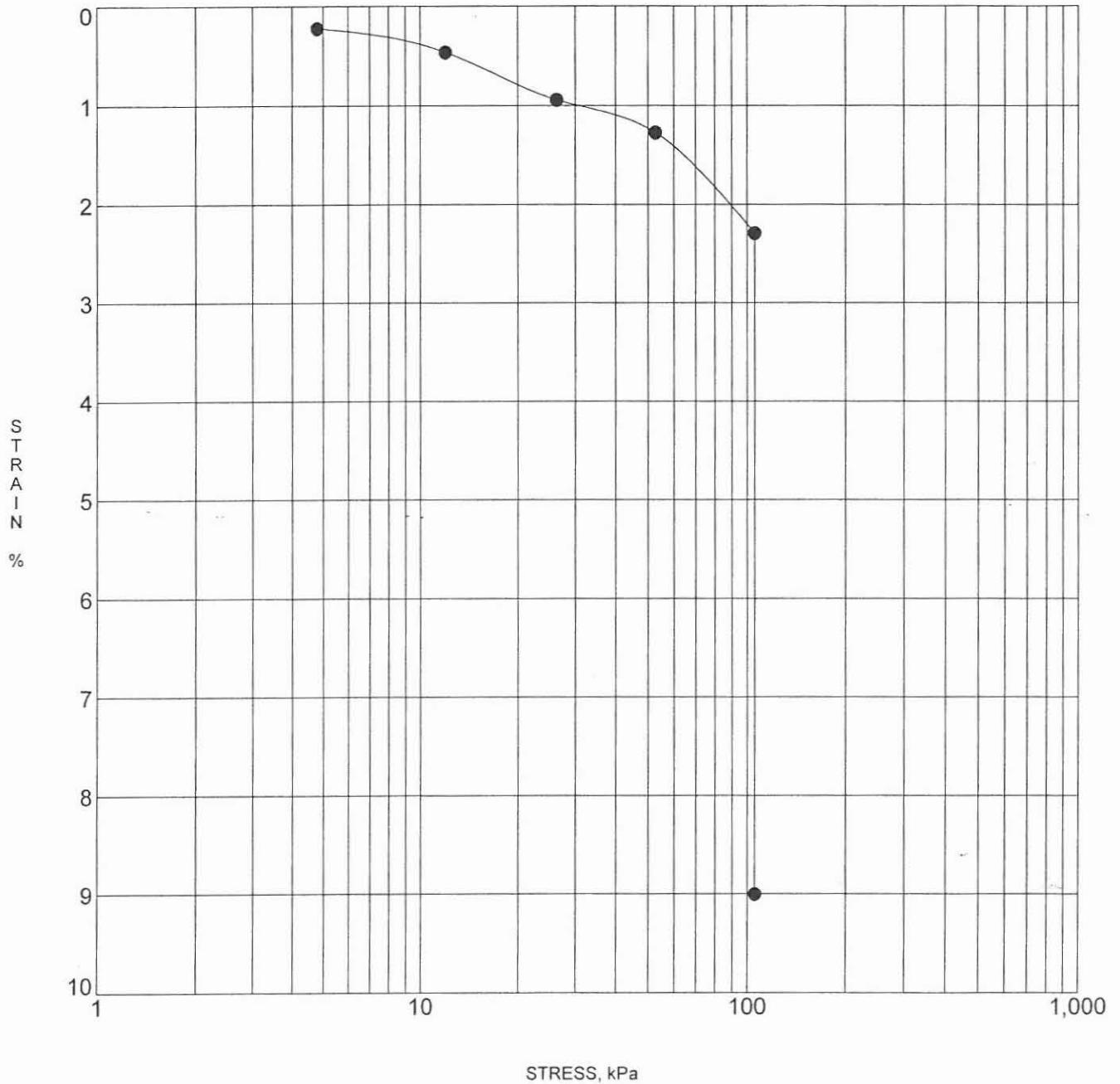
Sieve analysis results do not include material greater than 75mm. Refer to the actual boring logs for the possibility of cobble and boulder sized materials.

NT=Not Tested
Sheet 1 of 1

Ellsworth Road
Germann to 1/2 Mile N/o Elliot
Mesa, Arizona
Project No. 010034SA

**SPEEDIE
AND ASSOCIATES**

CONSOLIDATION TEST



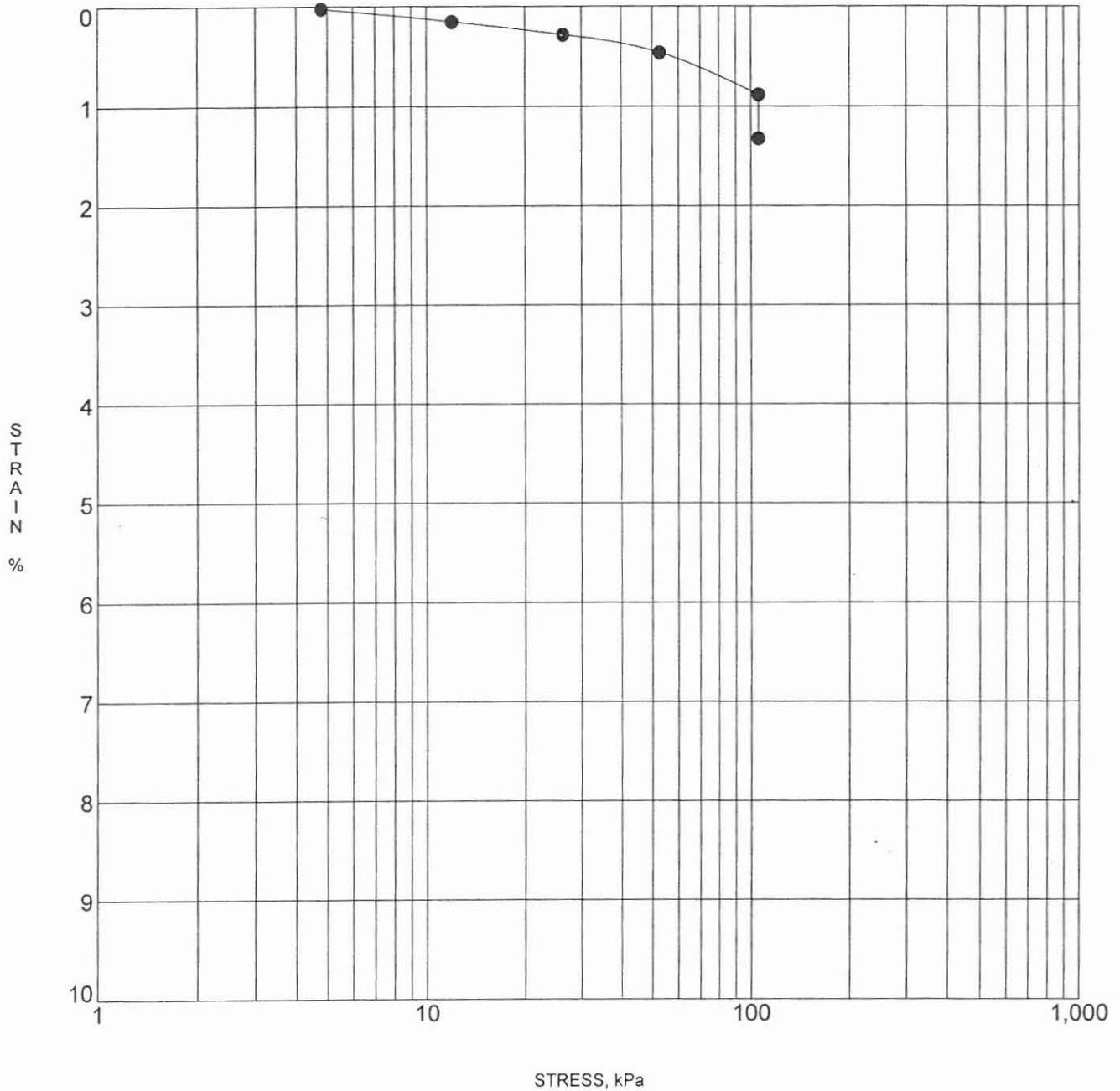
BORING B-7
 SAMPLE No. RS-4
 Sample inundated at end of test at 105 kPa

PROJECT Ellsworth Road - Germann to 1/2 Mile N/o Elliot

JOB NO. 010034SA
 DATE 2/12/01

**SPEEDIE
 AND ASSOCIATES**

CONSOLIDATION TEST



BORING B-9
 SAMPLE No. RS-2
 Sample inundated at end of test at 105 kPa

PROJECT Ellsworth Road - Germann to 1/2 Mile N/o Elliot

JOB NO. 010034SA
 DATE 2/12/01

**SPEEDIE
 AND ASSOCIATES**

SWELL TEST DATA

BORING or TEST PIT No.	SAMPLE DEPTH, (m)	MAXIMUM DRY DENSITY (kg/cu m)	OPTIMUM MOISTURE CONTENT (%)	REMOLDED DRY DENSITY (kg/cu m)	INITIAL MOISTURE CONTENT (%)	PERCENT COMPACTION	FINAL MOISTURE CONTENT (%)	CONFINING LOAD (kPa)	TOTAL SWELL (%)
B- 8, BS-4	4.6	1726.8	17.4	1651.7	15.7	95.6	22.4	4.79	2.9
B-25, BS-2	1.5	1954.3	11.3	1867.9	9.4	95.6	15.3	4.79	2.8

SWELL TEST DATA

BORING or TEST PIT No.	SAMPLE DEPTH, (m)	MAXIMUM DRY DENSITY (kg/cu m)	OPTIMUM MOISTURE CONTENT (%)	REMOLED DRY DENSITY (kg/cu m)	INITIAL MOISTURE CONTENT (%)	PERCENT COMPACTION	FINAL MOISTURE CONTENT (%)	CONFINING LOAD (kPa)	TOTAL SWELL (%)
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B-17:1999, BS-2	1.5	1781.3	14.8	1698.1	13.0	95.3	21.6	4.79	4.0
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MOISTURE-DENSITY RELATIONS

PROJECT: Ellsworth Road

PROJECT NO.: 010034SA

LOCATION: Germann to 1/2 Mile N/o Elliot

DATE: 2/12/01

BORING NO.: B-2

SAMPLE NO.: BS-2

SAMPLE DEPTH: 1.83 (m)

LABORATORY NO.: E7474

METHOD OF COMPACTION: D698A

LIQUID LIMIT: NP

PLASTIC LIMIT: NP

PLASTICITY INDEX: NP

NP

CLASSIFICATION: ML

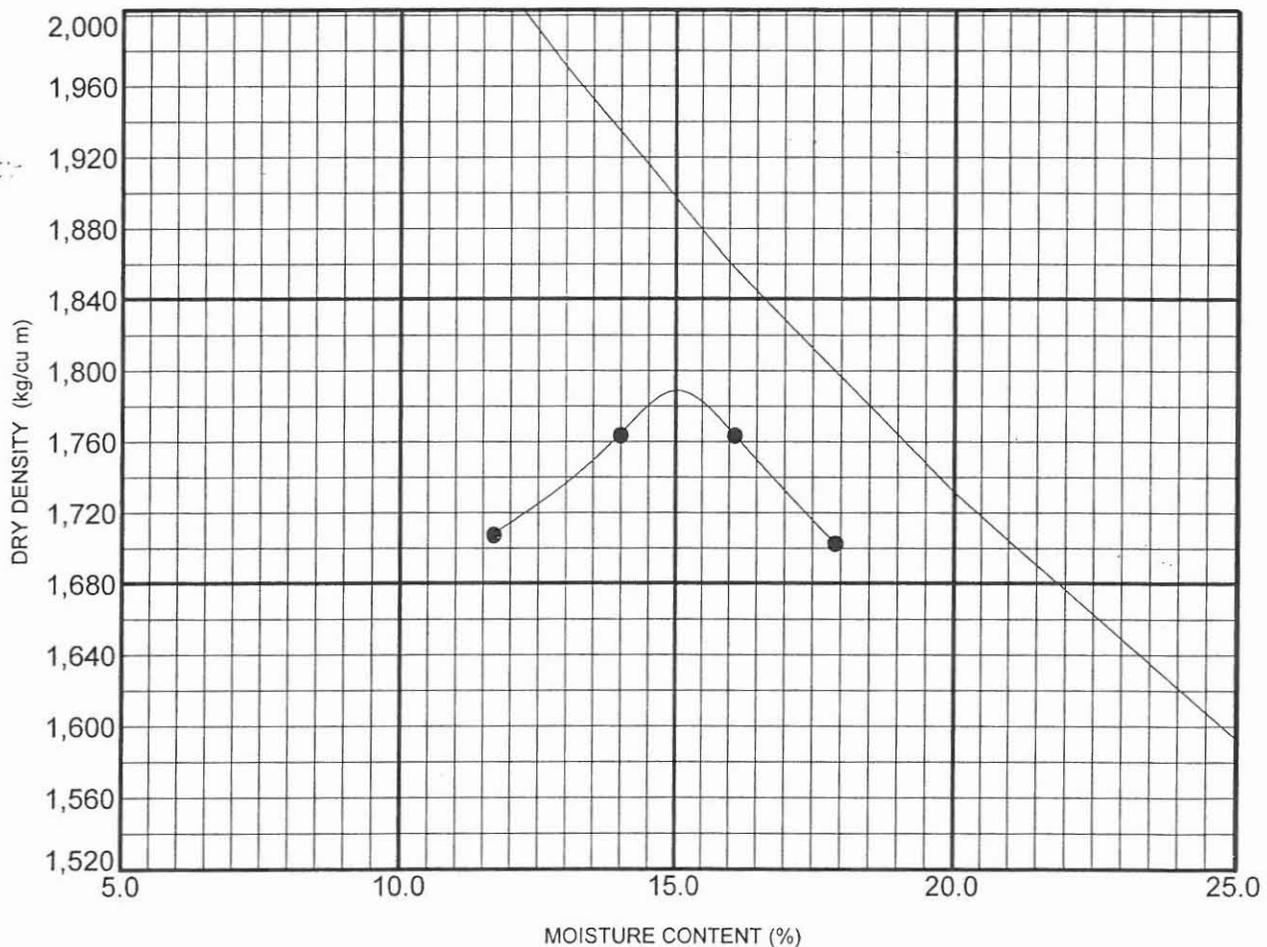
ASTM SOIL DESCRIPTION:

SANDY SILT

MAXIMUM DRY DENSITY: 111.4 PCF

(SI) MAXIMUM DRY DENSITY: 1784.5 kg/cu m

OPTIMUM MOISTURE CONTENT: 15.2%



MOISTURE-DENSITY RELATIONS

PROJECT: Ellsworth Road

PROJECT NO.: 010034SA

LOCATION: Germann to 1/2 Mile N/o Elliot

DATE: 2/13/01

BORING NO.: B-8

SAMPLE NO.: BS-4

SAMPLE DEPTH: 4.57 (m)

LABORATORY NO.: E7503

METHOD OF COMPACTION: D698A

LIQUID LIMIT: 34

PLASTIC LIMIT: 17

PLASTICITY INDEX: 17

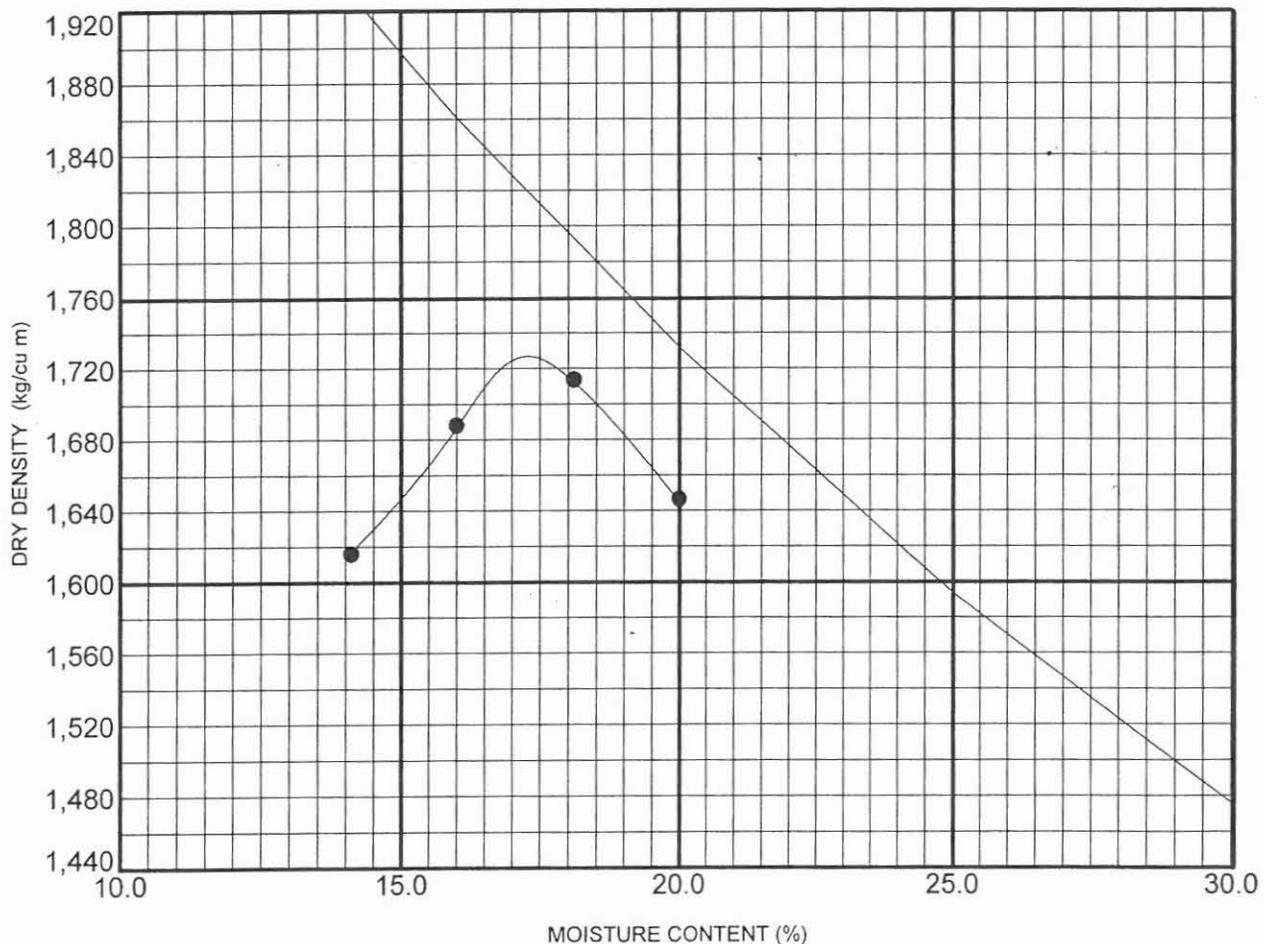
CLASSIFICATION: CL

ASTM SOIL DESCRIPTION: SANDY LEAN CLAY

MAXIMUM DRY DENSITY: 107.8 PCF

(SI) MAXIMUM DRY DENSITY: 1726.8 kg/cu m

OPTIMUM MOISTURE CONTENT: 17.4%



MOISTURE-DENSITY RELATIONS

PROJECT: Ellsworth Road

PROJECT NO.: 010034SA

LOCATION: Germann to 1/2 Mile N/o Elliot

DATE: 2/12/01

BORING NO.: B-12

SAMPLE NO.: BS-4

SAMPLE DEPTH: 4.57 (m)

LABORATORY NO.: E7526

METHOD OF COMPACTION: D698A

LIQUID LIMIT: 30

PLASTIC LIMIT: 21

PLASTICITY INDEX: 10

CLASSIFICATION: SC

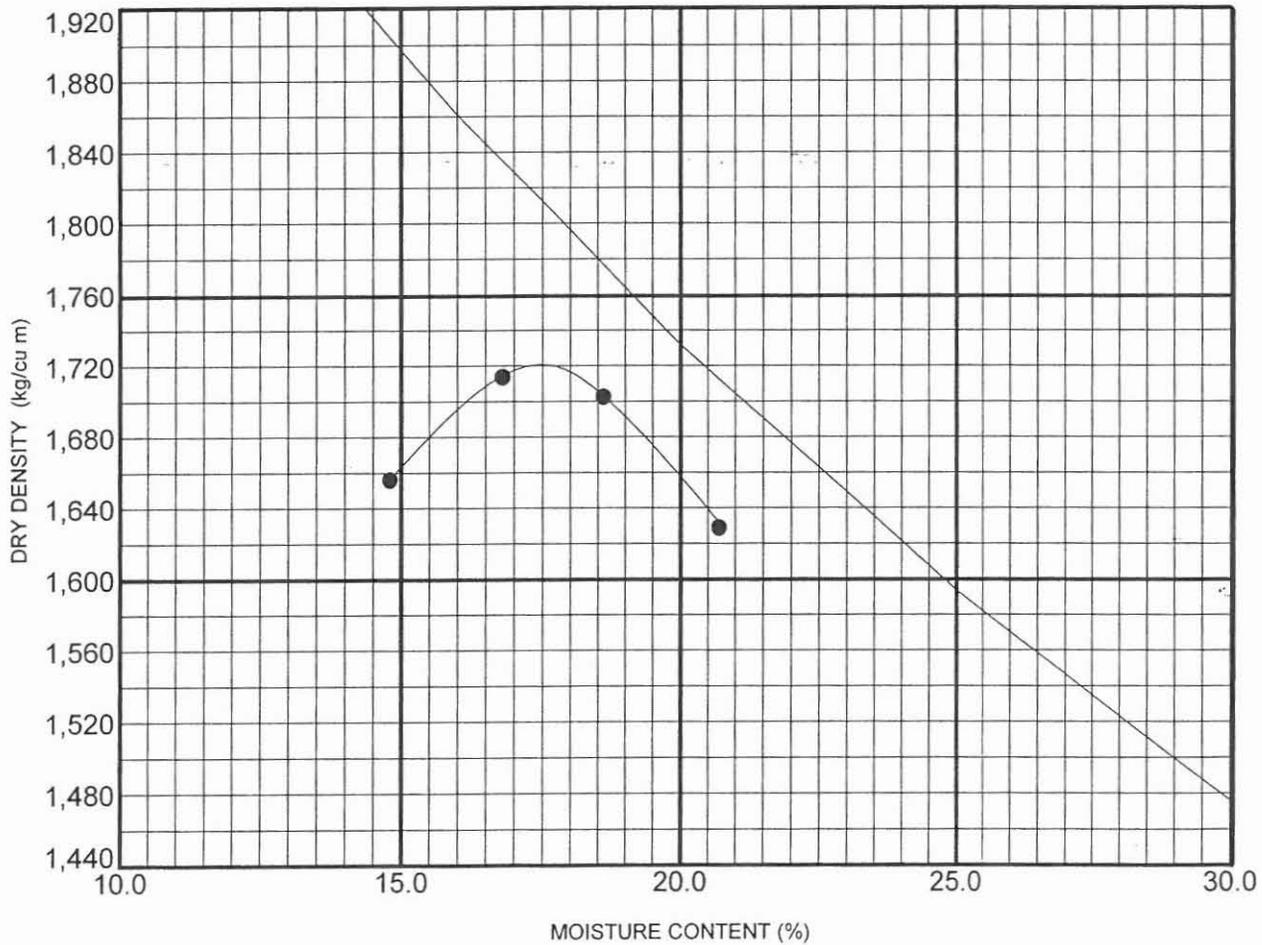
ASTM SOIL DESCRIPTION:

CLAYEY SAND

MAXIMUM DRY DENSITY: 107.5 PCF

(SI) MAXIMUM DRY DENSITY: 1722.0 kg/cu m

OPTIMUM MOISTURE CONTENT: 17.6%

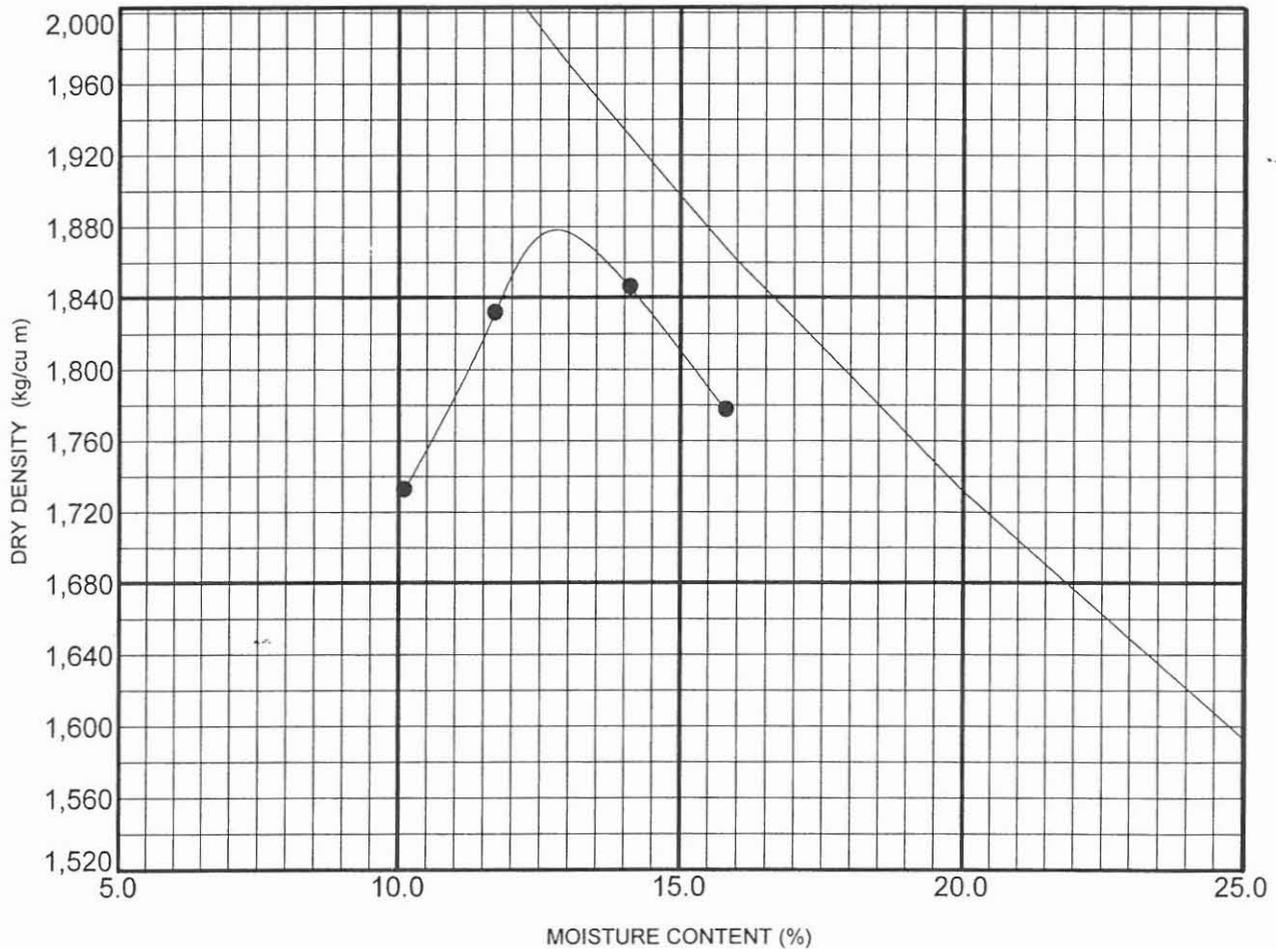


MOISTURE-DENSITY RELATIONS

PROJECT: Ellsworth Road PROJECT NO.: 010034SA
LOCATION: Germann to 1/2 Mile N/o Elliot DATE: 2/13/01
BORING NO.: B-15 SAMPLE NO.: BS-2 SAMPLE DEPTH: 1.52 (m) LABORATORY NO.: E7541
METHOD OF COMPACTION: D698A
LIQUID LIMIT: 24 PLASTIC LIMIT: 16 PLASTICITY INDEX: 8
CLASSIFICATION: CL ASTM SOIL DESCRIPTION: SANDY LEAN CLAY

MAXIMUM DRY DENSITY: 117.4 PCF
(SI) MAXIMUM DRY DENSITY: 1880.6 kg/cu m

OPTIMUM MOISTURE CONTENT: 12.9%



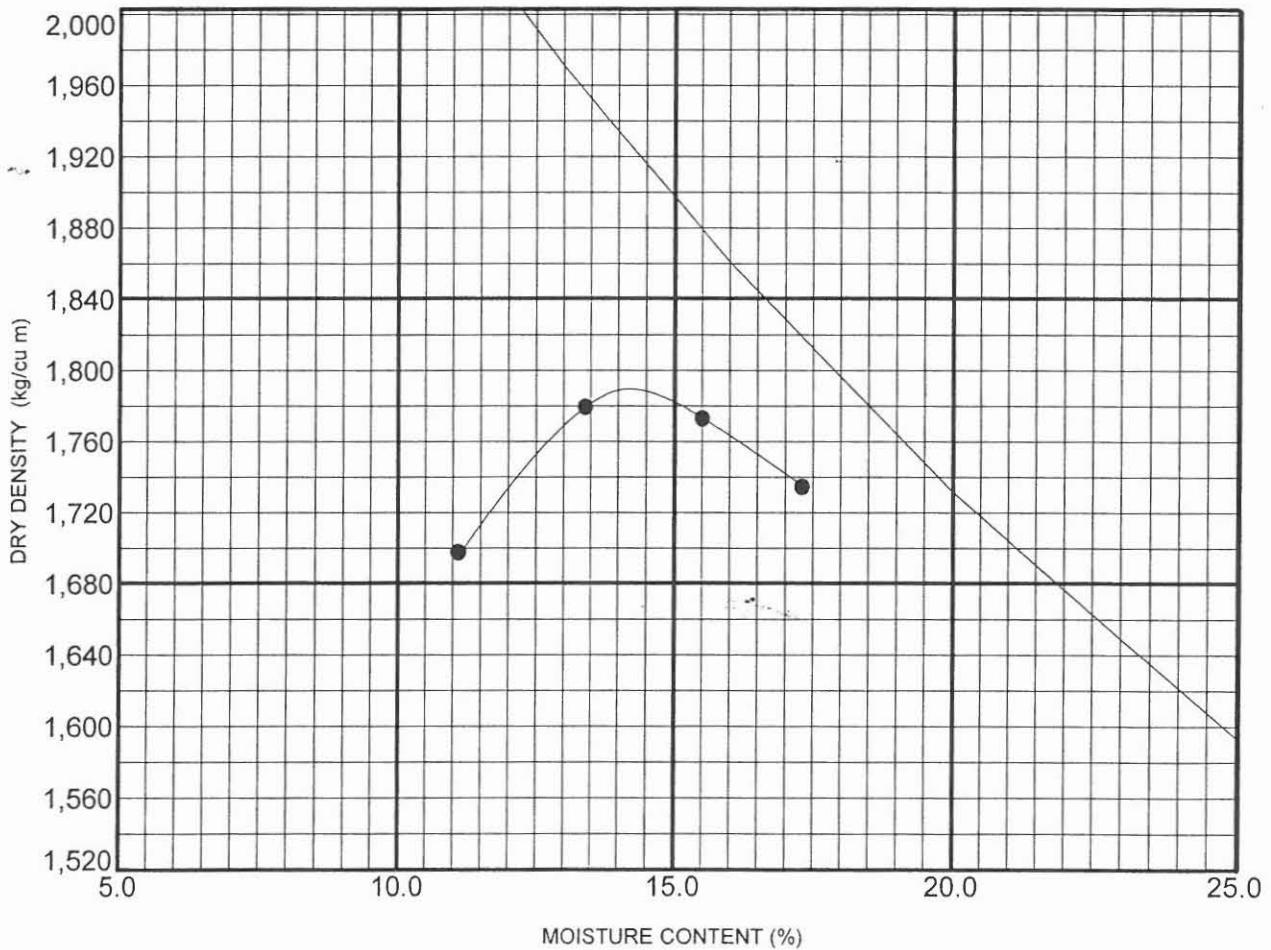
MOISTURE-DENSITY RELATIONS

PROJECT:	Ellsworth Road	PROJECT NO.:	010034SA				
LOCATION:	Germann to 1/2 Mile N/o Elliot	DATE:	2/12/01				
BORING NO.:	B-18	SAMPLE NO.:	BS-2	SAMPLE DEPTH:	1.52 (m)	LABORATORY NO.:	E7552
METHOD OF COMPACTION:	D698A						
LIQUID LIMIT:	31	PLASTIC LIMIT:	15	PLASTICITY INDEX:			16
CLASSIFICATION:	CL	ASTM SOIL DESCRIPTION:	SANDY LEAN CLAY				

MAXIMUM DRY DENSITY: 111.9 PCF

(SI) MAXIMUM DRY DENSITY: 1792.5 kg/cu m

OPTIMUM MOISTURE CONTENT: 14.1%



MOISTURE-DENSITY RELATIONS

PROJECT: Ellsworth Road

PROJECT NO.: 010034SA

LOCATION: Germann to 1/2 Mile N/o Elliot

DATE: 2/12/01

BORING NO.: B-20

SAMPLE NO.: BS-2

SAMPLE DEPTH: 1.52 (m)

LABORATORY NO.: E7558

METHOD OF COMPACTION: D698A

LIQUID LIMIT: 30

PLASTIC LIMIT: 15

PLASTICITY INDEX:

15

CLASSIFICATION: SC

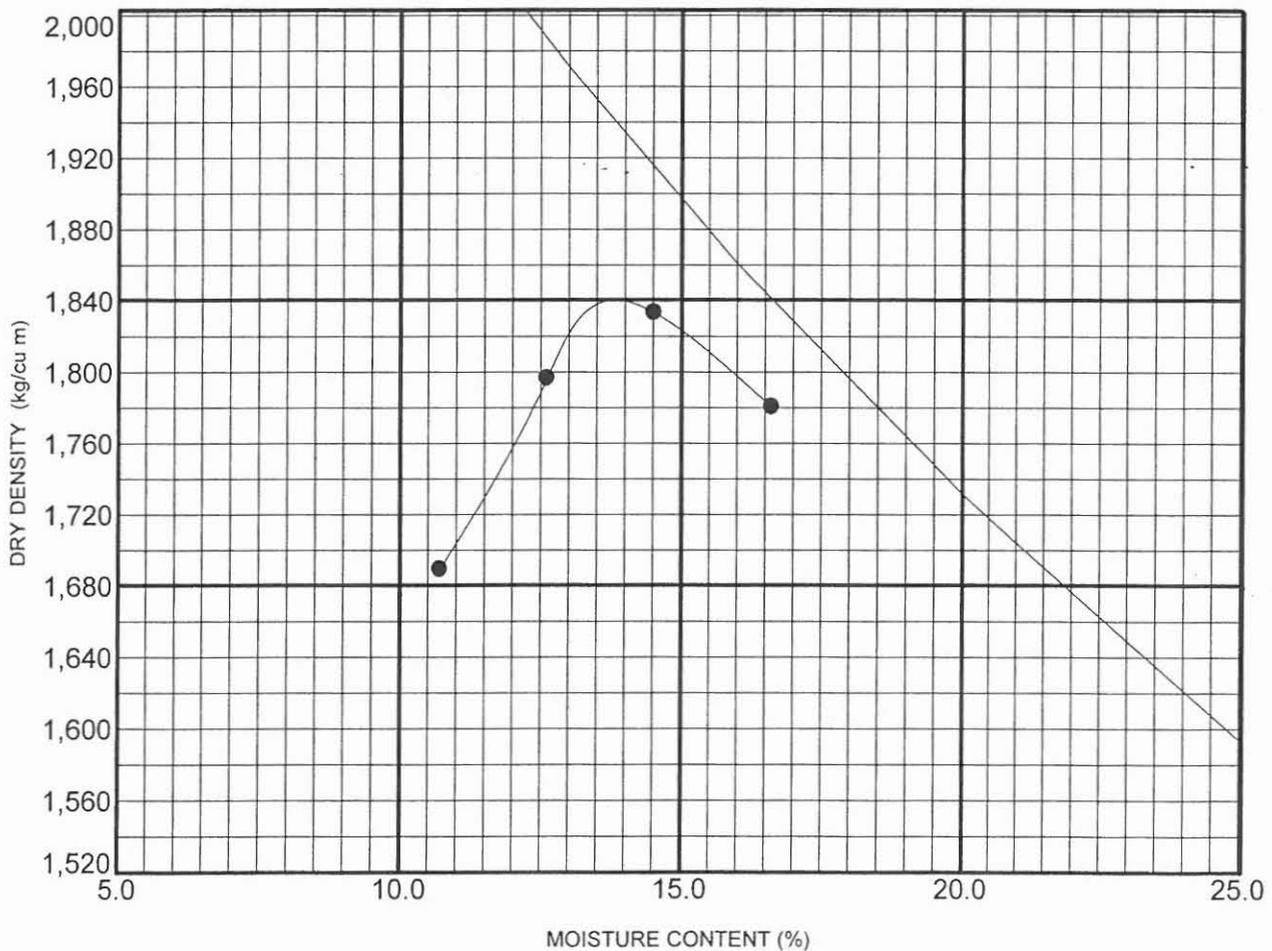
ASTM SOIL DESCRIPTION:

CLAYEY SAND

MAXIMUM DRY DENSITY: 115.0 PCF

(SI) MAXIMUM DRY DENSITY: 1842.1 kg/cu m

OPTIMUM MOISTURE CONTENT: 13.7%

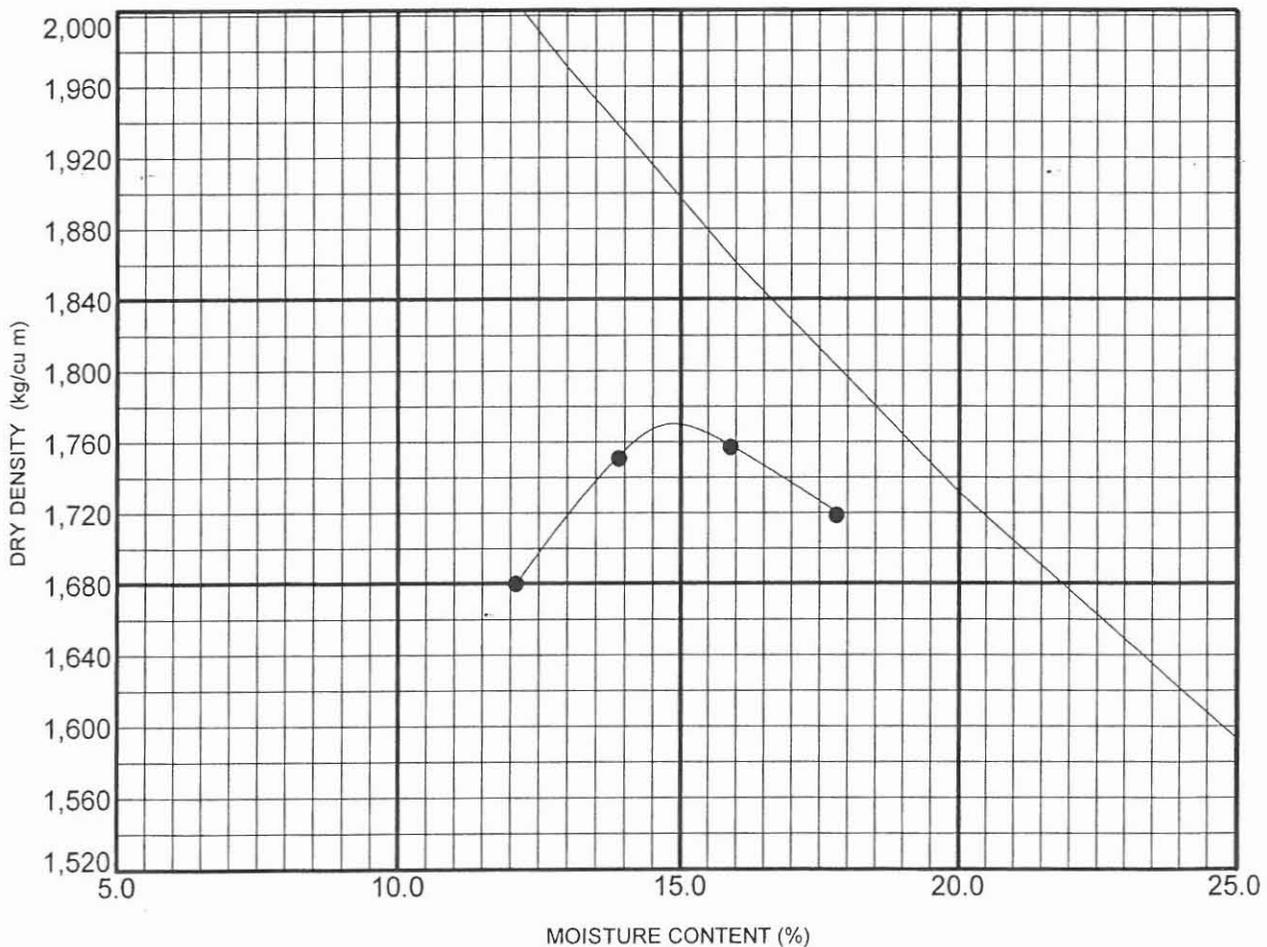


MOISTURE-DENSITY RELATIONS

PROJECT: Ellsworth Road PROJECT NO.: 010034SA
LOCATION: Germann to 1/2 Mile N/o Elliot DATE: 2/12/01
BORING NO.: B-22 SAMPLE NO.: BS-3 SAMPLE DEPTH: 3.05 (m) LABORATORY NO.: E7566
METHOD OF COMPACTION: D698A
LIQUID LIMIT: 32 PLASTIC LIMIT: 16 PLASTICITY INDEX: 17
CLASSIFICATION: CL ASTM SOIL DESCRIPTION: SANDY LEAN CLAY

MAXIMUM DRY DENSITY: 110.6 PCF
(SI) MAXIMUM DRY DENSITY: 1771.6 kg/cu m

OPTIMUM MOISTURE CONTENT: 14.8%

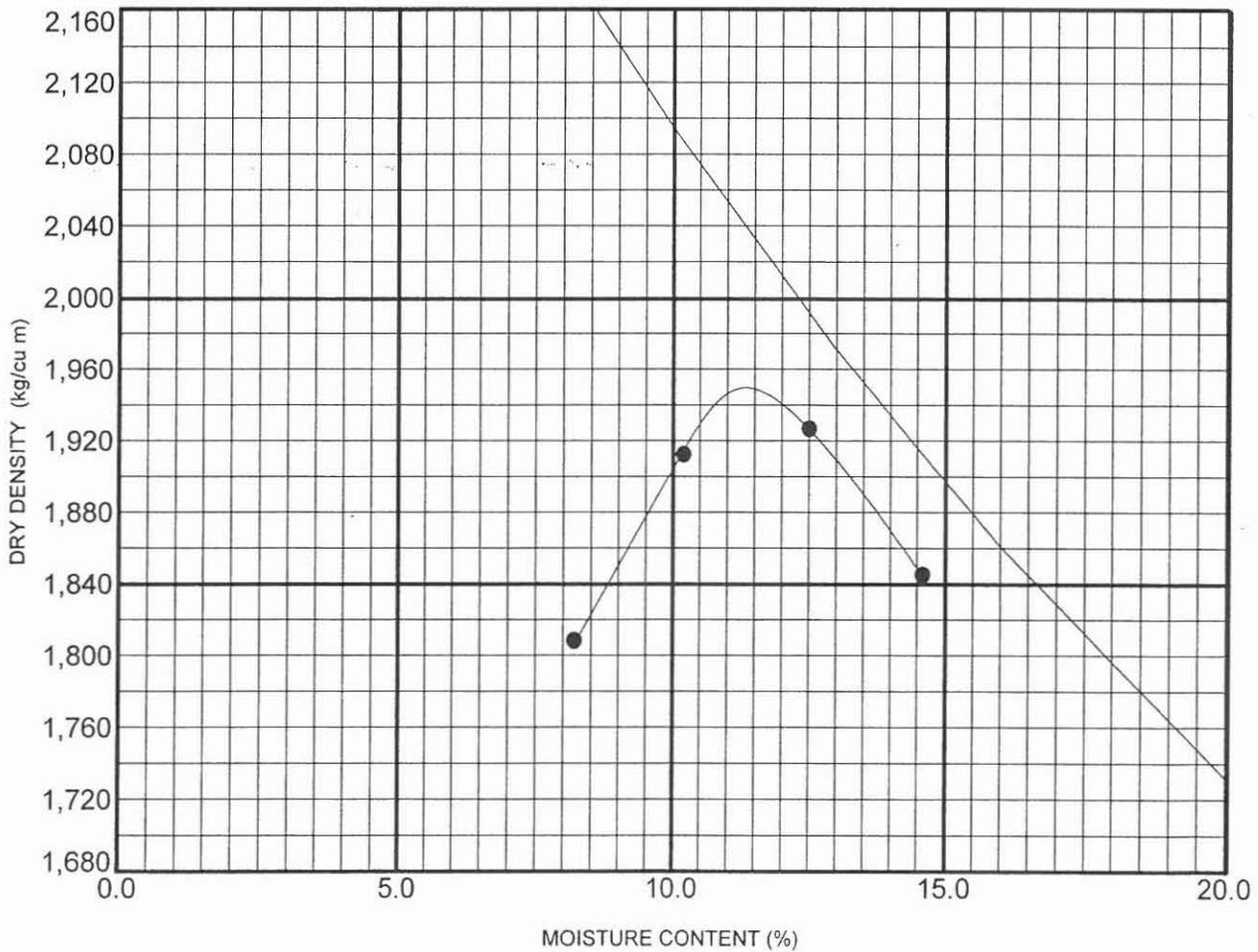


MOISTURE-DENSITY RELATIONS

PROJECT: Ellsworth Road PROJECT NO.: 010034SA
LOCATION: Germann to 1/2 Mile N/o Elliot DATE: 2/13/01
BORING NO.: B-25 SAMPLE NO.: BS-2 SAMPLE DEPTH: 1.52 (m) LABORATORY NO.: E7577
METHOD OF COMPACTION: D698A
LIQUID LIMIT: 29 PLASTIC LIMIT: 15 PLASTICITY INDEX: 14
CLASSIFICATION: CL ASTM SOIL DESCRIPTION: SANDY LEAN CLAY

MAXIMUM DRY DENSITY: 122.0 PCF
(SI) MAXIMUM DRY DENSITY: 1954.3 kg/cu m

OPTIMUM MOISTURE CONTENT: 11.3%



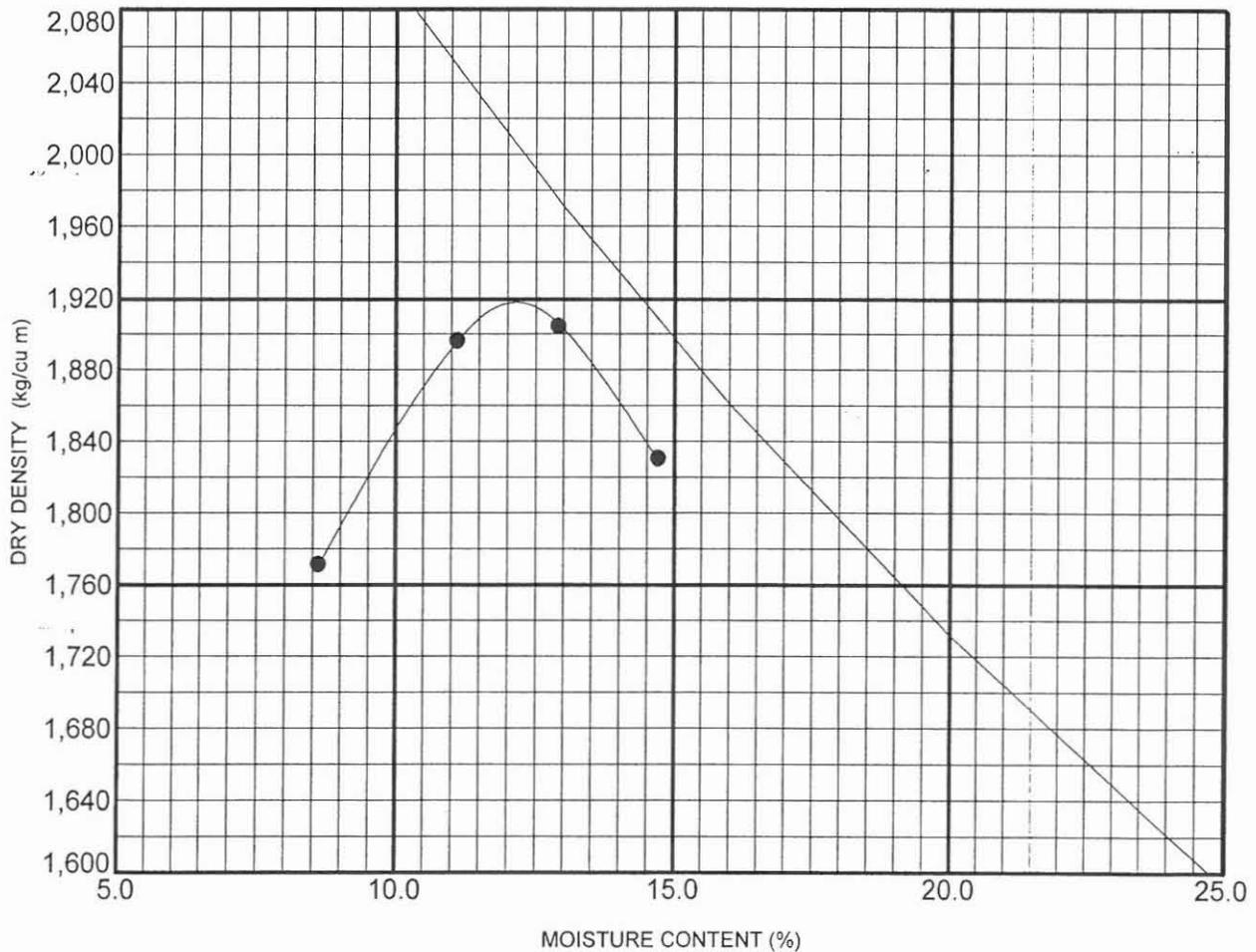
MOISTURE-DENSITY RELATIONS

PROJECT: Ellsworth Road PROJECT NO.: 010034SA
LOCATION: Germann to 1/2 Mile N/o Elliot DATE: 2/13/01
BORING NO.: B-27 SAMPLE NO.: BS-2 SAMPLE DEPTH: 1.52 (m) LABORATORY NO.: E7584
METHOD OF COMPACTION: D698A
LIQUID LIMIT: 25 PLASTIC LIMIT: 14 PLASTICITY INDEX: 11
CLASSIFICATION: SC ASTM SOIL DESCRIPTION: CLAYEY SAND

MAXIMUM DRY DENSITY: 119.9 PCF

(SI) MAXIMUM DRY DENSITY: 1920.6 kg/cu m

OPTIMUM MOISTURE CONTENT: 12.1%



MOISTURE-DENSITY RELATIONS

PROJECT: Ellsworth Road

PROJECT NO.: 010034SA

LOCATION: Germann to 1/2 Mile N/o Elliot

DATE: 6/18/99

BORING NO.: B-17:1999 SAMPLE NO.: BS-2

SAMPLE DEPTH: 1.52 (m)

LABORATORY NO.: S7063

METHOD OF COMPACTION: D698A

LIQUID LIMIT: 30

PLASTIC LIMIT: 18

PLASTICITY INDEX:

12

CLASSIFICATION: CL

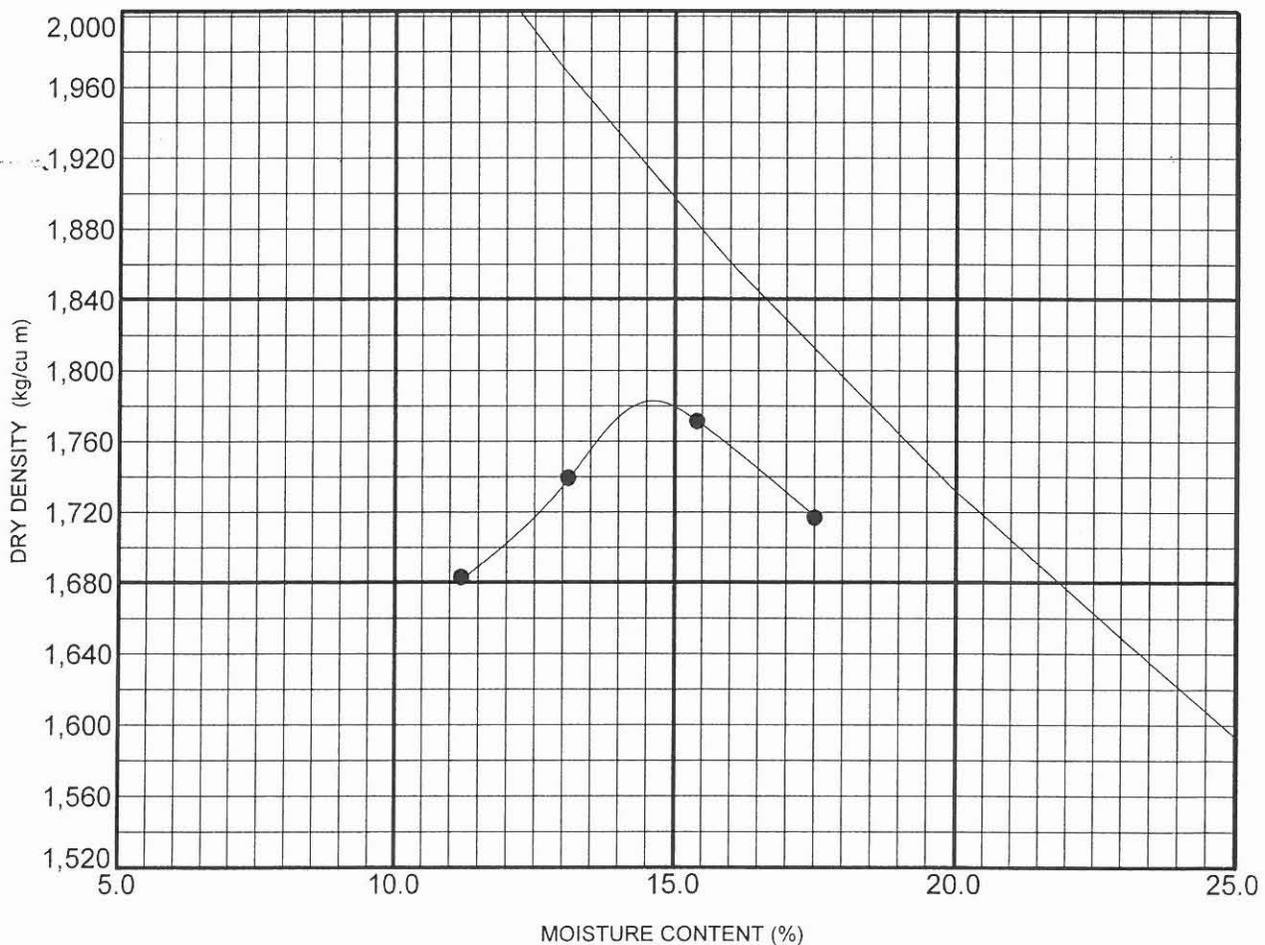
ASTM SOIL DESCRIPTION:

SANDY LEAN CLAY

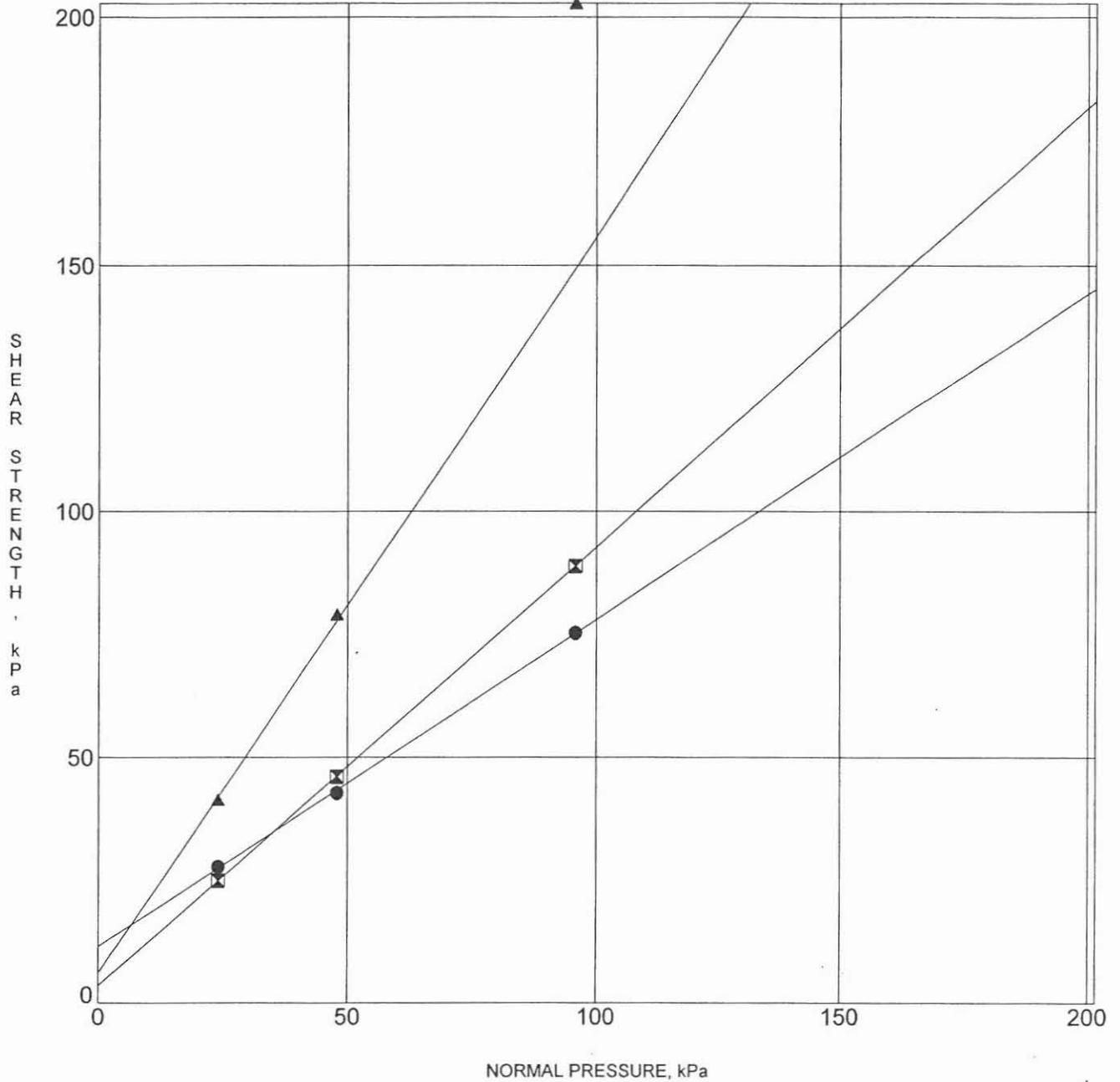
MAXIMUM DRY DENSITY: 111.2 PCF

(SI) MAXIMUM DRY DENSITY: 1781.3 kg/cu m

OPTIMUM MOISTURE CONTENT: 14.8%



SHEAR TEST DIAGRAM



Specimen Identification	Cohesion, kPa		Friction Angle	DD kg/cu m	MC%
● B-6	10.0	11.5	34.0	1382.4	9.8
⊠ B-9	5.0	3.5	42.0	1448.6	10.7
▲ B-13	10.0	3.8	58.0	1811.2	10.7

PROJECT Ellsworth Road - Germann to 1/2 Mile N/o Elliot

JOB NO. 010034SA
DATE 2/13/01

**SPEEDIE
AND ASSOCIATES**

TABULATION OF CORRELATED R-VALUES - All Samples

SOIL BORING or TEST PIT NUMBER	STATION & OFFSET	DEPTH OF SAMPLE TIP		#200 SIEVE	PLASTICITY INDEX	R-VALUE AT 300 PSI CALCULATE D	R-VALUE AT 300 PSI TESTED
		FROM	TO				
B-1		3	8	44	2	50	63
B-2		1.1	6	55	0	47	
B-3		5.1	10	65	4	35	33
B-5		10.1	15	53	17	25	40
B-7		7	12	47	6	41	50
B-8		10.1	15	59	17	23	
B-10		10.1	15	74	13	22	25
B-12		10.5	15	37	10	41	
B-14		1.1	6	51	21	22	26
B-15		0	5	59	8	32	
B-17		0	5	59	14	26	20
B-18		0.5	5	58	16	24	
B-19		0	5	53	10	33	42
B-20		0.5	5	48	15	29	
B-21		0	5	56	12	29	22
B-22		5.1	10	66	17	21	
B-23		1	2.5	56	19	22	36
B-25		0.5	5	57	14	26	
B-26		0	5	54	11	31	24
B-27		0.5	5	47	11	34	
B-28		0	5	45	11	35	35

Nt =	12
Nc =	21
Rt =	35
Rc =	31
σ_t =	13
σ_c =	8
SVF =	1
R_{mean} =	32
M_R =	18,820 psi