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

REPORT ON GEOTECHNICAL INVESTIGATION

DESIGNATION: Utopia Storm Drain

LOCATION: Utopia Avenue,
32nd Street to Cave Creek Road
Phoenix, Arizona

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REPORT ON GEOTECHNICAL INVESTIGATION

DESIGNATION: Utopia Storm Drain

LOCATION: Utopia Avenue,
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Phoenix, Arizona

CLIENT: Flood Control District of
Maricopa County

PROJECT NO: 930315SA

DATE: January 21, 1994

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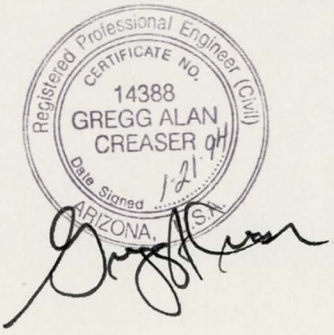

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INTRODUCTION

This report presents the results of a subsoil investigation carried out at the site of a proposed storm drain lateral to be located along Utopia Avenue, from 32nd Street to Cave Creek Road in Phoenix, Arizona.

Preliminary information calls for the construction of an 84-inch storm drain lateral and pavement replacement along Grovers Avenue. It is our understanding that the maximum depth to flow line for the area discussed in this report will be on the order of 20 feet below existing grade.

GENERAL ROUTE AND SOIL CONDITIONS

Route Conditions - The alignment of the proposed storm drain lateral is within the right-of-way of Utopia Avenue. The roadway is paved "half-width" with asphaltic concrete for the entire length of the proposed route. Surrounding land usage is generally residential in nature.

General Subsurface Conditions - Subsoil conditions along the route are somewhat variable. The native subsoils consist of strata varying from stiff to hard sandy clays with weak to moderate calcareous cementation to clayey sands and gravelly sands with occasional cobbles. Fill, consisting of Plasticity indices range from 7 to 25 percent. Field and laboratory resistivity tests conducted indicate resistivity values range from 1000 to 3828 ohms-cm with pH values on the order of 8.1 to 8.6.

The subsoils generally exhibit Standard Penetration Resistance (SPT) values of 15 to 50-plus blows per foot, with the lower blow counts generally occurring in the upper five feet. All boring were dry upon completion and groundwater is reported by ADWR to be on the order of 320 feet deep in the general vicinity. Therefore, groundwater should not be a factor in the design or construction of the storm drain lateral.

ANALYSIS AND RECOMMENDATIONS

Analysis - Due to the nature of the coarser grained less cohesive soils sporadically encountered along the route, significant disturbances from gravel and occasional cobbles may make neat trenches difficult to achieve. Therefore, cast-in-place pipe may not be feasible. Trench excavations for utilities can be accomplished by conventional trenching equipment. Trench walls may experience some sloughing in the coarser grained soils. If trenches are greater than shoulder-height, precautions must be taken to protect workmen in accordance with all current governmental regulations. No special recommendations are made if pre-cast reinforced concrete pipe is used except that pipe bedding will be require to prevent point loads due to the presence of cobbles. Based on the resistivity tests conducted, the soils are classified by American Iron and Steel Institute as moderate to severely corrosive. We therefore recommend that

aluminum alloy or bituminous coated CMP be used in conjunction with a low corrosive bedding material if CMP is desired.

Utilities Installation - Trench excavation, backfilling and compaction should be carried out under MAG Section 601. Backfill of trenches may be carried out with native excavated material, provided that oversized material is removed in the bedding zone. This material should be moisture-conditioned, placed in 8 inch lifts and mechanically compacted. Water settling is not recommended. Compaction requirements as set forth in Section 601 of M.A.G. Specification should be followed.

Asphalt Pavement - If earthwork in paved areas is carried out to finish subgrade elevation as set forth herein, the subgrade will provide adequate support for pavements.

The existing pavement section is currently 2.0 inches of asphalt over 4.0 inches of aggregate base course. Based on the City of Phoenix minimum pavement design for residential streets and our experience in the area, a minimum replacement pavement section of 2.0 inches of asphalt over 6.0 inches of aggregate base course is recommended. This assumes that all subgrades are prepared in accordance with the recommendations contained herein, 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.

Pavement base course material should be A.B.C. per M.A.G. Section 702 Specifications. Asphalt concrete materials and mix design should conform to M.A.G. 710. It is recommended that mix designation D-1/2 or C-3/4 be used for the pavements. While the C-3/4 mix has a somewhat rougher texture, it offers more stability. Pavement installation should be carried out under applicable portions of M.A.G. Section 321.

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 Soils Engineer monitor 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

Clay W. Spencer, Staff Geologist

Gregg A. Creaser, P.E. January 21, 1994

APPENDIX

FIELD AND LABORATORY INVESTIGATION

SOIL BORING LOCATION PLAN

SOIL LEGEND

LOG OF TEST BORINGS

TABULATION OF TEST DATA

MOISTURE-DENSITY RELATIONS

SWELL TEST DATA

FIELD AND LABORATORY INVESTIGATION

On December 16, 1993, five 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 field technician, 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 for classification and pavement design parameters. Remolded swell tests were performed on samples compacted to densities and moisture contents expected during construction. All field and laboratory data is presented in this appendix.

SOIL LEGEND

SAMPLE DESIGNATION	DESCRIPTION	
AS	Auger Sample-	A grab sample taken directly from auger flights
BS	Large Bulk Sample-	A grab sample taken directly from auger flights
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 (N).
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, 1⅜ 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 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.

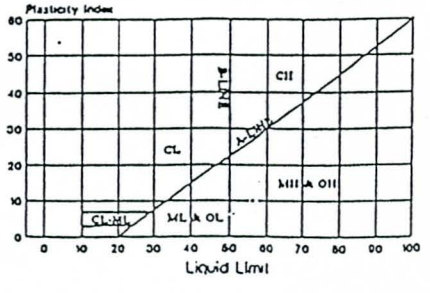
CONSISTENCY			RELATIVE DENSITY	
Clays & Silts	Blows/Foot *	Strength †	Sands and Gravels	Blows/Foot *
Very Soft	0-2	0-¼	Very Loose	0-4
Soft	2-4	¼-½	Loose	5-10
Firm	5-8	½-1	Medium Dense	11-30
Stiff	9-15	1-2	Dense	31-50
Very Stiff	16-30	2-4	Very Dense	> 50
Hard	> 30	> 4		

* Number of blows of a 140 lb hammer free falling 30 inches to drive a 2 inch O.D. split spoon sampler (ASTM D-1588)
† Unconfined compressive strength in tons/sq ft. Read from a pocket penetrometer

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
Coarse Grained Soils: More than 50% of material is larger than #200 sieve size	Gravel and Gravelly Soils: 50% Coarse Fraction is > #4 Sieve Size	Clean Gravels		GW	Well Graded Gravels
				GP	Poorly Graded Gravels
		Gravels w/Fines		GM	Silty Gravels
				GC	Clayey Gravels
	Sand and Sandy Soils: 50% Coarse Fraction is < #4 Sieve Size	Clean Sands		SW	Well Graded Sands
				SP	Poorly Graded Sands
		Sands w/Fines		SM	Silty Sand
				SC	Clayey Sand
Fine Grained Soils: More than 50% of material is smaller than #200 sieve size	Silts and Clays: Liquid limit is less than 50%			ML	Inorganic Silts, Low Plasticity
				CL	Inorganic Clays, Low Plasticity
				OL	Organic Silts, High Plasticity
	Silts and Clays: Liquid limit is greater than 50%			MH	Inorganic Silts, High Plasticity
				CH	Inorganic Clays, High Plasticity
				OH	Organic Clays, High Plasticity
Highly Organic Soils				PT	Peat and Humus, Highly Organic

MATERIAL SIZE	PARTICLE SIZE			
	Lower Limit		Upper Limit	
	mm	Sieve Size †	mm	Sieve Size †
Sands				
Fine	.075	#200	0.42	#40
Medium	0.42	#40	2.00	#10
Coarse	2.00	#10	4.76	#4
Gravels				
Fine	4.76	#4	191	¾" *
Coarse	191	¾" *	762	3" *
Cobbles	762	3" *	304.8	12" *
Boulders	304.8	12" *	914.4	36" *

†U.S. Standard *Clear Square Openings



Rig Type: CME-55
Boring Type: 7" Hollow Stem Auger
Surface Elevation: 997.8
STA 34 + 45, 18' LT of CL

Visual Classification

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Pentration Resistance Blows per Foot (0 25 50)
RS-1	2.0	--	--	
S-2	6.0	--	--	54/12"
S-3	11.0	--	--	
S-4	16.0	--	--	89/12"
S-5	19.8	--	--	50/4"

Fill: Hard Brown/Grey SANDY CLAY (CL-Dry) with Trace Gravel

3.5

Dense to Very Dense Light to Reddish Brown CLAYEY SAND (SC-Dry) with Some Gravel and Weak to Mild Calcareous Cementation

pH = 8.1

16.5

Very Dense Brown SANDY GRAVEL (GW-Dry), Some Volcanic, with Cobbles

19.8

End of Boring

Boring Date: 12-16-93
Field Engineer/Technician: M. VanHook
Driller: S. Belsky
Contractor: Heber Mining

Water Level

Depth	Hour	Date

Log of Test Boring Number: B-1
Utopia Storm Drain
Utopia Ave. 32nd. St. to Cave Creek
Phoenix, Az.
Project No. 930315SA

Rig Type: CME-55
Boring Type: 7" Hollow Stem Auger
Surface Elevation: 1000.5
STA 41 + 27, 3' RT of CL

Visual Classification

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Pentration Resistance Blows per Foot (0 25 50)
S-1	2.5	--	--	
BS-2	4.0	--	--	
S-3	6.0	--	--	
S-4	9.8	--	--	50/3"
S-5	16.0	--	--	
S-6	20.1	--	--	50/1"

Stiff Brown SANDY CLAY/SANDY SILT (CL/ML-Dry) with Trace Gravel

3.5

pH = 8.1, Minimum Resistivity = 1000 ohm-cm

Medium Dense Brown/Grey GRAVELLY SAND (SP-Dry) with Trace Clay and Weak Calcareous Cementation

8.0

Hard Light Brown/Grey SANDY CLAY (CL-Dry) and Gravel with Mild to Hard Calcareous Cementation

13.0

Medium Dense Brown GRAVELLY SAND (SP-Dry)

18.0

Very Dense Light Brown SANDY GRAVEL (GW-Dry) with Little Cobbles

pH = 8.6

20.1

End of Boring

Boring Date: 12-16-93
Field Engineer/Technician: M. VanHook
Driller: S. Belsky
Contractor: Heber Mining

Water Level

Depth	Hour	Date

Log of Test Boring Number: B-2
Utopia Storm Drain
Utopia Ave. 32nd. St. to Cave Creek
Phoenix, Az.
Project No. 930315SA

Rig Type: CME-55
Boring Type: 7" Hollow Stem Auger
Surface Elevation: 1001.2
STA 44 + 50, 4' RT of CL

Visual Classification

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Pentration Resistance Blows per Foot (0 25 50)
S-1	2.5	--	--	
S-2	5.4	--	--	50/5"
S-3	9.9	--	--	50/4"
S-4	16.0	--	--	
S-5	20.0	--	--	50/4"

Hard Light Brown to Brown/Grey SANDY CLAY (CL-Dry) with Weak to Strong Calcareous Cementation

13.0

Dense Brown/Grey CLAYEY SAND (SC-Dry) with Some Gravel

20.0

End of Boring

Boring Date: 12-16-93
Field Engineer/Technician: M. VanHook
Driller: S. Belsky
Contractor: Heber Mining

Water Level

Depth	Hour	Date

Log of Test Boring Number: B-3
Utopia Storm Drain
Utopia Ave. 32nd. St. to Cave Creek
Phoenix, Az.
Project No. 930315SA

Rig Type: CME-55
Boring Type: 7" Hollow Stem Auger
Surface Elevation: 1004.0
STA 48 + 70, 6' RT of CL

Visual Classification

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Pentration Resistance Blows per Foot (0 25 50)
S-1	2.5	--	--	
S-2	4.9	--	--	50/5"
S-3	9.8	--	--	50/3"
S-4	14.8	--	--	50/3"

Very Stiff to Hard Light Brown to Brown/Grey SANDY CLAY (CL-Dry) with Heavy Weak to Mild Calcareous Cementation and Gravel Increasing From 15'

pH = 8.6

17.5

Auger Refusal on Cobbles

Boring Date: 12-16-93
Field Engineer/Technician: M. VanHook
Driller: S. Belsky
Contractor: Heber Mining

Water Level

Depth	Hour	Date

Log of Test Boring Number: B-4
Utopia Storm Drain
Utopia Ave. 32nd. St. to Cave Creek
Phoenix, Az.
Project No. 930315SA

Rig Type: CME-55
Boring Type: 7" Hollow Stem Auger
Surface Elevation: 1007.3
STA 53 + 27, 3' LT of CL

Visual Classification

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Pentration Resistance Blows per Foot (0 25 50)

2" Asphalt/4" AB
Fill: Medium Dense Brown SANDY PEA GRAVEL (GP-Dry) with Trace Silt and Clay

5.0

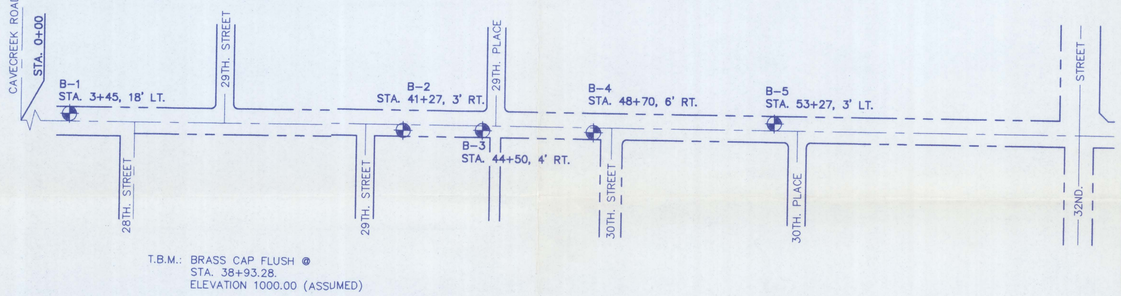
Boring Terminated Due to Fear of Hitting Unmarked Utilities

Boring Date: 12-16-93
Field Engineer/Technician: M. VanHook
Driller: S. Belsky
Contractor: Heber Mining

Water Level

Depth	Hour	Date

Log of Test Boring Number: B-5
Utopia Storm Drain
Utopia Ave. 32nd. St. to Cave Creek
Phoenix, Az.
Project No. 930315SA



T.B.M.: BRASS CAP FLUSH @
STA. 38+93.28.
ELEVATION 1000.00 (ASSUMED)

SITE PLAN
N.T.S.

REV.
REV.
REV.
REV.

BORING LOGS

UTOPIA STORM DRAIN
UTOPIA AVE. - 32ND. ST. TO CAVE CREEK
PHOENIX, AZ

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

PROJECT NO.: 930315SA	DRAWN BY: M.J.C.	DATE: 1-18-94
SCALE: 1"=3'	CHECKED BY: G.A.C.	SHEET: 1 OF 1

TABULATION OF TEST DATA

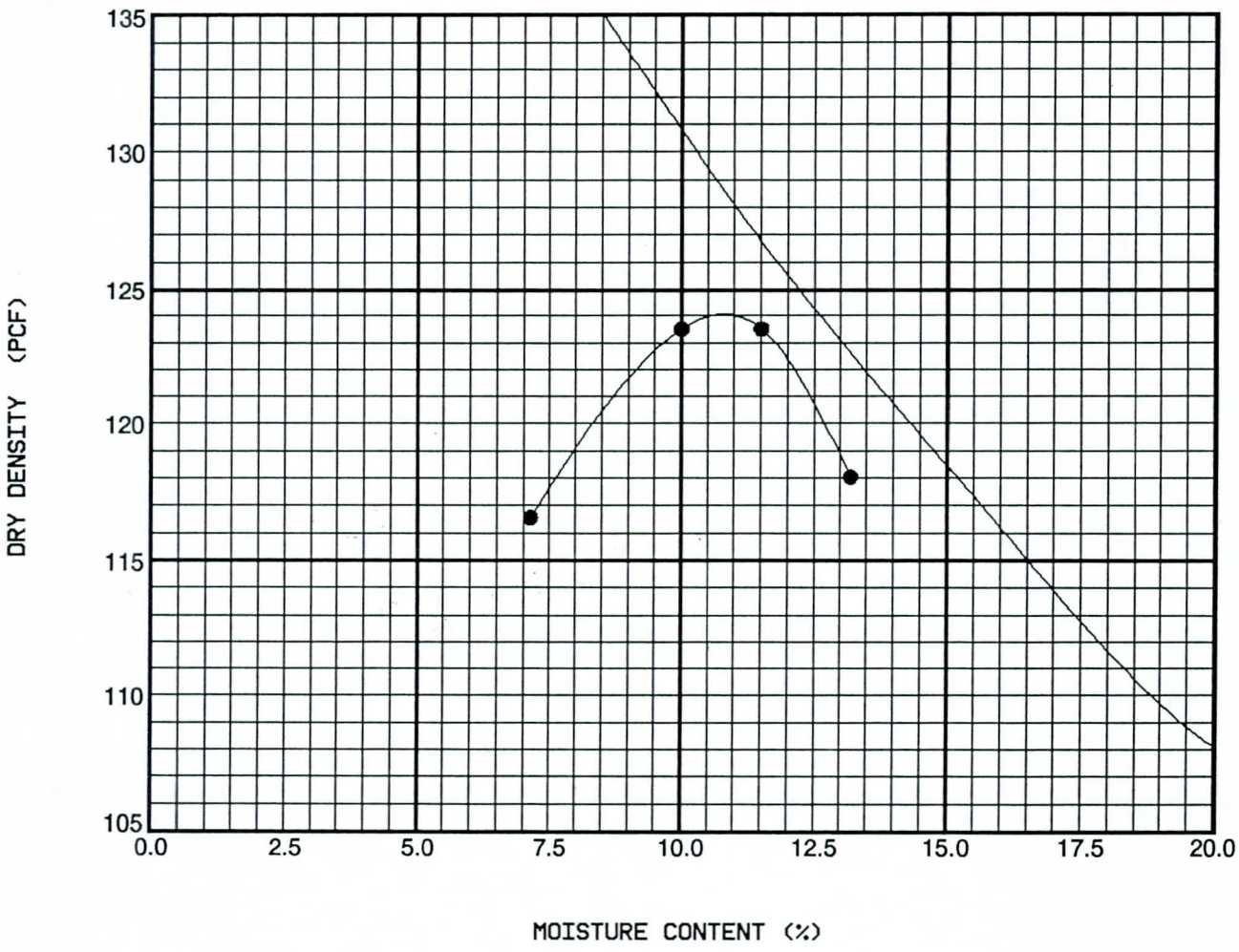
PROJECT: Utopia Storm Drain - Utopia Ave. 32nd St. to C.C.
NUMBER: 930315SA

Test Boring Number	Sample Depth (feet)	Water Content %	Dry Density (pcf)	<#200 Sieve %	<#40 Sieve %	<#10 Sieve %	<#4 Sieve %	<3" Sieve %	Liquid Limit %	Plastic Limit %	Plasticity Index %	ASTM Classification
B- 1	2.0	--	--	58	72	86	94	100	26	17	9	CL
B- 2	4.0	--	--	51	69	86	95	100	25	18	7	CL-ML
B- 3	16.0	--	--	16	26	50	73	100	37	22	16	SC
B- 4	2.5	--	--	61	77	89	97	100	48	23	25	CL

MOISTURE-DENSITY RELATIONS

PROJECT: Utopia Storm Drain **PROJECT NO.:** 930315SA **DATE:** 12/16/93
LOCATION: Utopia Ave. 32nd St. to C.C.
BORING NO.: B- 2 **SAMPLE NO.:** BS-2 **SAMPLE DEPTH:** 4.00
METHOD OF COMPACTION: ASTM D698A
LIQUID LIMIT: 25 **PLASTIC LIMIT:** 18 **PLASTICITY INDEX:** 7
CLASSIFICATION: CL-ML **ASTM SOIL DESCRIPTION:** SANDY SILTY CLAY

MAXIMUM DRY DENSITY: 123.9 PCF **OPTIMUM MOISTURE CONTENT:** 10.7 %



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SWELL TEST DATA

BORING/ PIT NO.	SAMPLE DEPTH (FT.)	REMOLDED DRY DENSITY (PCF)	INITIAL MOISTURE CONTENT PERCENT	PERCENT COMPACTION	INITIAL DEGREE OF SATURATION PERCENT	FINAL DEGREE OF SATURATION PERCENT	TOTAL SWELL PERCENT
B-2	4.0	117.9	8.8	95.2*	58	63	0.8

*Based on a maximum dry density of 123.9 pcf at 10.7 percent optimum moisture

Utopia Storm Drain
Utopia Avenue, 32nd Street to
Cave Creek Road
Maricopa County

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