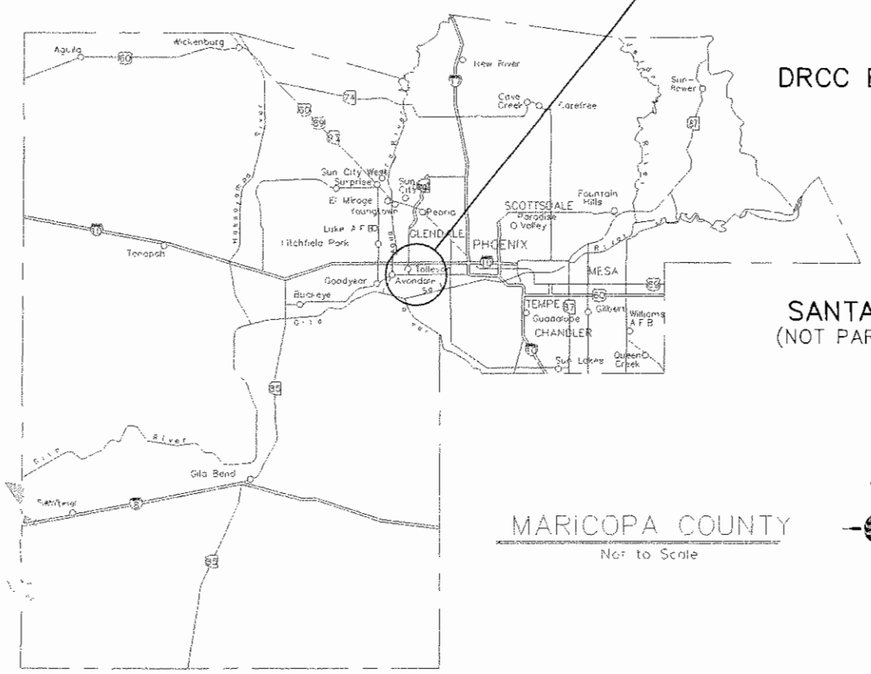
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

IN COOPERATION WITH CITY OF PHOENIX
PLANS FOR THE CONSTRUCTION OF
DURANGO REGIONAL CONVEYANCE CHANNEL AND
DETENTION BASIN – PHASE 1

PCN 565.04.31
FCD CONTRACT FCD 2005 C017

REVIEW COPY
NOT FOR
CONSTRUCTION

PROJECT LOCATION



MARICOPA COUNTY
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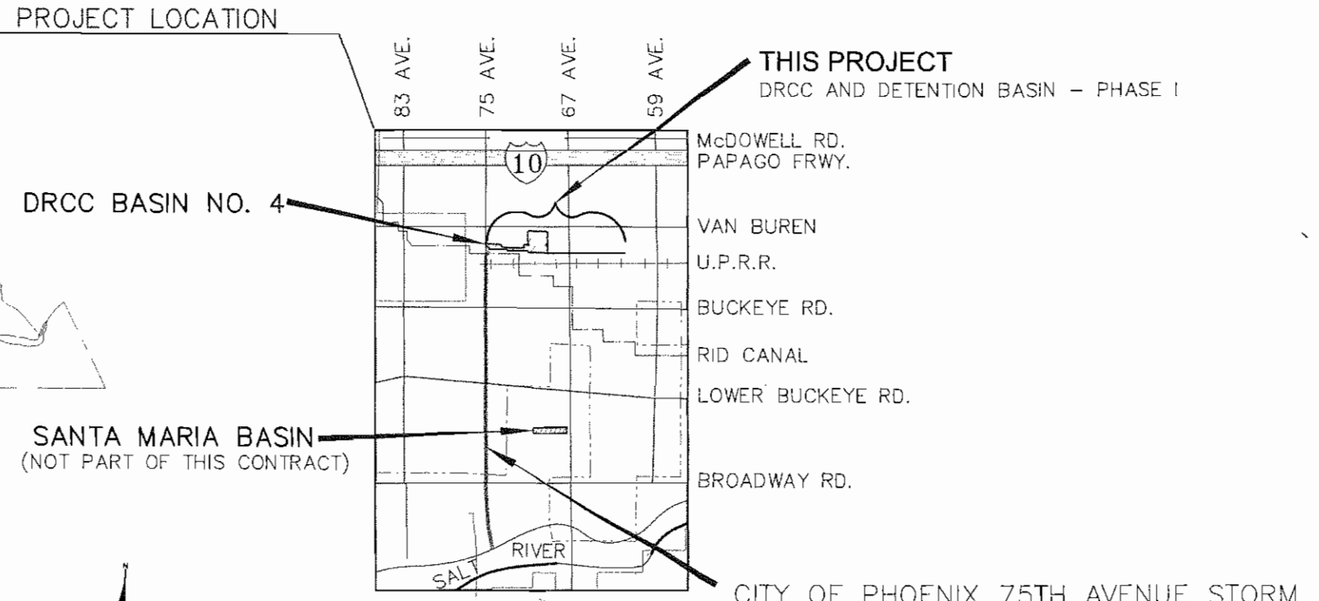


VICINITY MAP
Not to Scale

CITY OF PHOENIX

STREET TRANSPORTATION DIRECTOR — DATE

PARKS AND RECREATION DIRECTOR — DATE

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY:

PROJECT MANAGER — DATE

ISSUED FOR PUBLIC BIDDING BY:

CHIEF ENGINEER AND GENERAL MANAGER — DATE

BOARD OF DIRECTORS OF THE FLOOD CONTROL DISTRICT

ANDY KUNASEK – CHAIRMAN

DISTRICT 1	FULTON BROCK
DISTRICT 2	DON STAPLEY
DISTRICT 3	ANDY KUNASEK
DISTRICT 4	MAX WILSON
DISTRICT 5	MARY ROSE WILCOX

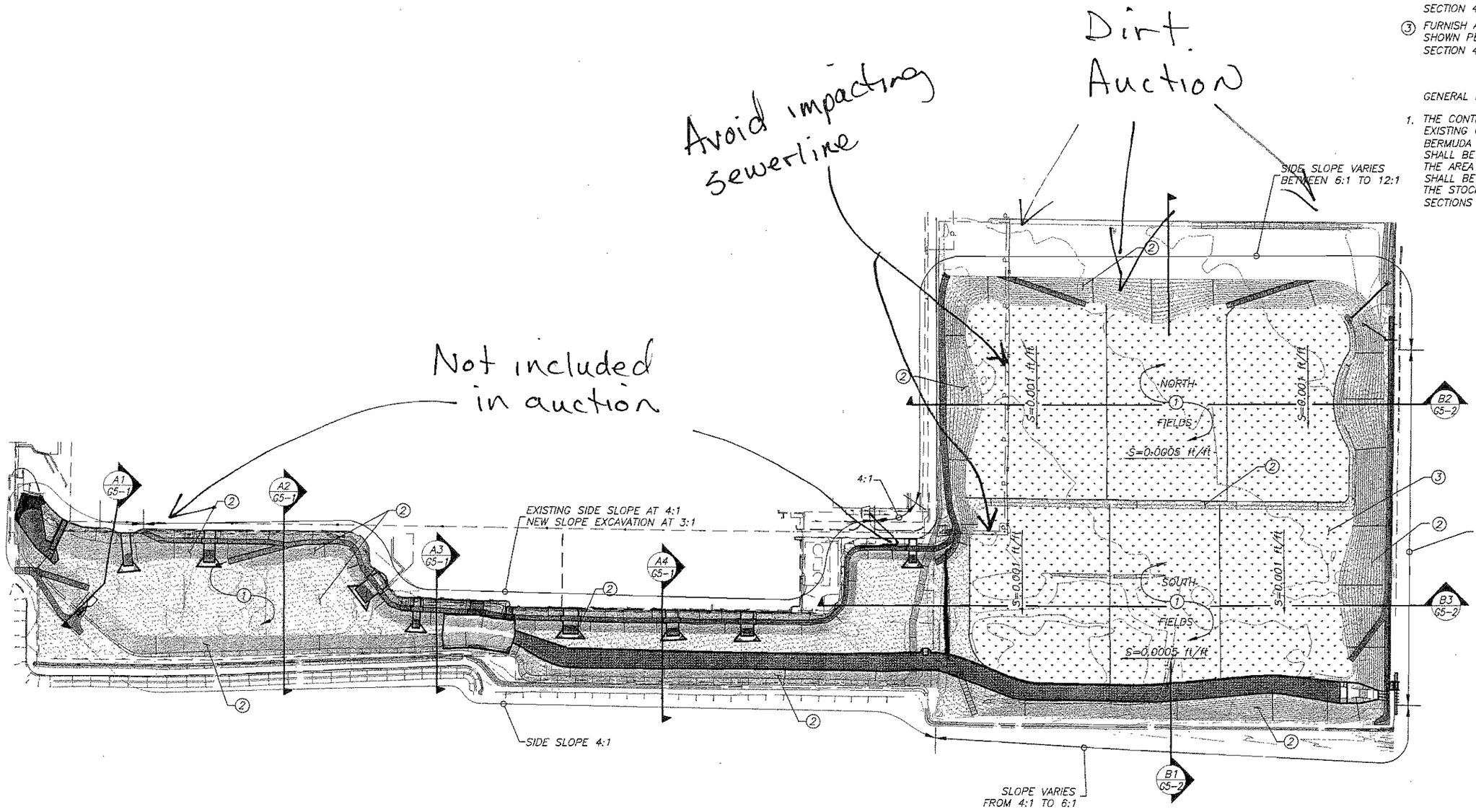
12/27/05, V:\52817\-cover\cover1.p

CONSTRUCT

1. EXCAVATE AND GRADE TO SLOPE AND LIMITS SHOWN ON SHEETS C2 THROUGH C7. EXCAVATION OPERATION SHALL ADHERE TO SPECIAL PROVISION SECTION 215. SEE GENERAL NOTE 1. (798,100 CY)
2. FURNISH AND INSTALL GRAVEL MULCH TO LIMITS SHOWN PER PLAN SHEETS – SEE SPECIAL PROVISIONS SECTION 432. (116,400 SY)
3. FURNISH AND INSTALL BERMUDA GRASS TO LIMITS SHOWN PER PLAN SHEETS – SEE SPECIAL PROVISIONS SECTION 430 AND GENERAL NOTE 1. (123,700 SY)

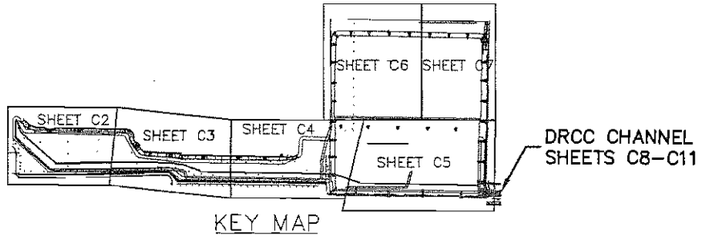
GENERAL NOTES:

1. THE CONTRACTOR SHALL STOCKPILE THE TOP 12" OF EXISTING GROUND FOR THE AREA SHOWN TO RECEIVE BERMUDA GRASS (BUZZ OATS PARCEL). STOCKPILE SHALL BE AT A LOCATION APPROVED BY THE ENGINEER. THE AREA DESIGNATED TO RECEIVE BERMUDA GRASS SHALL BE OVER EXCAVATED TO ALLOW PLACEMENT OF THE STOCKPILED TOP SOIL – SEE SPECIAL PROVISIONS SECTIONS 215 AND 430 (NPI).



REVIEW COPY
NOT FOR CONSTRUCTION

TWO WORKING DAYS BEFORE YOU DIG, CALL 263-1100 BLUE STAKE



KEY MAP

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

DRCC AND DETENTION BASIN
PCN 565.04.31

	BY	DATE
DESIGNED	DTP	12/2005
DRAWN	BGS	12/2005
CHECKED	RJB	12/2005

Registered Professional Engineer (Civil) CERTIFICATE NO. 33842 DAVID T. PHELPS Date Signed ARIZONA, U.S.A.

STANTEC Consulting Inc.
8211 South 48th Street
Phoenix, AZ. 85044
Tel. (602) 438-2200

DRAWING NO. C1

DRCC NO 4
OVERALL BASIN PLAN

SHEET 13 OF 49

12/27/05; V:\52817\ACTIVE\ROADWAY\81760097\DRAWINGS\BASIN_CHANNEL\SHEETS\100%SUB\097C01.DWG

R·A·M

RICKER • ATKINSON • McBEE & ASSOCIATES, INC.

Geotechnical Engineering • Construction Materials Testing

Stantec Consulting, Inc.
8211 South 48th Street
Phoenix, Arizona 85044-5355

November 22, 2005

Attention: Joe Bergquist, P.E.

Subject: Geotechnical Engineering Report
Durango Regional Conveyance Channel
And Detention Basins
Harrison Street Alignment – 75th Avenue
To About 1800 Feet West of 67th Avenue
Phoenix, Arizona

R.A.M. Project No. G11500
Supplement No. 1

At your request this firm has drilled the remaining four test borings for the subject project. Test Borings SB8 and SB9 were not drilled during the original field work due to lack of access permission. Test Borings SM1 and SM2 were not drilled due to a move in the basin location and lack of permission to enter the project site. We also drilled two, 15-foot deep percolation test holes adjacent to SM1 and SM2. The location of the test borings are shown on the attached Site Plan and the results of the test borings and percolation tests (P1 and P2) are shown on the attached Test Boring Logs.

In general, the soils encountered in all of the test borings drilled for this supplement were sandy clay with a trace of gravel, the soils were firm to stiff and had medium plasticity. In Test Boring SB9 the upper 12 inches of the deposit was fill. Soil moisture contents were described as damp. No groundwater was encountered in these test borings. After presoaking, stabilized percolation rates of 15 and 13 minutes per inch were measured in Test Holes P1 and P2, respectively.

If you have any questions, please do not hesitate to call. This supplement should be attached to and made part of the original report.

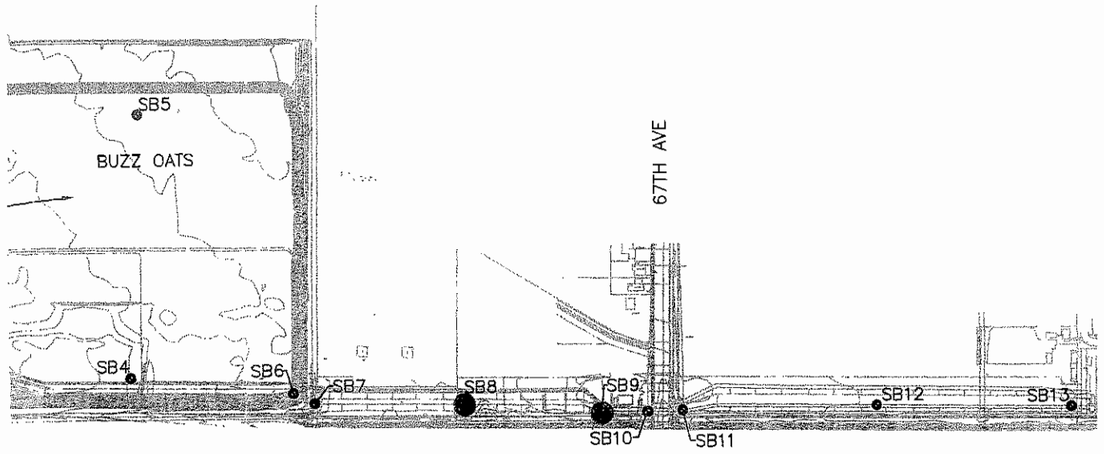
Respectfully submitted,
RICKER, ATKINSON, MCBEE & ASSOCIATES, INC.

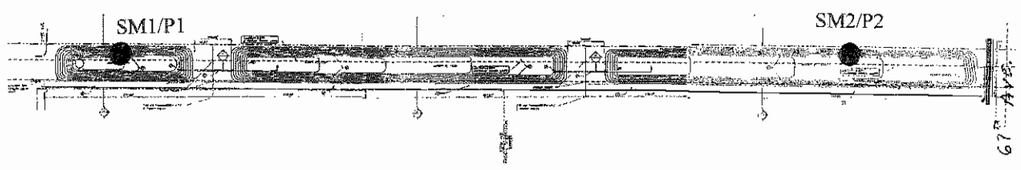
Registered Professional Engineer (Civil)
CERTIFICATE NO.
10971
KENNETH L.
RICKER
Date Signed 11-22-05
ARIZONA U.S.A.

By: Kenneth L. Ricker, P.E.

/ces
Copies to: Addressee (5)

2105 South Hardy Drive, Suite 13, Tempe, AZ 85282 • Telephone (480) 921-8100 • Facsimile (480) 921-4081





● Test Boring Location
● Supplemental Test Boring Location

Not To Scale

SITE PLAN

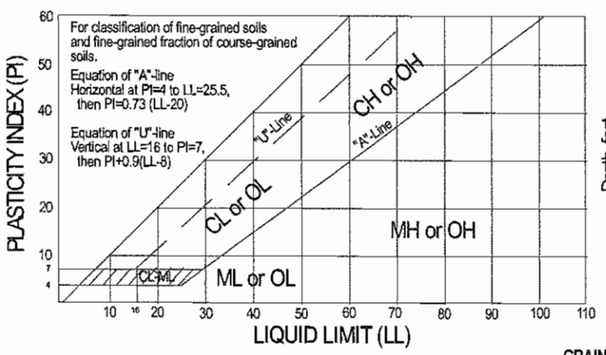
R.A.M. Project No. G11500

LEGEND

CLASSIFICATION OF SOILS

ASTM Designation: D2487-83
(Based on Unified Soil Classification System)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests					Soil Classification: Group Symbol	Soil Classification: Name
COARSE-GRAINED SOILS More than 50% retained on No. 200 Sieve	Gravels More than 50% coarse fraction retained on No. 4 Sieve	Clean Gravels Less than 5% fines	Cu >4 and 1 <Cc<3		GW	Well graded gravel
			Cu<4 and/or 1>Cc>3		GP	Poorly graded gravel
		Gravels with Fines More than 12% fines	Fines classify as ML or MH		GM	Silty gravel
			Fines classify as CL or CH		GC	Clayey gravel
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines	Cu >6 and 1 <Cc<3		SW	Well-graded sand
			Cu<6 and/or 1>Cc>3		SP	Poorly graded sand
		Sands with Fines More than 12% fines	Fines classify as ML or MH		SM	Silty sand
			Fines classify as CL or CH		SC	Clayey sand
FINE-GRAINED SOILS 50% or more passes the No. 200 Sieve	Silts and Clays Liquid limit less than 50	Inorganic	PI>7 and plots on or above "A" line		CL	Lean clay
			PI<4 or plots below "A" line		ML	Silt
		Organic	Liquid Limit - oven dried / Liquid limit - not dried	<0.75	OL	Organic clay / Organic silt
	Silts and Clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line		CH	Fat clay
			PI plots below "A" line		MH	Elastic silt
		Organic	Liquid limit - oven dried / Liquid limit - not dried	<0.75	OH	Organic clay / Organic silt
HIGHLY ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor				PT	Peat



TEST BORING LOG DEFINITIONS

Blows per foot using 140 pound hammer with 30 inch free-fall.

Depth, feet	Blows/Foot: C	Blows/Foot: N/R	Sample Type	Dry Density pcf	Water Content, %	Unified Classification	Description

C = Continuous Penetration Resistance (2 inch diameter rod)
N = Standard Penetration Resistance (ASTM D1586)
R = Penetration Resistance (3 inch diameter ring line sampler)

GRAIN SIZES

U.S. STANDARD SERIES SIEVE: 200, 40, 10, 4
CLEAR SQUARE SIEVE OPENINGS: 3/4", 3", 12"

SILTS & CLAYS DISTINGUISHED ON BASIS OF PLASTICITY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

MOISTURE CONDITION (INCREASING MOISTURE ⟶)

DRY — SLIGHTLY DAMP — DAMP — MOIST (Plastic Limit) — VERY MOIST — WET (SATURATED) (Liquid Limit)

CONSISTENCY CORRELATION: CLAYS & SILTS	BLOWS/FOOT*
VERY SOFT	0-2
SOFT	2-4
FIRM	4-8
STIFF	8-16
VERY STIFF	16-32
HARD	OVER 32

RELATIVE DENSITY CORRELATION: SANDS & GRAVELS	BLOWS/FOOT*
VERY LOOSE	0-4
LOOSE	4-10
MEDIUM DENSE	10-30
DENSE	30-50
VERY DENSE	OVER 50

*Number of blows of 140 lb hammer falling 30" to drive a 2" O.D. (1-3/8" I.D.) split-spoon sampler (ASTM D1586).

TEST BORING LOG

Project: DRCC & Basins TEST BORING: SB8
Elevation: Not Determined Datum: --- Date: 11-18-05

Depth, feet	Blows/Foot C	Blows/Foot N/R	Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
		28	R	100	13	CL	Sandy Clay, Trace Gravel; brown, damp, firm to stiff, medium plasticity.
5		47	R	97	17		
10		50	R	85	10		
							Stopped drilling 12 feet. No groundwater observed.
15							
20							
25							

This boring log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

R.A.M. Project No: G11500
Supplement No. 1

TEST BORING LOG

Project: DRCC & Basins — TEST BORING: SB8

Elevation: Not Determined — Datum: --- — Date: 11-18-05

Depth, feet	Blows/Foot C	Blows/Foot N/R	Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
		37	R	109	7	CL	Fill: Sandy Clay, Some Gravel; brown, damp, stiff, medium plasticity.
						CL	Sandy Clay, Trace Gravel; brown, damp, firm to stiff, medium plasticity.
5		37	R	88	15		
10		50	R	100	10		
							Stopped drilling 12 feet. No groundwater observed.
15							
20							
25							

This boring log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

R.A.M. Project No: G11500
Supplement No. 1

TEST BORING LOG

Project: DRCC & Basins — TEST BORING: SM1

Elevation: Not Determined — Datum: --- — Date: 11-18-05

Depth, feet	Blows/Foot C	Blows/Foot N/R	Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
		17	R	94	10	CL	Sandy Clay, Trace Gravel; brown, damp, firm to stiff, medium plasticity.
5		47	R	101	19		
10		42	R	109	18		
							Stopped drilling 12 feet. No groundwater observed.
15							
20							
25							

This boring log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

R.A.M. Project No: G11500
Supplement No. 1

TEST BORING LOG

Project: DRCC & Basins TEST BORING: SM2
Elevation: Not Determined Datum: --- Date: 11-18-05

Depth, feet	Blows/Foot C	Blows/Foot N/R	Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
		24	R	95	9	CL	Sandy Clay, Trace Gravel; brown, damp, firm to stiff, medium plasticity.
5		50/8"	R	96	16		
10		26	R	96	20		
							Stopped drilling 12 feet. No groundwater observed.
15							
20							
25							

This boring log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

R.A.M. Project No: G11500
Supplement No. 1

TEST BORING LOG

Project: DRCC & Basins TEST BORING: P1
Elevation: Not Determined Datum: --- Date: 11-18-05

Depth, feet	Blows/Foot C	Blows/Foot N/R	Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
						CL	Sandy Clay, Trace Gravel; brown, damp, firm to stiff, medium plasticity.
5							
10							Stopped drilling 9 feet. No groundwater observed.
							Note: After presoaking, a stabilized percolation rate of 15 minutes per inch was measured.
15							
20							
25							

This boring log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

R.A.M. Project No: G11500
Supplement No. 1

TEST BORING LOG

Project: DRCC & Basins — TEST BORING: P2

Elevation: Not Determined — Datum: --- — Date: 11-18-05

Depth, feet	Blows/Foot C	Blows/Foot N/R	Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
						CL	Sandy Clay, Trace Gravel; brown, damp, firm to stiff, medium plasticity.
5							
10							Stopped drilling 9 feet. No groundwater observed.
							Note: After presoaking, a stabilized percolation rate of 13 minutes per inch was measured.
15							
20							
25							

This boring log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

R.A.M. Project No: G11500
Supplement No. 1

R·A·M

RICKER • ATKINSON • McBEE & ASSOCIATES, INC.

Geotechnical Engineering • Construction Materials Testing

Stantec Consulting, Inc.
8211 South 48th Street
Phoenix, Arizona 85044-5355

November 29, 2005

Attention: Joe Bergquist, P.E.

Subject: Geotechnical Engineering Report
Durango Regional Conveyance Channel
And Detention Basins
Harrison Street Alignment – 75th Avenue
To About 1800 Feet West of 67th Avenue
Phoenix, Arizona

R.A.M. Project No. G11500
Supplement No. 1
Addendum No. 1

Attached to this letter is the results of the laboratory test for Supplement No. 1. This data should be attached to the supplement and made a part thereof.

If you have any questions, please do not hesitate to call.

Respectfully submitted,
RICKER, ATKINSON, MCBEE & ASSOCIATES, INC.

Registered Professional Engineer (Civil)
CERTIFICATE NO. 10971
KENNETH L. RICKER
Date Signed 11-29-05
ARIZONA U.S.A.

By: Kenneth L. Ricker, P.E.

/ces
Copies to: Addressee (5)

2105 South Hardy Drive, Suite 13, Tempe, AZ 85282 • Telephone (480) 921-8100 • Facsimile (480) 921-4081

LABORATORY TEST RESULTS

Date: 28-Nov-05

SAMPLE SOURCE: As noted below

TESTING PERFORMED: Percent Passing No. 200 Sieve, Atterberg Limits (ASTM D1140, D4318)

SAMPLED BY: RAM/Miller

RESULTS:

Sample Source	Percent Retained No. 4 Sieve	Percent Passing No. 200 Sieve	Liquid Limit	Plasticity Index
SB8 @ 5'-12'	0	55	27	10
SB9 @ 5'-12'	1	75	43	25
SM1 @ 5'-12'	1	89	50	29
SM2 @ 5'-12'	0	83	36	15

Geotechnical Engineering Report
Durango Regional Conveyance Channel
And Detention Basins
Harrison Street Alignment – 75th Avenue
To About 1800 Feet East of 67th Avenue
Phoenix, Arizona
R.A.M. Project No. G11500

For:
Stantec Consulting, Inc.
8211 South 48th Street
Phoenix, Arizona 85044-5355

◆◆◆

By:
Ricker-Atkinson-McBee & Associates, Inc.
2105 South Hardy Drive, Suite 13
Tempe, Arizona 85282

R·A·M

RICKER • ATKINSON • McBEE & ASSOCIATES, INC.

Geotechnical Engineering • Construction Materials Testing

Stantec Consulting, Inc.
8211 South 48th Street
Phoenix, Arizona 85044-5355

July 7, 2005

Attention: Daniel L. Kaminski, P.E.

Subject: Geotechnical Engineering Report
Durango Regional Conveyance Channel
And Detention Basins
Harrison Street Alignment – 75th Avenue
To About 1800 Feet West of 67th Avenue
Phoenix, Arizona

R.A.M. Project No. G11500

Attached to this letter is the Geotechnical Engineering Report for the proposed Durango Regional Conveyance Channel and Detention Basins (DRCC & Detention Basins), to be located in Phoenix, Arizona.

The proposed project includes about 7,200 feet of open channel inter-connected with two detention basins, a siphon connection to the 75th Avenue storm drain, and various inlet and outlet structures. The results of our field explorations; laboratory testing; and engineering analysis, evaluation and recommendations are presented in the report.

The attached report was prepared based on project and site data available at this time and was prepared in a manner and to the standards of local geotechnical engineering practice. Our services did not include evaluations for the presence of hazardous materials, area subsidence resulting from groundwater withdrawal or other geologic hazards.

If you have any questions, please do not hesitate to call.

Respectfully submitted,
RICKER, ATKINSON, MCBEE & ASSOCIATES, INC.

Registered Professional Engineer (Civil) CERTIFICATE NO. 10971 KENNETH L. RICKER Date Signed 7-7-05 ARIZONA U.S.A.

By: Kenneth L. Ricker, P.E.

Registered Professional Engineer (Civil) CERTIFICATE NO. 28182 DAVID A. THOMAS Date Signed 7-7-05 ARIZONA U.S.A.

Reviewed by: David A. Thomas, P.E.

/ces
Copies to: Addressee (5)

2105 South Hardy Drive, Suite 13, Tempe, AZ 85282 • Telephone (480) 921-8100 • Facsimile (480) 921-4081

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- Workability 5

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- Imported Soils 5
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Direct Shear B1

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Registered Professional Engineer (Civil)
CERTIFICATE NO.
10971
KENNETH L.
RICKER
Date Signed 1-7-05
ARIZONA U.S.A.

REPORT

R·A·M

INTRODUCTION

This report presents the results of our geotechnical engineering services for the proposed Durango Regional Conveyance Channel and Detention Basins (DRCC & Detention Basins), to be located in Phoenix, Arizona. The scope of our services included performing a field exploration program, laboratory analysis and geotechnical engineering evaluation, analysis and recommendations. The geotechnical recommendations presented herein include those for anticipated excavation conditions, site development, and material use and requirements. We would be pleased to discuss with you any additional recommendations you may require. In addition, we are available to review project specifications and plans for conformance with our recommendations at no charge to you.

This firm should be notified for additional evaluation and recommendations if the project design parameters (locations, depths, alignments, etc.) are changed, and/or where site use or conditions encountered during construction differ from those presented herein.

PROPOSED CONSTRUCTION

The proposed project will include about 7,200 linear feet of open channel with two inter-connected detention basins, a siphon outlet to the 75th Avenue storm drain and various inlet and outlet structures. A majority of the channel will have a trapezoidal shape with 4H:1V armored side slopes and bottom, and a short section of concrete-lined rectangular-shaped channel. The channel will be 8 to 12 feet deep, east of the detention basins. From the basins west, the channel is in and below the bottom of the basins or at the bottom of the basins. The west basin is known as the Target Basin, located just east of 75th Avenue and south of the Target Warehouse. The existing basin will be deepened, enlarged and reconfigured so that the finished basin flows to the west and is 12 to 18 feet deep. The second basin is known as the Buzz Oats Detention Basin and is located about a half mile east of 75th Avenue. The basin is a large rectangular basin 8 to 12 feet deep. The basins have 4H:1V side slopes. The various inlet and outlet structures are armored open channels with sloping bottoms. The outlet siphon will extend from the west end of the Target Basin to the southwest under the Roosevelt Canal to the 75th Avenue Storm Drain. The system will flow from east to west.

SITE CONDITIONS

The proposed channel and inter-connected basins will be located along the alignment of Harrison Street from 75th Avenue to about 1,800 feet east of 67th Avenue, in Phoenix, Arizona. The channel/basin alignment was undeveloped land north of the Roosevelt Canal and the Union Pacific Railroad tracks except for the west part of the alignment. This part of the alignment was occupied by a shallow retention basin which was part of the Target Warehouse to the north. The alignment contains a dirt road, debris, rubble, fill and considerable weeds, grasses and trees.

FIELD EXPLORATIONS

Subsurface conditions were explored to date by drilling thirteen test borings to depths of 12.0 to 41.0 feet along the channel and detention basin alignment, and two test borings/percolation tests to depths of 12 feet, at the locations shown on the Site Plan in Appendix A. Four other test borings were planned, but had not been drilled at the time of this report due to access restrictions. The test borings were drilled with a CME 55 drill rig using seven-inch diameter, hollow-stem augers. The drilling equipment and crew were provided by D&S Drilling, Inc. The test boring locations were determined in the field by our staff geologist. During the field explorations representative undisturbed and disturbed samples were obtained, the field explorations logged and soils field-classified by our field technician, who also directed the drill crew. Relatively undisturbed samples of the subsoils were obtained by driving a 3-inch diameter, ring-lined, open-end sampler into the soil with a 140-pound hammer dropping 30 inches. The results of our field explorations are presented in the Test Boring Logs in Appendix A. After presoaking, the following stabilized percolation rates were measured:

Test Boring	Percolation Rates (minutes/inch)
P1	7
P2	21

LABORATORY ANALYSIS

Representative samples obtained during the field explorations were subjected to the following tests in our laboratory.

Type of Test	Type of Sample	Number of Samples Tested
Direct Shear	Undisturbed	13
Percent Passing No. 200 Sieve & Plasticity Index	Representative	21
Maximum Density – Optimum Moisture	Representative	4
Moisture Content/Dry Density *	Undisturbed	62

* Reported in the test boring logs

The results of the laboratory analysis are presented in Appendix B.

SUBSURFACE CONDITIONS

The results of the test borings are presented in Appendix A in the Test Boring Logs. Along the alignment of the proposed channel/detention basins, the subsurface profile was somewhat variable and generally consisted of sandy clay with a trace to some gravel (CL), interbedded with deposits of clayey sand with a trace to some gravel (SC), silty sand with a trace to some gravel (SM) and sand with some silt and a trace of gravel (SP). The granular soils (SP, SM and SC) were medium dense and contained no to medium plasticity fines. The fine grained soils (CL) were firm to stiff and exhibited medium plasticity. In general, soil moisture contents were described as nearly dry to very moist throughout the depths explored. No groundwater was observed in the test borings during the field exploration.

SITE DEVELOPMENT RECOMMENDATIONS

Permanent Cut and Fill Slopes:

Project plans indicate that permanent cuts and fill slopes to a height of 21 feet are planned for slopes of 4H:1V. These slopes will be stable for existing condition, saturated conditions and rapid draw-down conditions. However, these soils are susceptible to rilling and eroding. Therefore, all surfaces exposed to water movements must be properly protected.

Construction Excavation and Temporary Construction Cut Slopes:

The proposed channel/detention basin will be founded at depths of up to 21 feet below existing grade with the siphon basin up to 30 feet deep. The following criteria are presented to aid in development of excavation plans.

1. Dewatering should not be required.

2. Unbraced temporary slopes in the fine grained soils (CL) and the granular soils (SM and SC) should be constructed no steeper than 3/4H:1V and 1H:1V, respectively. Cut slopes will have to be flattened to 1.5H:1V, or flatter, where excavations penetrate the non-plastic sands to low plasticity silty sand soils (SP/SM).

3. Surface areas behind the crest of excavations should be graded so that surface waters do not pond within 10 feet of the crest or drain into the excavation.

4. Heavy material stockpiles should not be placed within 10 feet of the crest. Similarly, heavy construction equipment should not pass or be parked within 10 feet of the crest.

5. The crest of slopes should be monitored daily for evidence of movement or potential problems.

The design of any bracing or shoring systems should be reviewed by a qualified geotechnical engineer. Also, observations should be made by the geotechnical engineer during excavating to evaluate site conditions and determine if modifications are necessary in excavation procedures. If unbraced slopes are utilized, some surface raveling, erosion, and spalling should be expected unless measures are taken to stabilize exposed cut surfaces.

Surface Drainage:

Most soils will undergo some degree of volume change as the result of wetting. The degree of volume change will depend on the type of soil, swell potential, natural soils structure or degree of compaction (if a fill). Therefore, good site and surface drainage away from these elements is

required. The facilities excavation backfill must be well compacted to minimize the possibility of moisture infiltration through this zone.

Excavatability:

The excavatability of site materials is difficult to evaluate based only on the exploration equipment used during this design report. Therefore, we recommend that the contractor evaluate the excavatability of site materials by performing test excavations with the size and type of equipment the contractor plans on using at the site. For design purposes the following paragraph presents our best analysis as to the excavatability of site soils.

The near surface soils to depths of at least 30 feet can probably be removed with conventional trackhoe excavating equipment capable of excavations greater than that depth. However, excavations penetrating the no to low plasticity sand soils may be slower and more difficult to accomplish due to caving. In addition, excavations penetrating the cemented zones may be slower to accomplish. OSHA requires all excavations over five feet in depth, in which personnel are to enter, be either braced or sloped in accordance with OSHA regulations.

Workability:

Wetting site soils such that moisture contents are at or above optimum could result in some to heavy soil pumping under dynamic loadings such as heavy construction equipment driving over the area.

MATERIALS SUITABILITY AND REQUIREMENTS

Site Materials:

The near surface soils may be used as fill and backfills in channel and trench areas, provided these soils are free of organic materials, debris and rubble.

Imported Soils:

Fill required beyond that available from site sources for use as fills and backfills, should be imported soils meeting the following requirements:

Maximum Particle Size ----------6 inches
Maximum Swell Potential ----------1.5%*

* Based on a sample which is remolded to 95% of the ASTM D698 maximum dry density at a moisture content of 2 percent below optimum, placed under a surcharge load of 100 psf and wetted.

Pipe Bedding:

Materials used as pipe bedding should be granular soils which meet the requirements of Section 601 of the MAG Specifications as modified by the City of Phoenix Supplement. The fine grained soils (CL) and most of the clayey sand soils will not be suitable for use as pipe bedding.

SITE PREPARATION AND GRADING PROCEDURES

Trench Excavation Areas:

Recommendations presented in the previous sections of this report are based upon the following site preparation and grading procedures. Therefore, all earthwork should be accomplished with observation and testing by a qualified technician under the direction of a registered geotechnical/materials engineer. The following apply to trench excavation areas.

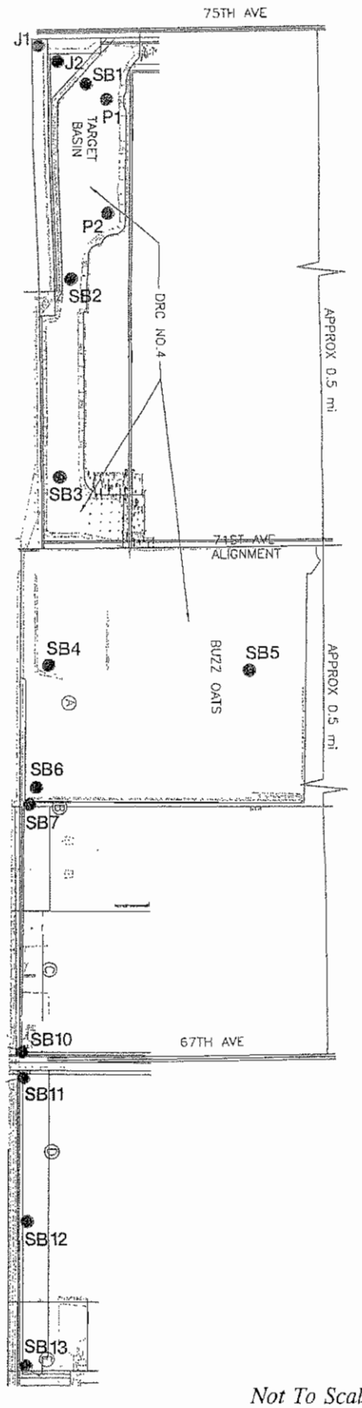
1. Clear and grub the site by removing and disposing of all vegetation, any trash and debris, and any rubble and remnants of former developments.

2. Moisture condition and place all fill and backfill materials required to achieve specified grades. Fill materials should be moisture conditioned, placed and compacted in horizontal lifts of thicknesses compatible with the compaction equipment being used.

3. Compact subgrade, fill, backfill, subbase fill or base material to the requirements presented in the City of Phoenix Supplement to MAG Section 601.

APPENDIX A
FIELD EXPLORATIONS

R·A·M



● Test Boring Location

Not To Scale

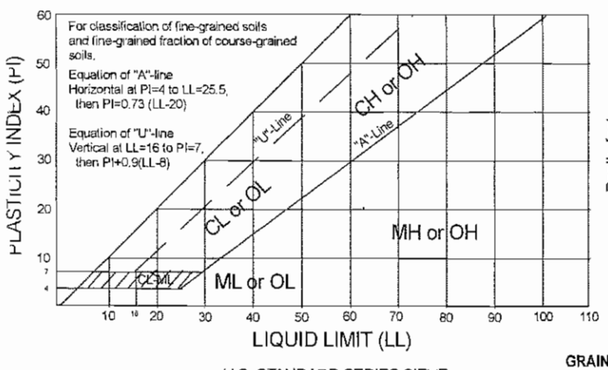
SITE PLAN

LEGEND

CLASSIFICATION OF SOILS

ASTM Designation: D2487-83
(Based on Unified Soil Classification System)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests					Soil Classification: Group Symbol	Soil Classification: Name
COARSE-GRAINED SOILS More than 50% retained on No. 200 Sieve	Gravels More than 50% coarse fraction retained on No. 4 Sieve	Clean Gravels Less than 5% fines	Cu >4 and 1 <Cc<3		GW	Well graded gravel
			Cu<4 and/or 1>Cc>3		GP	Poorly graded gravel
		Gravels with Fines More than 12% fines	Fines classify as ML or MH		GM	Silty gravel
			Fines classify as CL or CH		GC	Clayey gravel
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines	Cu >6 and 1 <Cc<3		SW	Well-graded sand
			Cu<6 and/or 1>Cc>3		SP	Poorly graded sand
		Sands with Fines More than 12% fines	Fines classify as ML or MH		SM	Silty sand
			Fines classify as CL or CH		SC	Clayey sand
FINE-GRAINED SOILS 50% or more passes the No. 200 Sieve	Silts and Clays Liquid limit less than 50	Inorganic	PI>7 and plots on or above "A" line		CL	Lean clay
			PI<4 or plots below "A" line		ML	Silt
		Organic	Liquid Limit - oven dried / Liquid limit - not dried	<0.75	OL	Organic clay / Organic silt
	Silts and Clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line		CH	Fat clay
			PI plots below "A" line		MH	Elastic silt
		Organic	Liquid limit - oven dried / Liquid limit - not dried	<0.75	OH	Organic clay / Organic silt
HIGHLY ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor				PT	Peat



TEST BORING LOG DEFINITIONS

Blows per foot using 140 pound hammer with 30 inch free-fall.

Depth, feet	Blows/Foot: C	Blows/Foot: N/R	Sample Type	Dry Density pcf	Water Content, %	Unified Classification	Description

C = Continuous Penetration Resistance (2 inch diameter rod)
N = Standard Penetration Resistance (ASTM D1586)
R = Penetration Resistance (3 inch diameter ring line sampler)

GRAIN SIZES

	U.S. STANDARD SERIES SIEVE 200 – 40	40 – 10	10 – 4	CLEAR SQUARE SIEVE OPENINGS 4 – 3/4"	3/4" – 3"	3" – 12"	12"
SILTS & CLAYS DISTINGUISHED ON BASIS OF PLASTICITY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

MOISTURE CONDITION (INCREASING MOISTURE ⟶)

DRY — SLIGHTLY DAMP — DAMP — MOIST (Plastic Limit) — VERY MOIST — WET (SATURATED) — (Liquid Limit)

CONSISTENCY CORRELATION: CLAYS & SILTS	BLOWS/FOOT*	RELATIVE DENSITY CORRELATION: SANDS & GRAVELS	BLOWS/FOOT*
VERY SOFT	0-2	VERY LOOSE	0-4
SOFT	2-4	LOOSE	4-10
FIRM	4-8	MEDIUM DENSE	10-30
STIFF	8-16	DENSE	30-50
VERY STIFF	16-32	VERY DENSE	OVER 50
HARD	OVER 32		

*Number of blows of 140 lb hammer falling 30" to drive a 2" O.D. (1-3/8" I.D.) split-spoon sampler (ASTM D1586).

TEST BORING LOG

Project: DRCC & Basins TEST BORING: J1
Elevation: Not Determined Datum: --- Date: 3-30-05

Depth, feet	Blows/Foot C	Blows/Foot N/R	Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
		34	R	102	5	SC	Fill: Clayey Sand, Some Gravel; brown, nearly dry, medium dense, medium plasticity fines.
						CL	Sandy Clay, Trace Gravel; brown, damp, firm to stiff, medium plasticity.
5		12	R	89	18		
10		21	R	103	18		
15		22	R	107	5	SM	Silty Sand, Trace to Some Gravel; brown, nearly dry to moist, medium dense, no to low plasticity.
20		37	R	112	13		
25							

- continued -

This boring log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

TEST BORING LOG

Project: DRCC & Basins TEST BORING: J1 cont.
Elevation: Not Determined Datum: --- Date: 3-30-05

Depth, feet	Blows/Foot C	Blows/Foot N/R	Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
		33	R	109	9	SM	Silty Sand, Trace to Some Gravel; - cont.
30		50/9"	R	102	10		Moderate cementation below 30 feet.
35		46	R	103	21	SC	Clayey Sand, Trace to Some Gravel; brown, very moist, medium dense, medium plasticity fines, moderate cementation.
40		32	R	99	22		
							Stopped drilling 41 feet. No groundwater observed.
45							
50							

This boring log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

TEST BORING LOG

Project: DRCC & Basins TEST BORING: J2
Elevation: Not Determined Datum: --- Date: 3-30-05

Depth, feet	Blows/Foot C	Blows/Foot N/R	Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
		11	R	101	17	CL	Fill: Sandy Clay, Some Gravel; brown, damp, stiff, medium plastiity.
5		12	R	91	18	CL	Sandy Clay, Trace Gravel; brown, damp, firm to stiff, medium plasticity.
10		30	R	107	16	SM	Silty Sand, Trace to Some Gravel; brown, nearly dry to moist, medium dense, no to low plasticity.
15		32	R	108	6		
20		30	R	106	16		
25							

- continued -

This boring log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

TEST BORING LOG

Project: DRCC & Basins TEST BORING: J2 cont.
Elevation: Not Determined Datum: --- Date: 3-30-05

Depth, feet	Blows/Foot C	Blows/Foot N/R	Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
		26	R	110	10	SM	Silty Sand, Trace to Some Gravel; - cont.
30		50/6"	R	NR			
35		50	R	99	23	SC	Clayey Sand, Trace to Some Gravel; brown, very moist, medium dense, medium plasticity fines, moderate cementation.
40		21	R	92	32		
							Stopped drilling 41 feet. No groundwater observed. NR = No Recovery
45							
50							

This boring log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

TEST BORING LOG

Project: DRCC & Basins TEST BORING: P1
Elevation: Not Determined Datum: --- Date: 3-30-05

Depth, feet	Blows/Foot C	Blows/Foot N/R	Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
						SC	Clayey Sand, Trace to Some Gravel; brown, very moist, medium dense, medium plasticity fines, moderate cementation.
5							5
10							10
						SP	Sand, Some Silt, Trace Gravel; brown, nearly dry, medium dense, non-plastic fines.
							Stopped drilling 12 feet. No groundwater observed.
15							15
							Note: After presoaking, a stabilized percolation rate of 7 minutes per inch was measured.
20							20
25							25
							This boring log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

TEST BORING LOG

Project: DRCC & Basins TEST BORING: P2
Elevation: Not Determined Datum: --- Date: 3-30-05

Depth, feet	Blows/Foot C	Blows/Foot N/R	Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
						SC	Clayey Sand, Trace to Some Gravel; brown, very moist, medium dense, medium plasticity fines, moderate cementation.
5							
10						SP	Sand, Some Silt, Trace Gravel; brown, nearly dry, medium dense, non-plastic fines.
							Stopped drilling 12 feet. No groundwater observed.
15							
							Note: After presoaking, a stabilized percolation rate of 21 minutes per inch was measured.
20							
25							

This boring log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

TEST BORING LOG

Project: DRCC & Basins TEST BORING: SB1
Elevation: Not Determined Datum: --- Date: 3-30-05

Depth, feet	Blows/Foot C	Blows/Foot N/R	Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
		8	R	99	17	CL	Sandy Clay, Trace Gravel; brown, damp, firm to stiff, medium plasticity.
5		21	R	113	16		
10		18	R	101	9	SM	Silty Sand, Trace to Some Gravel; brown, nearly dry to moist, medium dense, no to low plasticity.
15		30	R	100	22	CL	Sandy Clay, Trace Gravel; brown, damp, firm to stiff, medium plasticity.
20		38	R	103	16		
							Stopped drilling 21 feet. No groundwater observed.
25							

This boring log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

TEST BORING LOG

Project: DRCC & Basins — TEST BORING: SB2

Elevation: Not Determined — Datum: --- — Date: 3-30-05

Depth, feet	Blows/Foot C	Blows/Foot N/R	Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
		10	R	105	18	CL	Sandy Clay, Trace Gravel; brown, damp, firm to stiff, medium plasticity.
5		20	R	100	23		
10		14	R	96	15	SM	Silty Sand, Trace to Some Gravel; brown, nearly dry to moist, medium dense, no to low plasticity.
15		50/9"	R	117	11	CL	Sandy Clay, Trace Gravel; brown, damp, firm to stiff, medium plasticity.
20		50/10"	R	115	7	SM	Silty Sand, Trace to Some Gravel; brown, nearly dry to moist, medium dense, no to low plasticity.
							Stopped drilling 20.8 feet. No groundwater observed.
25							

This boring log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

TEST BORING LOG

Project: DRCC & Basins TEST BORING: SB3
Elevation: Not Determined Datum: --- Date: 3-30-05

Depth, feet	Blows/Foot C	Blows/Foot N/R	Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
		11	R	95	21	CL	Sandy Clay, Trace Gravel; brown, damp, firm to stiff, medium plasticity.
5		33	R	108	19		
10		28	R	104	9	SM	Silty Sand, Trace to Some Gravel; brown, nearly dry to moist, medium dense, no to low plasticity.
15		38	R	98	13	CL	Sandy Clay, Trace Gravel; brown, damp, firm to stiff, medium plasticity.
20		50/10"	R	107	8	SM	Silty Sand, Trace to Some Gravel; brown, nearly dry to moist, medium dense, no to low plasticity.
							Stopped drilling 20.8 feet. No groundwater observed.
25							

This boring log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

TEST BORING LOG

Project: DRCC & Basins TEST BORING: SB4
Elevation: Not Determined Datum: --- Date: 4-14-05

Depth, feet	Blows/Foot C	Blows/Foot N/R	Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
		27	R	112	3	CL	Sandy Clay, Trace Gravel; brown, damp, firm to stiff, medium plasticity.
5		20	R	98	8	SM	Silty Sand, Trace to Some Gravel; brown, nearly dry to moist, medium dense, no to low plasticity.
10		23	R	105	5	SP	Sand, Some Silt, Trace Gravel; brown, nearly dry, medium dense, non-plastic fines.
15		50/11"	R	102	16	CL	Sandy Clay, Trace Gravel; brown, damp, firm to stiff, medium plasticity.
20		50/5"	R	101	12		
							Stopped drilling 20.4 feet. No groundwater observed.
25							

This boring log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

TEST BORING LOG

Project: DRCC & Basins TEST BORING: SB5
Elevation: Not Determined Datum: --- Date: 4-14-05

Depth, feet	Blows/Foot C	Blows/Foot N/R	Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
		30	R	115	13	CL	Sandy Clay, Trace Gravel; brown, damp, firm to stiff, medium plasticity.
5		13	R	99	14		
10		17	R	97	18		
15		49	R	99	9	SM	Silty Sand, Trace to Some Gravel; brown, nearly dry to moist, medium dense, no to low plasticity.
20		38	R	111	4		
							Stopped drilling 21 feet. No groundwater observed.
25							

This boring log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

TEST BORING LOG

Project: DRCC & Basins TEST BORING: SB6
Elevation: Not Determined Datum: --- Date: 4-14-05

Depth, feet	Blows/Foot C	Blows/Foot N/R	Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
		19	R	109	8	CL	Sandy Clay, Trace Gravel; brown, damp, firm to stiff, medium plasticity.
5		16	R	111	14		
10		38	R	96	7		
						SM	Silty Sand, Trace to Some Gravel; brown, nearly dry to moist, medium dense, no to low plasticity.
15		30	R	102	9	SC	Clayey Sand, Trace to Some Gravel; brown, slightly damp, medium dense, medium plasticity fines, moderate cementation.
20		32	R	114	5		
							Stopped drilling 21 feet. No groundwater observed.
25							

This boring log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

TEST BORING LOG

Project: DRCC & Basins TEST BORING: SB7
Elevation: Not Determined Datum: --- Date: 4-14-05

Depth, feet	Blows/Foot C	Blows/Foot N/R	Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
		15	R	103	11	CL	Sandy Clay, Trace Gravel; brown, damp, firm to stiff, medium plasticity.
5		13	R	100	16		
10		29	R	104	8		
							Stopped drilling 12 feet. No groundwater observed.
15							
20							
25							

This boring log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

TEST BORING LOG

Project: DRCC & Basins TEST BORING: SB10
Elevation: Not Determined Datum: --- Date: 4-14-05

Depth, feet	Blows/Foot C	Blows/Foot N/R	Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
		40	R	103	9	CL	Fill: Sandy Clay, Some Gravel; brown, damp, stiff, medium plasticity.
5		24	R	100	25	CL	Sandy Clay, Trace Gravel; brown, damp, firm to stiff, medium plasticity.
10		27	R	100	22		
							Stopped drilling 12 feet. No groundwater observed.
15							
20							
25							

This boring log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

TEST BORING LOG

Project: DRCC & Basins TEST BORING: SB11
Elevation: Not Determined Datum: --- Date: 4-14-05

Depth, feet	Blows/Foot C	Blows/Foot N/R	Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
		12	R	101	22	CL	Sandy Clay, Trace Gravel; brown, damp, firm to stiff, medium plasticity.
5		19	R	96	23		
10		26	R	95	23		
							Stopped drilling 12 feet. No groundwater observed.
15							
20							
25							

This boring log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

TEST BORING LOG

Project: DRCC & Basins TEST BORING: SB13
Elevation: Not Determined Datum: --- Date: 4-14-05

Depth, feet	Blows/Foot C	Blows/Foot N/R	Sample Type	Dry Density, pcf	Water Content, %	Unified Classification	Description
		22	R	93	7	CL	Sandy Clay, Trace Gravel; brown, damp, firm to stiff, medium plasticity.
5		10	R	89	16		
10		40	R	103	15		
							Stopped drilling 12 feet. No groundwater observed.
15							
20							
25							

This boring log represents the conditions encountered on the date of drilling at this particular location. No other warranty is expressed or implied to the actual conditions which may exist within the vicinity of this boring location.

APPENDIX B
LABORATORY ANALYSIS

R·A·M

LABORATORY TEST RESULTS

Date: 19-May-05

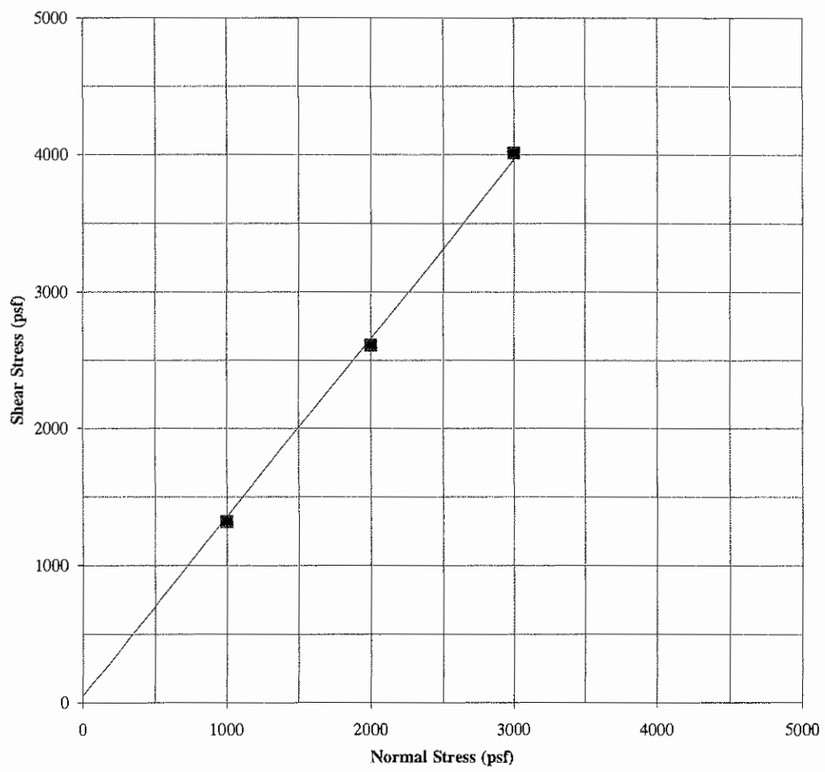
SAMPLE SOURCE: J1 @ 5'-6'

TESTING PERFORMED: Direct Shear (ASTM D3080) - Driven Ring Sample

SAMPLED BY: RAM/Miller

RESULTS:

Dry Density (pcf):	89	Moisture Content (%):	18
Cohesion (psf):	0	Friction Angle (phi):	53



REMARKS: Samples not submerged prior to testing.

LABORATORY TEST RESULTS

Date: 19-May-05

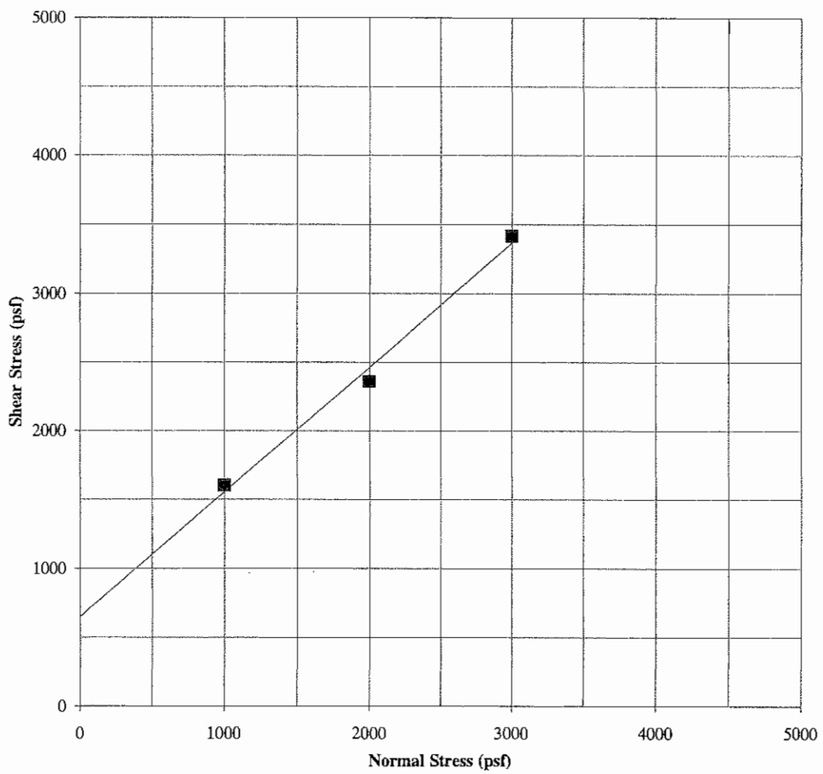
SAMPLE SOURCE: J2 @ 20'-21'

TESTING PERFORMED: Direct Shear (ASTM D3080) - Driven Ring Sample

SAMPLED BY: RAM/Miller

RESULTS:

Dry Density (pcf):	106	Moisture Content (%):	16
Cohesion (psf):	600	Friction Angle (phi):	42



REMARKS: Samples not submerged prior to testing.

LABORATORY TEST RESULTS

Date: 19-May-05

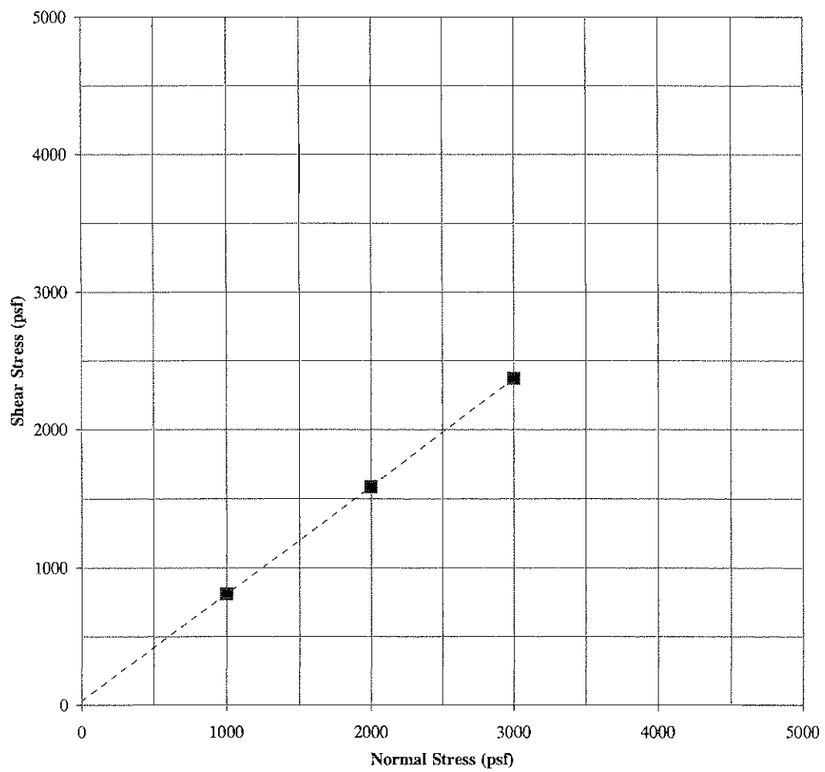
SAMPLE SOURCE: SB1 @ 10'-11'

TESTING PERFORMED: Direct Shear (ASTM D3080) - Driven Ring Sample

SAMPLED BY: RAM/Miller

RESULTS:

Dry Density (pcf):	101	Moisture Content (%):	9
Cohesion (psf):	0	Friction Angle (phi):	38



REMARKS: Samples submerged prior to testing.

LABORATORY TEST RESULTS

Date: 19-May-05

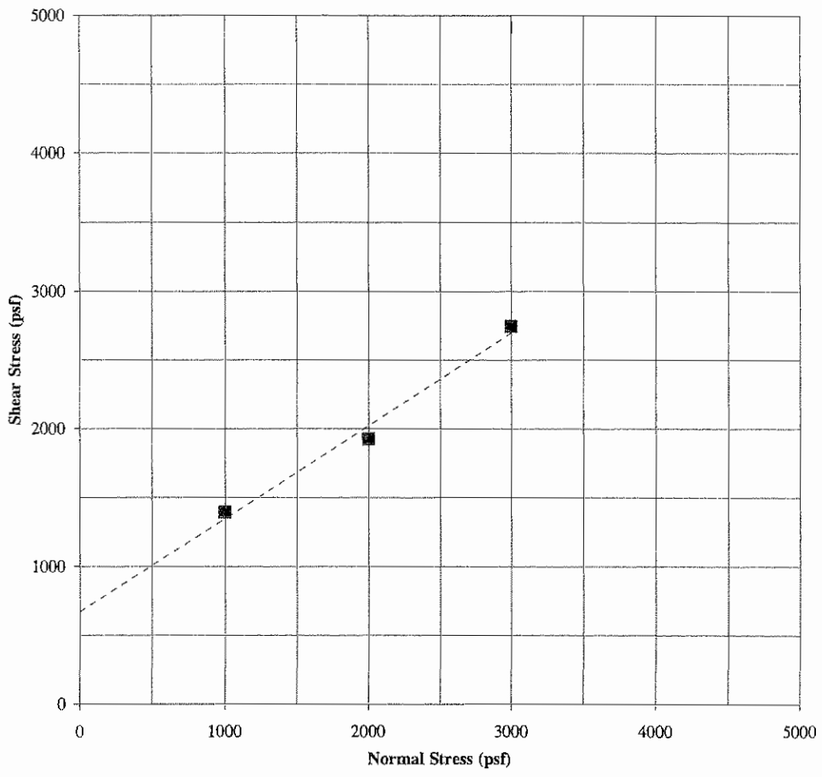
SAMPLE SOURCE: SB2 @ 15'-16'

TESTING PERFORMED: Direct Shear (ASTM D3080) - Driven Ring Sample

SAMPLED BY: RAM/Miller

RESULTS:

Dry Density (pcf):	117	Moisture Content (%):	11
Cohesion (psf):	700	Friction Angle (phi):	34



REMARKS: Samples submerged prior to testing.

LABORATORY TEST RESULTS

Date: 19-May-05

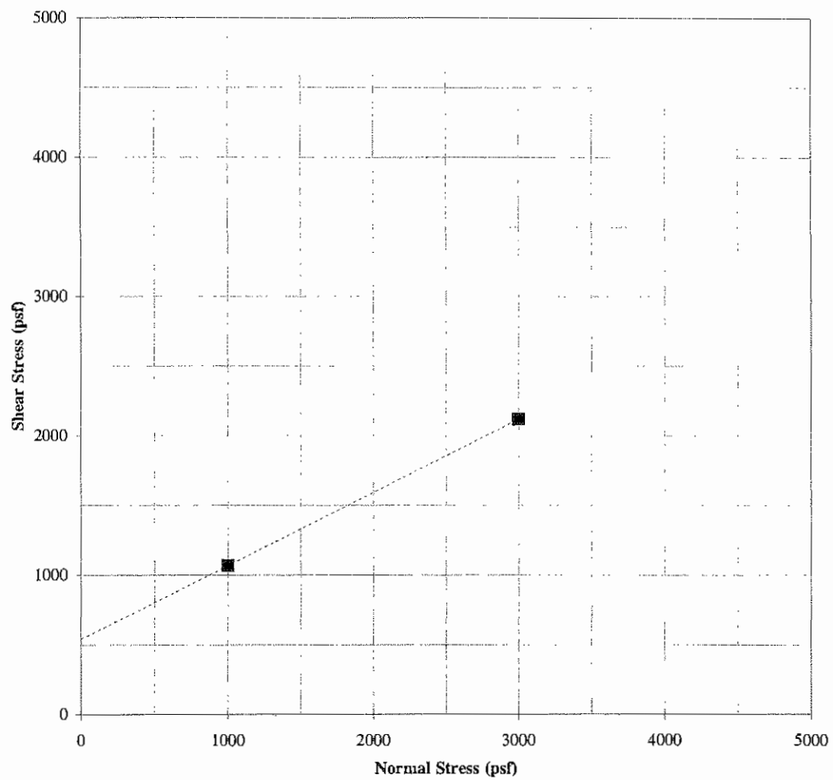
SAMPLE SOURCE: SB3 @ 0'-1'

TESTING PERFORMED: Direct Shear (ASTM D3080) - Driven Ring Sample

SAMPLED BY: RAM/Miller

RESULTS:

Dry Density (pcf):	95	Moisture Content (%):	21
Cohesion (psf):	500	Friction Angle (phi):	28



REMARKS: Samples submerged prior to testing.

LABORATORY TEST RESULTS

Date: 19-May-05

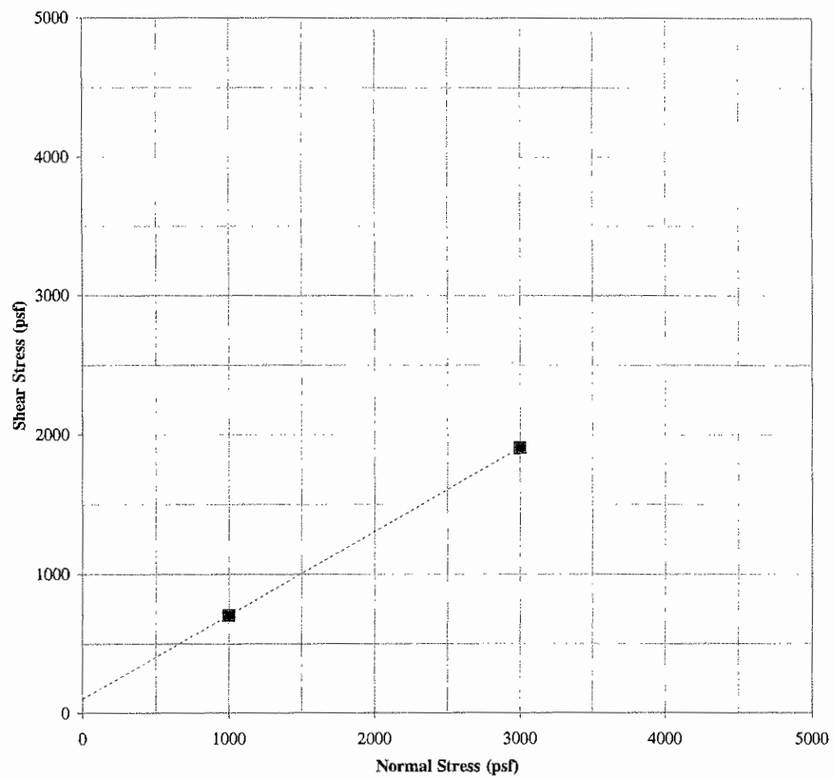
SAMPLE SOURCE: SB4 @ 0'-1'

TESTING PERFORMED: Direct Shear (ASTM D3080) - Driven Ring Sample

SAMPLED BY: RAM/Miller

RESULTS:

Dry Density (pcf):	112	Moisture Content (%):	3
Cohesion (psf):	100	Friction Angle (phi):	31



REMARKS: Samples submerged prior to testing.

LABORATORY TEST RESULTS

Date: 19-May-05

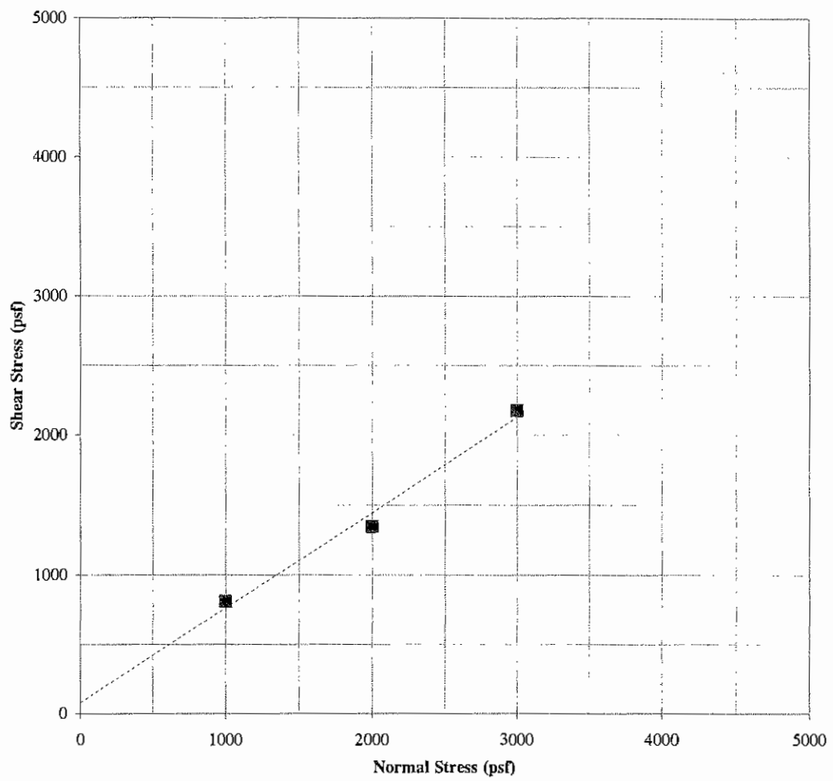
SAMPLE SOURCE: SB5 @ 5'-6'

TESTING PERFORMED: Direct Shear (ASTM D3080) - Driven Ring Sample

SAMPLED BY: RAM/Miller

RESULTS:

Dry Density (pcf):	100	Moisture Content (%):	14
Cohesion (psf):	100	Friction Angle (phi):	34



REMARKS: Samples submerged prior to testing.

LABORATORY TEST RESULTS

Date: 19-May-05

SAMPLE SOURCE: SB6 @ 10'-11'

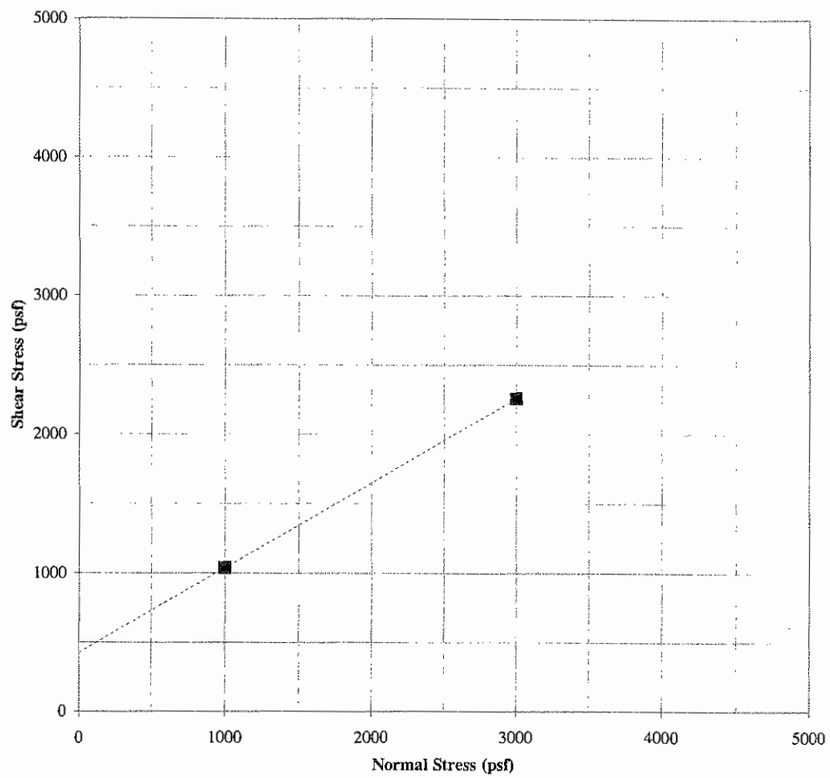
TESTING PERFORMED: Direct Shear (ASTM D3080) - Driven Ring Sample

SAMPLED BY: RAM/Miller

RESULTS:

Dry Density (pcf): 97 Moisture Content (%): 7

Cohesion (psf): 400 Friction Angle (phi): 31



REMARKS: Samples submerged prior to testing.

LABORATORY TEST RESULTS

Date: 19-May-05

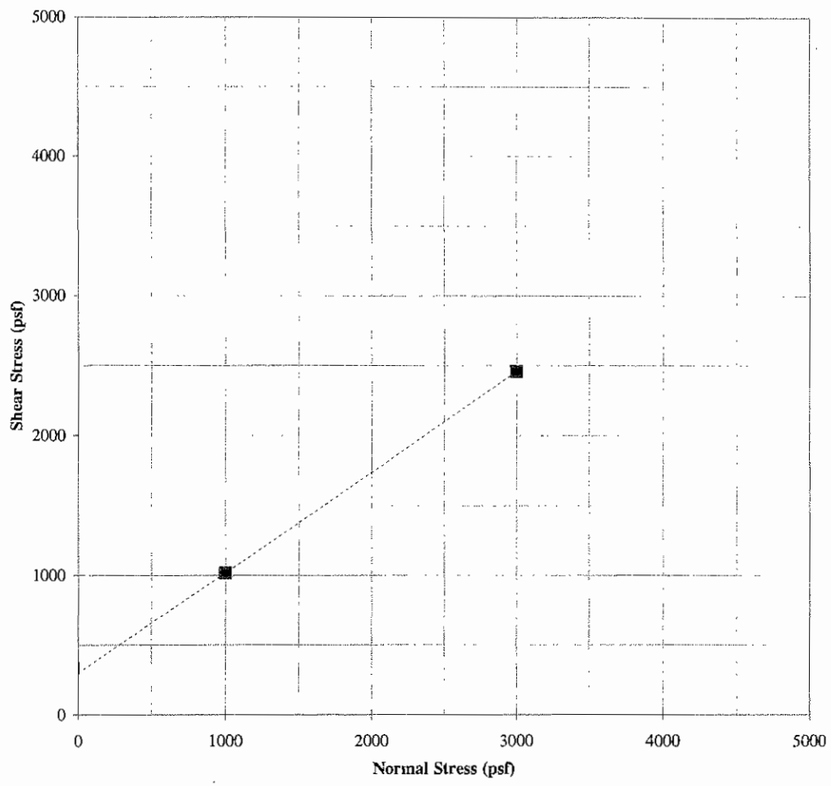
SAMPLE SOURCE: SB7 @ 10'-11'

TESTING PERFORMED: Direct Shear (ASTM D3080) - Driven Ring Sample

SAMPLED BY: RAM/Miller

RESULTS:

Dry Density (pcf):	104	Moisture Content (%):	8
Cohesion (psf):	300	Friction Angle (phi):	36



REMARKS: Samples submerged prior to testing.

LABORATORY TEST RESULTS

Date: 19-May-05

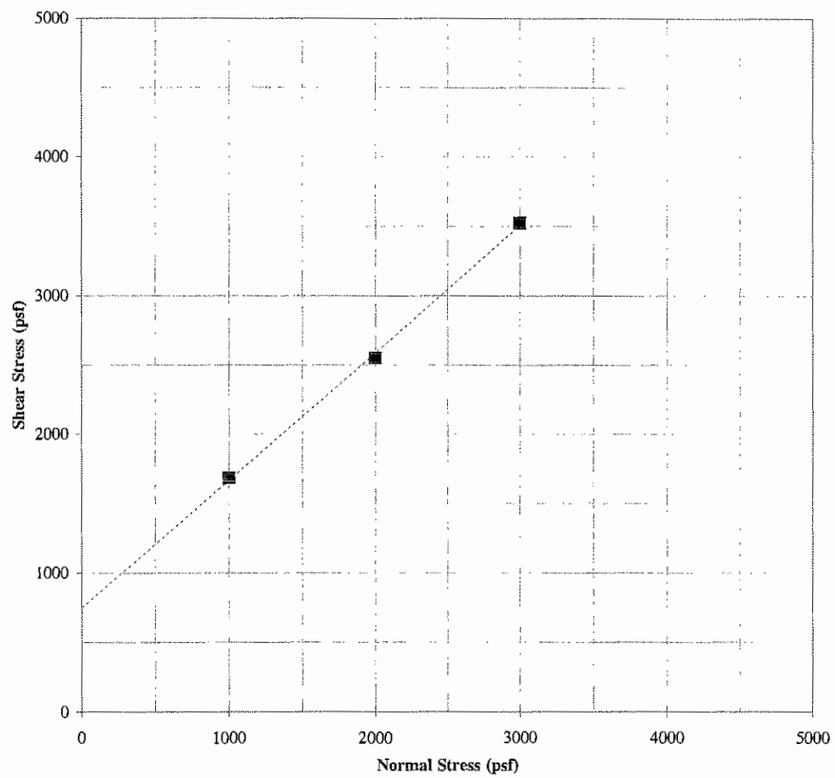
SAMPLE SOURCE: SB10 @ 10'-11'

TESTING PERFORMED: Direct Shear (ASTM D3080) - Driven Ring Sample

SAMPLED BY: RAM/Miller

RESULTS:

Dry Density (pcf):	100	Moisture Content (%):	22
Cohesion (psf):	700	Friction Angle (phi):	43



REMARKS: Samples submerged prior to testing.

LABORATORY TEST RESULTS

Date: 19-May-05

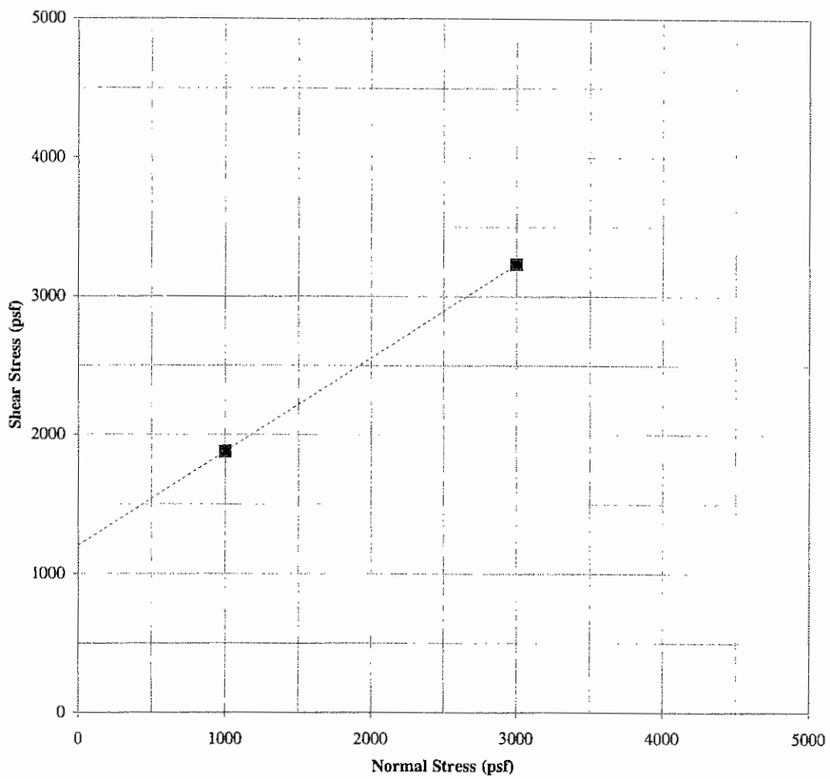
SAMPLE SOURCE: SB11 @ 0'-1'

TESTING PERFORMED: Direct Shear (ASTM D3080) - Driven Ring Sample

SAMPLED BY: RAM/Miller

RESULTS:

Dry Density (pcf):	101	Moisture Content (%):	22
Cohesion (psf):	1200	Friction Angle (phi):	34



REMARKS: Samples submerged prior to testing.

LABORATORY TEST RESULTS

Date: 19-May-05

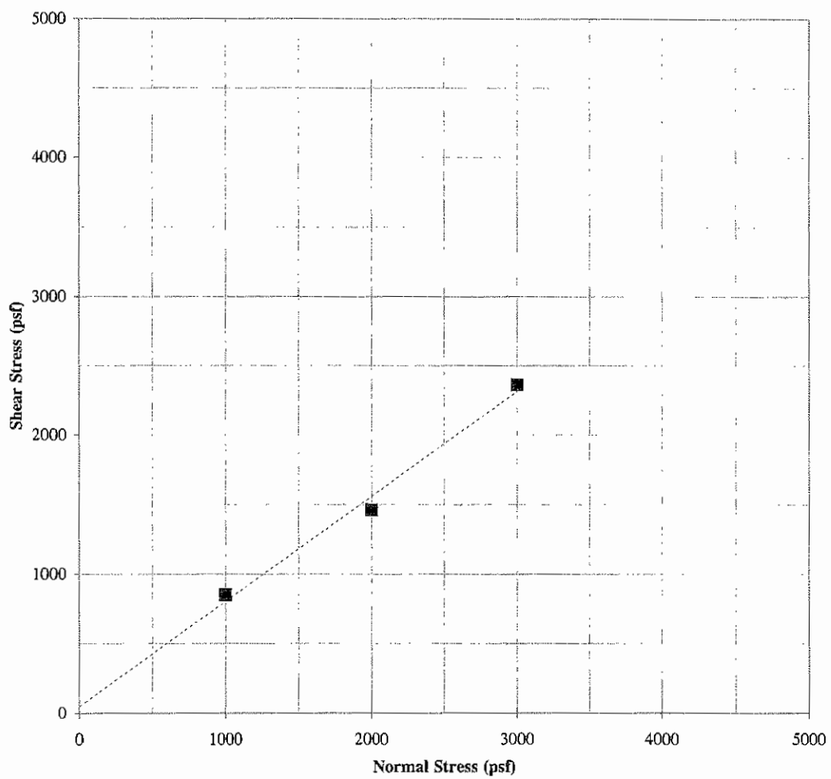
SAMPLE SOURCE: SB12 @ 5'-6'

TESTING PERFORMED: Direct Shear (ASTM D3080) - Driven Ring Sample

SAMPLED BY: RAM/Miller

RESULTS:

Dry Density (pcf):	99	Moisture Content (%):	9
Cohesion (psf):	0	Friction Angle (phi):	37



REMARKS: Samples submerged prior to testing.

LABORATORY TEST RESULTS

Date: 19-May-05

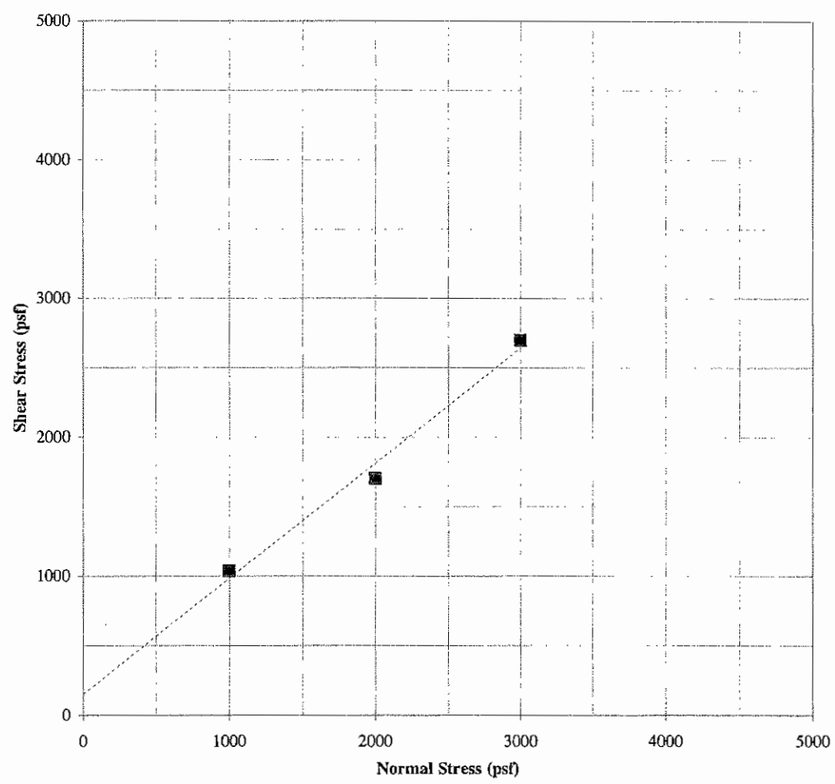
SAMPLE SOURCE: SB13 @ 10'-11'

TESTING PERFORMED: Direct Shear (ASTM D3080) - Driven Ring Sample

SAMPLED BY: RAM/Miller

RESULTS:

Dry Density (pcf):	103	Moisture Content (%):	15
Cohesion (psf):	200	Friction Angle (phi):	40



REMARKS: Samples submerged prior to testing.

LABORATORY TEST RESULTS

Date: 19-May-05

SAMPLE SOURCE: As noted below

TESTING PERFORMED: Percent Passing No. 200 Sieve, Atterberg Limits (ASTM D1140, D4318)

SAMPLED BY: RAM/Miller

RESULTS:

Sample Source	Percent Retained No. 4 Sieve	Percent Passing No. 200 Sieve	Liquid Limit	Plastieity Index
J1 @ 5'-10'	3	66	35	16
J1 @ 20'-25'	7	22	N/A	Non-Plastic
J1 @ 30'-35'	23	17	22	5
J2 @ 15'-20'	4	18	N/A	Non-Plastic
J2 @ 25'-30'	10	22	N/A	Non-Plastic
J2 @ 35'-40'	10	37	27	7
P1 @ 5'-10'	0	42	25	7
P2 @ 10'-12'	6	9.2	N/A	Non-Plastic
SB1 @ 0'-5'	3	68	39	19
SB1 @ 10'-15	1	22	N/A	Non-Plastic
SB2 @ 5'-10'	0	82	33	10
SB2 @ 15'-20'	1	68	36	16
SB3 @ 0'-5'	2	70	39	18
SB3 @ 10'-15'	1	23	N/A	Non-Plastic
SB4 @ 0'-5'	3	51	27	9

Date: 19-May-05

SAMPLE SOURCE: As noted below

TESTING PERFORMED: Percent Passing No. 200 Sieve, Atterberg Limits (ASTM D1140, D4318)

SAMPLED BY: RAM/Miller

RESULTS:

Sample Source	Percent Retained No. 4 Sieve	Percent Passing No. 200 Sieve	Liquid Limit	Plasticity Index
SB5 @ 5'-10'	0	74	42	22
SB6 @ 10'-15'	0	49	25	6
SB7 @ 5'-12'	1	73	40	17
SB10 @ 5'-12'	0	64	32	15
SB11 @ 0'-5'	0	77	45	23
SB13 @ 5'-12'	0	79	41	21

LABORATORY TEST RESULTS

Date: 19-May-05

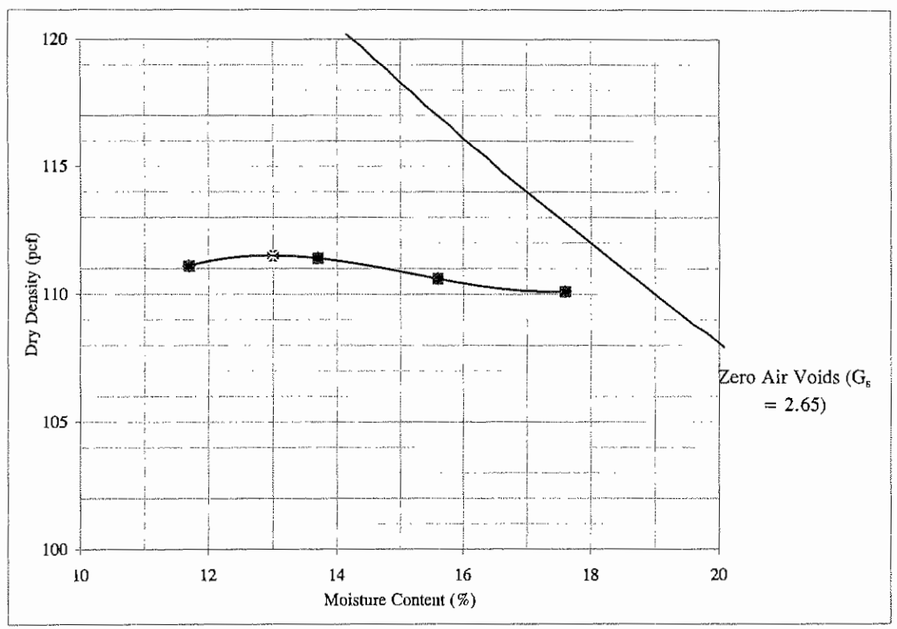
SAMPLE SOURCE: SB2 @ 5'-10'

TESTING PERFORMED Maximum Density-Optimum Moisture Determination (ASTM D698 Method A)

SAMPLED BY: RAM/Miller

RESULTS:

Maximum Density (pcf) = 111.5 Optimum Moisture (%) = 13.0



LABORATORY TEST RESULTS

Date: 19-May-05

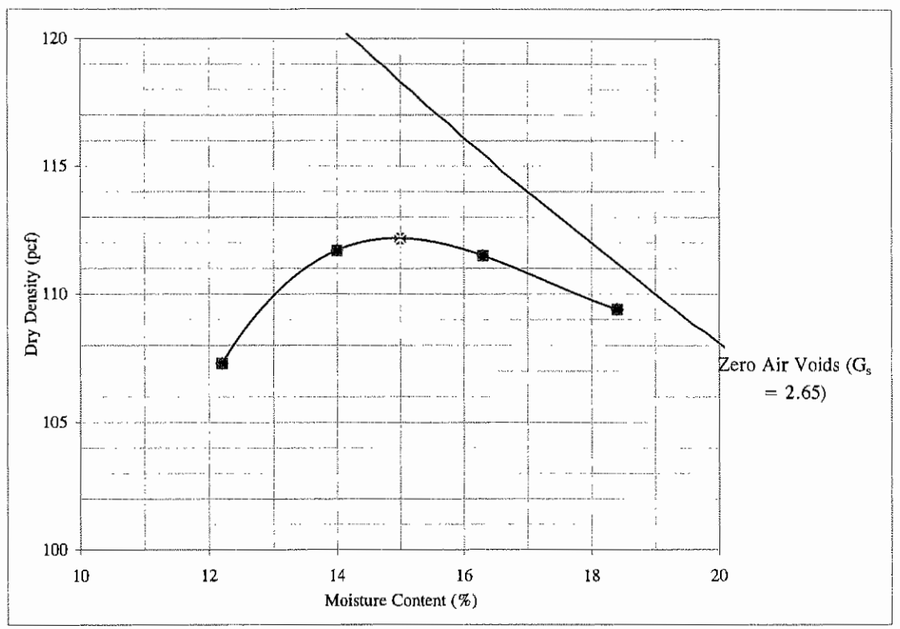
SAMPLE SOURCE: SB5 @ 5'-10'

TESTING PERFORMED Maximum Density-Optimum Moisture Determination (ASTM D698 Method A)

SAMPLED BY: RAM/Miller

RESULTS:

Maximum Density (pcf) = 112.2 Optimum Moisture (%) = 15.0



LABORATORY TEST RESULTS

Date: 19-May-05

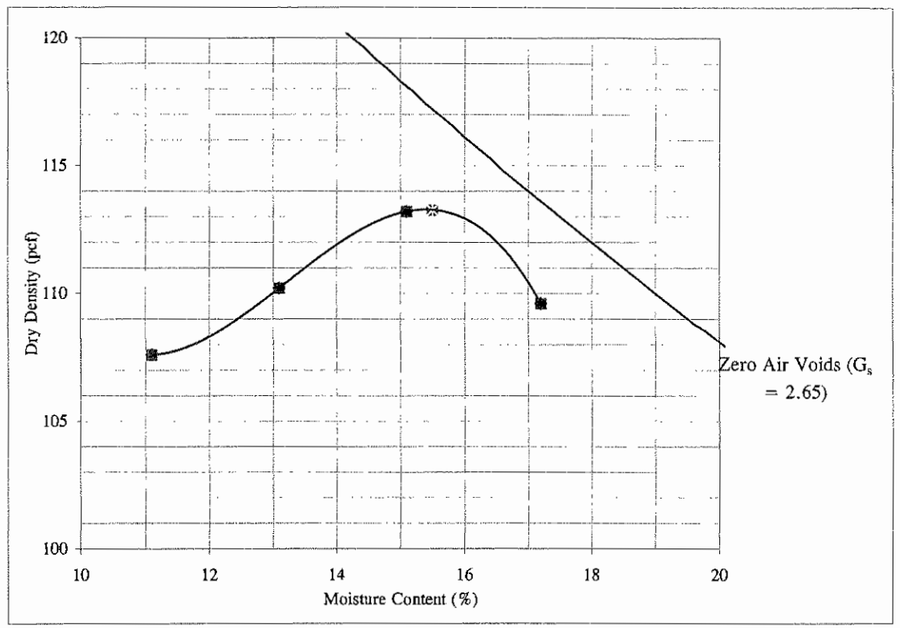
SAMPLE SOURCE: SB6 @ 10'-15'

TESTING PERFORMED Maximum Density-Optimum Moisture Determination (ASTM D698 Method A)

SAMPLED BY: RAM/Miller

RESULTS:

Maximum Density (pcf) = 113.3 Optimum Moisture (%) = 15.5



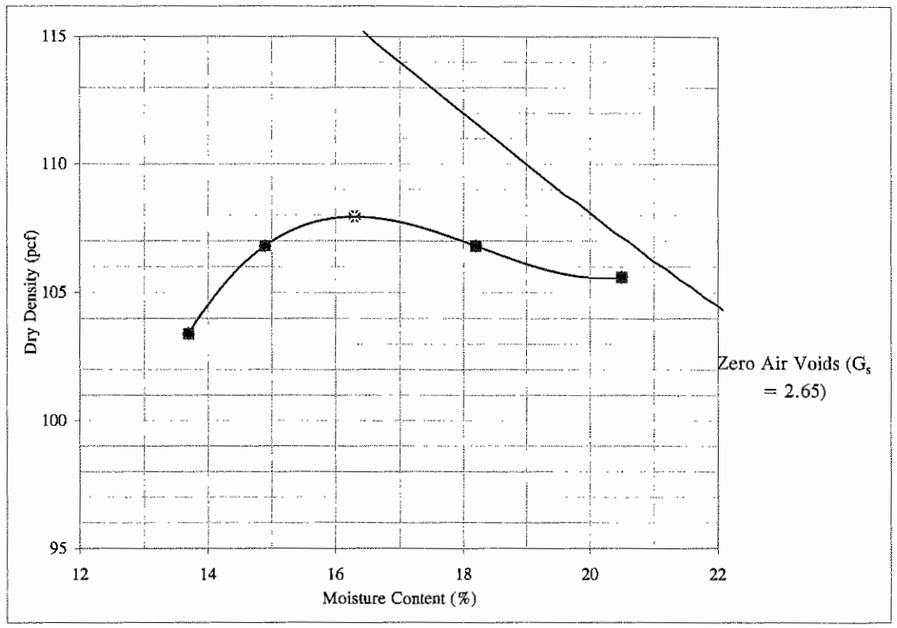
LABORATORY TEST RESULTS

Date: 19-May-05

SAMPLE SOURCE: SB11 @ 0'-5'

TESTING PERFORMED Maximum Density-Optimum Moisture Determination (ASTM D698 Method A)

SAMPLED BY: RAM/Miller

RESULTS:

Maximum Density (pcf) = 108.0 Optimum Moisture (%) = 16.3