INVITATION FOR BID #13PB031

SOUTHWEST WATERLINE UPGRADES

ADDENDUM #2

FEBRUARY 25, 2013

The following are the Questions and Answers and additional information that were brought up as a result of the Pre-Bid meeting on 02/14/2013.

PRE-BID QUESTIONS and ANSWERS

Q1

Is there pothole data available that shows the depth of existing utilities?

A1

Yes, a summary of the project's pothole data has been attached to this addendum as Attachment #1.

The following are the Questions and Answers as a result of the Questions deadline of 02/21/2013.

ADDITIONAL QUESTIONS AND ANSWERS

Q2

On plan sheet W101 construction note #77 calls for a restrained type fitting to connect to the existing pipe. The existing pipe is ACP. Is there a particular type of fitting intended?

A2

To address thrust concerns at this tie-in location, restrain all joints between the two tie-in points along 56th Street (Sta 10+30, 2.8' L to 12' R) and add a thrust collar per detail 5, sheet G5 between the valve and southern tie-in at Sta. 10+30, 9' R.

Q3

SP-30; Clarify/expand on the statement in the 3rd paragraph "All abandoned service lines shall be capped at the main and the meter". Under which Bid Item will this be paid?

A3

Revise this portion of the special provision to state "All abandoned service lines shall be capped two feet below existing grade at the existing meter". This effort will be paid under Bid Item 610812.

Q4

SP-3; Please confirm/clarify that the contractor will not be allowed to work at both locations (Sundown Drive & Windsor/Fairway Park streets) simultaneously.

A4

Modify 1. Scope of Work on page SP-3 of the Special Provisions to include:

Work can proceed at both locations (Sundown Drive area and Windsor/Fairway Park area) simultaneously as long as there is sufficient man power to maintain progress in both areas.

Q5

SP-4 & plan sheet G2 reference a geotechnical report prepared by Ninyo & Moore. Will this report be made available to the contractor?

A5

Yes, the project's geotechnical report has been attached to this addendum as Attachment #2. Please note that these reports also cover areas that are outside the scope of this bid.

Q6

What is the existing asphalt section on the residential streets, Cactus and Shea Blvd?

A6

Based on the project's potholing results, the paving near 56th and Thomas is 4-5" thick, Sundown is 3-5" thick, and Shea and Cactus are 4-5" thick.

Q7

Plan sheet W207, What is the depth of the existing 20" PCCP? Is there a profile of this area?

A7

There is not a profile of this specific tie in location and the 20" PCCP was not potholed. The Contractor shall pothole the line and the utilities to the south prior to installation activities. The proposed waterline's profile will maintain a downward slope to the south and be deflected to avoid the existing utilities in accordance with Keynote 84 and Detail 4, Sheet G5.

Q8

What specification(s) will be required for connecting the 20x8 T.S. & Valve to the 20" PCCP?

A8

The TS&V will be installed and tested in accordance with the manufacturer's recommendations (attached to this addendum as Attachment #3), MAG Standard Specification Section 630, and the City's supplement to that section.

- **See attached information, reports, pictures, special provisions, drawings, etc., for additional answers to questions for this solicitation.**

The Proposal due date and time remains 2:00 P.M., Local Time, MARCH 6, 2013.

All other aspects of this solicitation remain unchanged.

Offeror is required to acknowledge this addendum in their Bid.

John Snow
Bid & Contract Specialist
(480) 312-5716
jsnow@ScottsdaleAZ.gov

ATTENDANCE REGISTER

DATE: 2/14/2013 TIME: 1:00 P.M.

SOLICITATION # & TITLE: 13PB031 SOUTHWEST WATERLINE UPGRADES

PRE BID: ☒ BID OPENING: ☐

INDIVIDUAL NAME & EMAIL	COMPANY NAME & ADDRESS	PHONE/FAX NUMBER
Joseph Moyer Email: jmoyer@danakepner.com	Dana Kepner Company 7101 S. 19th Ave Phoenix, AZ 85009	Phone: 602-255-0234 Fax:- 602-254-6121
SETH A. Email: SUPPORT@bidjudge.com	BIDJUDGE.COM 10869 N. SCOTTSDALE RD. SCOTTSDALE, AZ	Phone: 6024562439 Fax:- 602 532 7025
EMMANUEL HECHER Email: ehecher@rainforest.com	RAIN FOR RENT 26001 S. ARIZONA AVE CHANDLER, AZ 85248	Phone: 602-725-6780 Fax:- 480-895-0545
Manuel Mistan Email: manuelm@citywidecontracting.com	citywide contracting 813 E Buckeye rd Phoenix, AZ 85034	Phone: 602 - 462 - 9695 Fax:- 602 - 462 - 9628
Jim JACKSON Email: JJACKSON@ACHEN.com	ACHEN GARDNER Const 550 S. 79th ST. CHANDLER, AZ 85225	Phone: 480 940 1300 Fax:- 480 940 4576
Cecil Zuniga Email: estimating@redpointcontracting.com	Redpoint Contracting 39506 N. Daisy Mountain Dr Phoenix, AZ 85086	Phone: 602 792-0013 Fax:- 602 792-0016
		Phone: Fax:-
		Phone: Fax:-
		Phone: Fax:-
		Phone: Fax:-

DATE: 2/14/2013 **ATTENDANCE REGISTER** **TIME: 1:00 P.M.**

SOLICITATION # & TITLE: 13PB031 SOUTHWEST WATERLINE UPGRADES

PRE BID: ☒ **BID OPENING:** ☐

INDIVIDUAL NAME & EMAIL	COMPANY NAME & ADDRESS	PHONE/FAX NUMBER
Jim Reeve Email: BIDS@PERSON CONSTRUCTION.COM	PERSON CONST. CORP 222 S. 52ND ST TEMPE, AZ 85281	Phone: 480-966-4424 Fax:- 480-894-1086
FREDERICK TACK Email: frederick.tack@ghd.com	GHD 7600 N 16TH ST. STE 205 PHOENIX, AZ 85020	Phone: 602-216-7206 Fax:- 602-216-7201
MIKE SANDERS Email: MMSANDERS@TEAMFISHEL.COM	TEAM FISHEL 1819 S 27TH AVE PHX 85009	Phone: 602-233-6949 Fax:- 602 233 2930
		Phone: Fax:-
		Phone: Fax:-
		Phone: Fax:-
		Phone: Fax:-
		Phone: Fax:-
		Phone: Fax:-
		Phone: Fax:-

Testhole Data Summary

AZTEC www.aztec.us TYPSA group

Date: 3/30/2012

Project Number: AZU1206-001

Project Name: Scottsdale Water Replacement

EXPIRES 09/30/2012

TH #	Location	Date of Excavation	Utility Owner	Utility Size	Utility Description	Coordinates		Stationing		Ground Elevation	Top Elevation	Bottom Elevation	Depth of Cover	Comments
						Northing	Easting	Stationing	Offset					
1	56th St and Thomas Rd	3/16/2012	None	None	None	None	None	None	None	0.00	0.00	0.00	0.00	Pothole cancelled per Bill Roberts.
2	56th Pl and Windsor Ave	3/16/2012	Southwest Gas	2"	Steel	901407.41	686716.40	None	None	1265.09	1262.04	1261.84	3.05	
3	56th Pl and Windsor Ave	3/19/2012	City of Scottsdale Water	54"	RCP	901403.95	686707.67	None	None	1265.06	1258.94	1253.40	6.12	
4	58th St and Cambridge Ave	3/16/2012	Southwest Gas	2"	Steel	901083.76	687594.23	None	None	1276.84	1274.08	1273.88	2.76	
5	56th Pl and Cambridge Ave	3/19/2012	City of Scottsdale Water	0	0			None	None	0.00	0.00	-5.00	0.00	Dug to a depth of 5' in the requested location. No facility found.
6	58th St and Windsor Ave	3/19/2012	City of Scottsdale Water	See Comments	See Comments	901415.64	687666.75	None	None	1274.49	1265.59	1274.49	8.90	Found poured concrete on elbow of water line. Unable to find edges or bottom of
7	58th St and Edgemont Ave	3/19/2012	City of Scottsdale Water	0	0	901768.59	687251.39	None	None	1266.90	1266.90	1261.90	0.00	Dug to a depth of 5' in the requested location. No facility found.
8	57th PL and Thomas Rd	3/30/2012	0	0	0			None	None	0.00	0.00	0.00	0.00	Per ELM Locators, no Century Link in the requested location.
9	Northwest corner of Starfire parking lot	3/20/2012	City of Scottsdale Water	8"	DIP	942590.57	702167.15	None	None	1375.11	1372.71	1371.96	2.40	
10	N Sundown Dr	3/20/2012	Century Link Communications	3/4"	PE	942393.03	701125.92	None	None	1374.44	1371.22	1371.16	3.22	
11	Sundown Dr s/of Cactus Rd	3/20/2012	Southwest Gas	2"	Steel	943826.83	701400.40	None	None	1385.09	1380.45	1380.25	4.64	
12	Cactus Rd and Sundown Dr	3/20/2012	APS/COX	See Comments	PVC	944544.90	701383.69	None	None	1389.81	1387.99	1387.61	1.82	Found one 4" and one 2" PVC in a bundle. Blue Stake marks for both APS
13	Cactus Rd and Sundown Dr	3/20/2012	Southwest Gas	4"	Steel	944552.25	701383.72	None	None	1389.60	1386.24	1385.86	3.36	
13A	Cactus Rd and Sundown Dr	3/20/2012	Unknown	2"	PVC	944553.84	701383.69	None	None	1389.63	1387.13	1386.93	2.50	
14	77th Pl and Shea Blvd	3/20/2012	City of Scottsdale Water	4"	ACP	939578.04	700438.16	None	None	1354.96	1351.64	1351.24	3.32	
15	Shea Blvd west of Hayden Rd.	3/26/2012	None	None	None	None	None	None	None	0.00	0.00	-8.72	0.00	Dug to a depth of 8.72' in the requested location and no facility was found.
16	Shea Blvd west of Hayden Rd	3/26/2012	Southwest Gas	4"	Steel	939270.52	701921.85	None	None	1357.56	1352.64	1357.56	4.92	
17	Shea Blvd and Sundown Dr	3/26/2012	City of Scottsdale Fiber Optic	Two 1.25"	PE	939313.44	700047.96	None	None	1354.98	1350.40	1350.26	4.58	

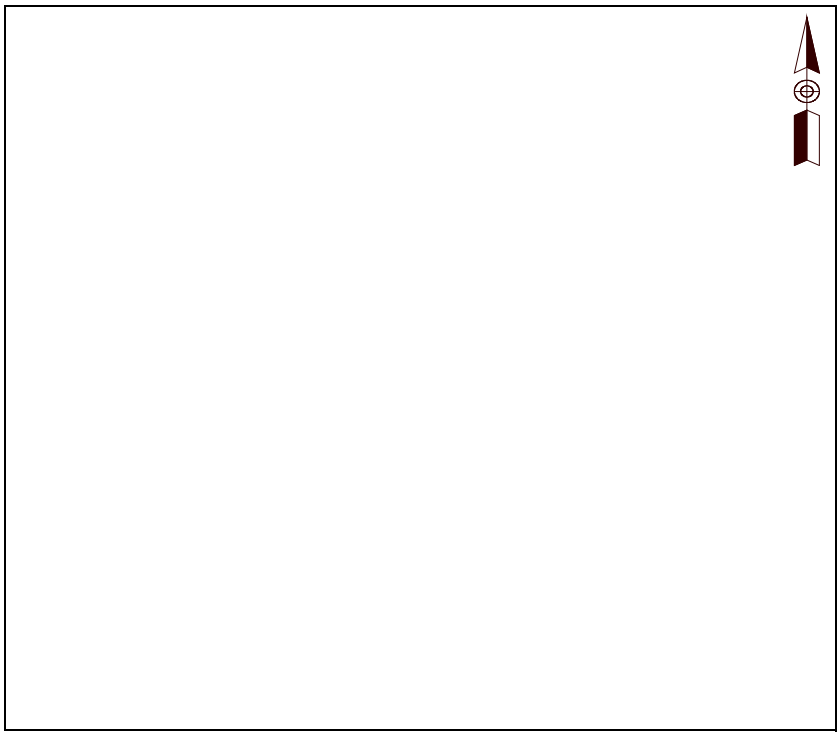
13PB031 Addendum #2 ATTACHMENT #1

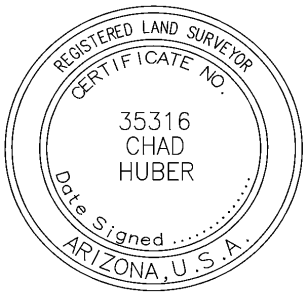
TEST HOLE DATA REPORT

Test Hole #	1	SUE Crew	J. Cherry
Date Dug	3/16/2012	Truck #	469
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	56th St and Thomas Rd		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE





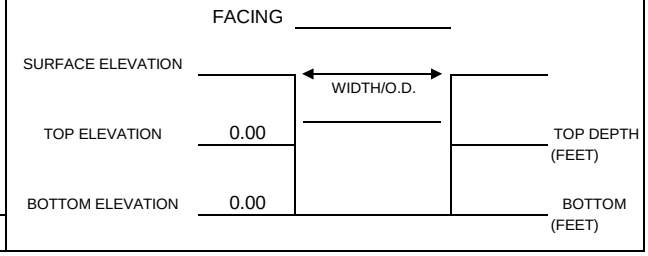
EXPIRES 09/30/2012

SITE BENCHMARK

BM#2 = BCHH @ 56th St and Thomas Rd
Elev = 1256.68

RIBBON COLOR

CROSS SECTION - NOT TO SCALE



COORDINATES: NORTHING None EASTING None

STATIONING: STATION None OFFSET None

PAVING THICKNESS None PAVING TYPE None SOIL CONDITION None

SIZE None TYPE None FACILITY OWNER None

COMMENTS:

Pothole cancelled per Bill Roberts.

PREPARED BY: J. Cherry CHECKED BY: J. Brandt

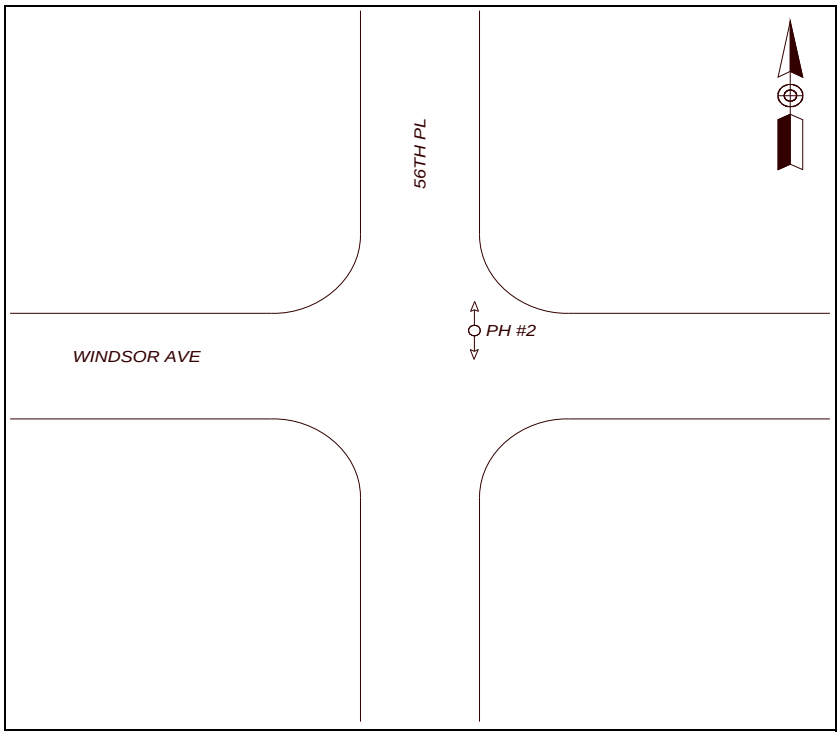
13PB031 Addendum #2 ATTACHMENT #1

TEST HOLE DATA REPORT

Test Hole #	2	SUE Crew	Z. Jubie
Date Dug	3/16/2012	Truck #	557
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	56th Pl and Windsor Ave		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE



REGISTERED LAND SURVEYOR
CERTIFICATE NO.
35316
CHAD
HUBER
Date Signed .....
ARIZONA, U.S.A.

EXPIRES 09/30/2012

SITE BENCHMARK

BM#2 = BCHH @ 56th St and Thomas Rd
Elev = 1256.68

RIBBON COLOR Yellow

CROSS SECTION - NOT TO SCALE

FACING North

SURFACE ELEVATION	1265.09	WIDTH/O.D. 2.38"	
TOP ELEVATION	1262.04	3.05	TOP DEPTH (FEET)
BOTTOM ELEVATION	1261.84	3.25	BOTTOM (FEET)

COORDINATES: NORTHING 901407.41 EASTING 686716.40

STATIONING: STATION None OFFSET None

PAVING THICKNESS 5" PAVING TYPE Asphalt SOIL CONDITION Dirt

SIZE 2" TYPE Steel FACILITY OWNER Southwest Gas

COMMENTS:

PREPARED BY: J. Cherry CHECKED BY: J. Brandt

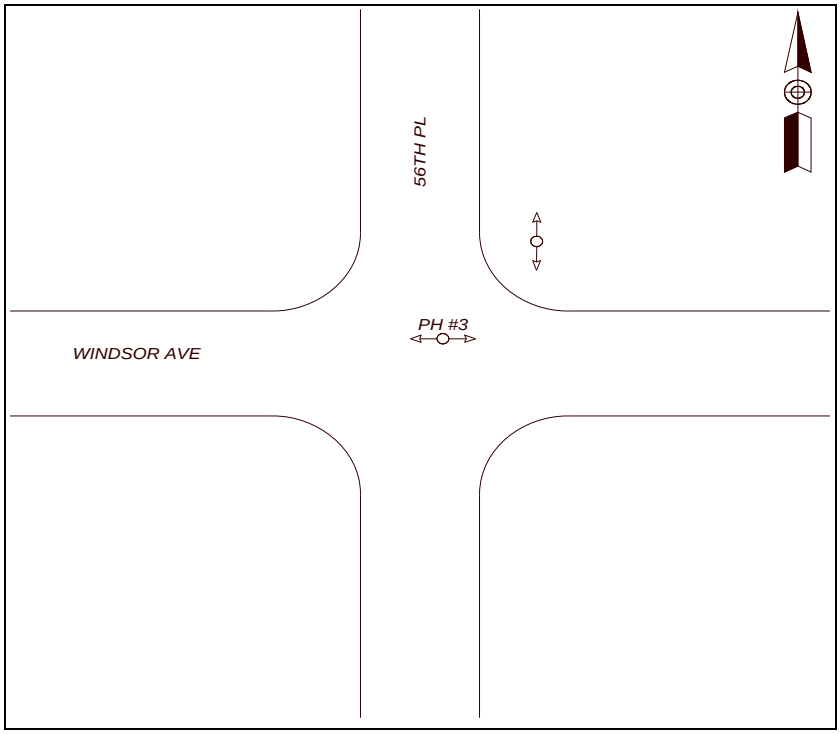
13PB031 Addendum #2 ATTACHMENT #1

TEST HOLE DATA REPORT

Test Hole #	3	SUE Crew	A. Pablo Bello
Date Dug	3/19/2012	Truck #	320
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	56th Pl and Windsor Ave		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE



REGISTERED LAND SURVEYOR
CERTIFICATE NO.
35316
CHAD
HUBER
Date Signed .....
ARIZONA, U.S.A.

EXPIRES 09/30/2012

SITE BENCHMARK

BM#2 = BCHH @ 56th St and Thomas Rd
Elev = 1256.68

RIBBON COLOR Blue

CROSS SECTION - NOT TO SCALE

FACING East

SURFACE ELEVATION	1265.06		
		WIDTH/O.D. 66.5"	
TOP ELEVATION	1258.94	6.12	TOP DEPTH (FEET)
BOTTOM ELEVATION	1253.40	11.66	BOTTOM (FEET)

COORDINATES: NORTHING 901403.95 EASTING 686707.67

STATIONING: STATION None OFFSET None

PAVING THICKNESS 4" PAVING TYPE Asphalt SOIL CONDITION Dirt

SIZE 54" TYPE RCP FACILITY OWNER City of Scottsdale Water

COMMENTS:

PREPARED BY: J. Cherry CHECKED BY: J. Brandt

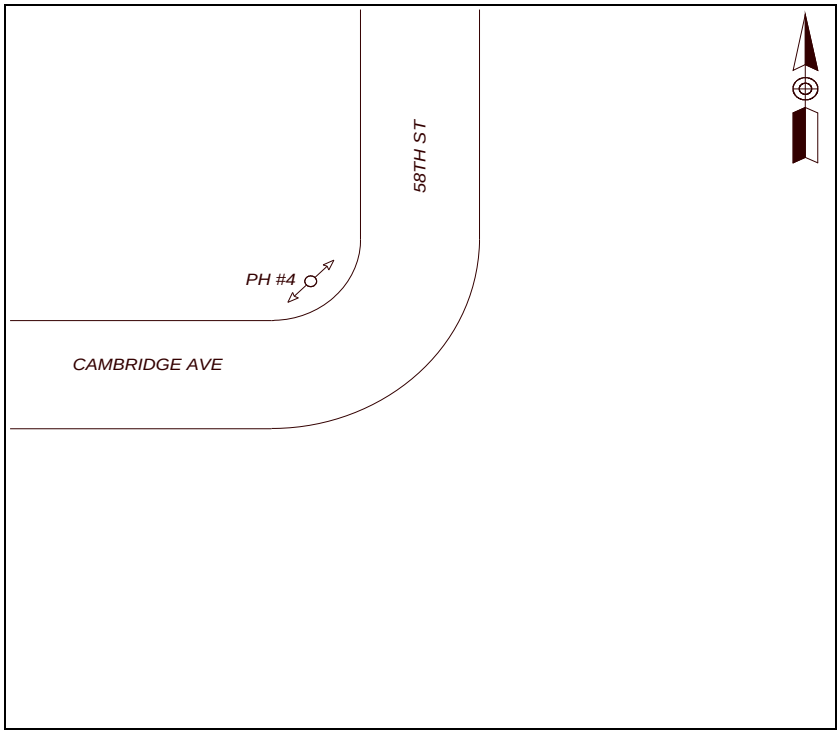
13PB031 Addendum #2 ATTACHMENT #1

TEST HOLE DATA REPORT

Test Hole #	4	SUE Crew	Z. Jubie
Date Dug	3/16/2012	Truck #	557
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	58th St and Cambridge Ave		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE



REGISTERED LAND SURVEYOR
CERTIFICATE NO.
35316
CHAD
HUBER
Date Signed .....
ARIZONA, U.S.A.

EXPIRES 09/30/2012

SITE BENCHMARK

BM#2 = BCHH @ 56th St and Thomas Rd
Elev = 1256.68

RIBBON COLOR Yellow

CROSS SECTION - NOT TO SCALE

FACING Northeast

SURFACE ELEVATION	1276.84	WIDTH/O.D. 2.38"	
TOP ELEVATION	1274.08	2.76	TOP DEPTH (FEET)
BOTTOM ELEVATION	1273.88	2.96	BOTTOM (FEET)

COORDINATES: NORTHING 901083.76 EASTING 687594.23

STATIONING: STATION None OFFSET None

PAVING THICKNESS None PAVING TYPE None SOIL CONDITION Dirt

SIZE 2" TYPE Steel FACILITY OWNER Southwest Gas

COMMENTS:

PREPARED BY: J. Cherry CHECKED BY: J. Brandt

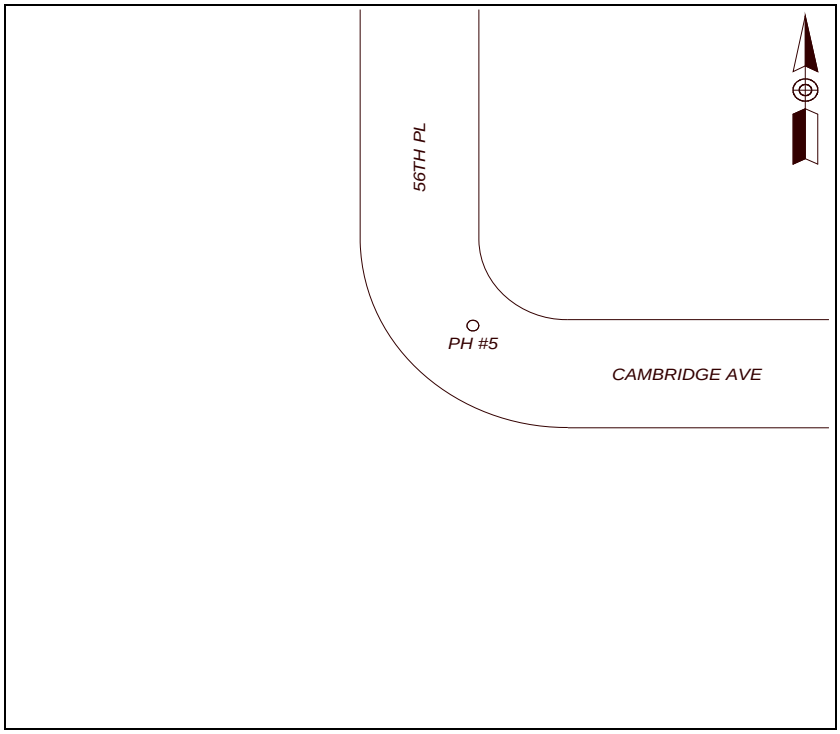
13PB031 Addendum #2 ATTACHMENT #1

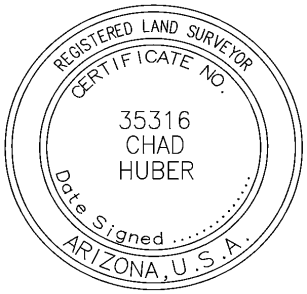
TEST HOLE DATA REPORT

Test Hole #	5	SUE Crew	A. Pablo Bello
Date Dug	3/19/2012	Truck #	320
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	56th Pl and Cambridge Ave		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE





EXPIRES 09/30/2012

SITE BENCHMARK

BM#2 = BCHH @ 56th St and Thomas Rd
Elev = 1256.68

RIBBON COLOR

CROSS SECTION - NOT TO SCALE

FACING

SURFACE ELEVATION		WIDTH/O.D.	
TOP ELEVATION	0.00		TOP DEPTH (FEET)
BOTTOM ELEVATION	-5.00	5.00	BOTTOM (FEET)

COORDINATES: NORTHING EASTING

STATIONING: STATION None OFFSET None

PAVING THICKNESS	4"	PAVING TYPE	Asphalt	SOIL CONDITION	Dirt
SIZE		TYPE		FACILITY OWNER	City of Scottsdale Water

COMMENTS:

Dug to a depth of 5' in the requested location. No facility found.

PREPARED BY: J. Cherry CHECKED BY: J. Brandt

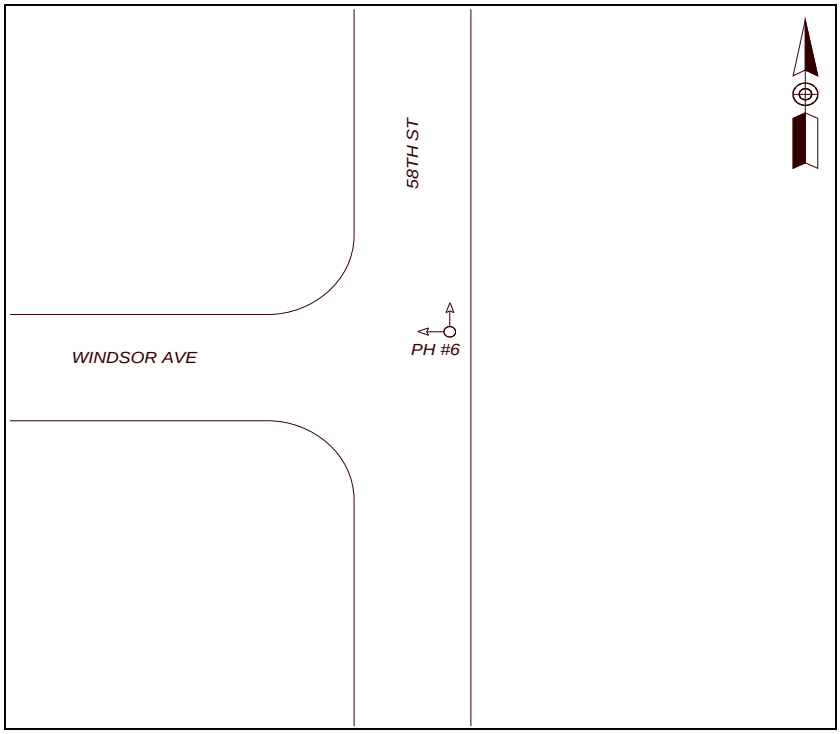
13PB031 Addendum #2 ATTACHMENT #1

TEST HOLE DATA REPORT

Test Hole #	6	SUE Crew	A. Pablo Bello
Date Dug	3/19/2012	Truck #	320
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	58th St and Windsor Ave		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE



REGISTERED LAND SURVEYOR
CERTIFICATE NO.
35316
CHAD
HUBER
Date Signed .....
ARIZONA, U.S.A.

EXPIRES 09/30/2012

SITE BENCHMARK

BM#2 = BCHH @ 56th St and Thomas Rd
Elev = 1256.68

RIBBON COLOR Blue

CROSS SECTION - NOT TO SCALE

FACING North

SURFACE ELEVATION	1274.49	WIDTH/O.D.	
TOP ELEVATION	1265.59	8.90	TOP DEPTH (FEET)
BOTTOM ELEVATION	1274.49		BOTTOM (FEET)

COORDINATES: NORTHING 901415.64 EASTING 687666.75

STATIONING: STATION None OFFSET None

PAVING THICKNESS 4" PAVING TYPE Asphalt SOIL CONDITION Dirt

SIZE See Comments TYPE See Comments FACILITY OWNER City of Scottsdale Water

COMMENTS:

Found poured concrete on elbow of water line. Unable to find edges or bottom of concrete.

PREPARED BY: J. Cherry CHECKED BY: J. Brandt

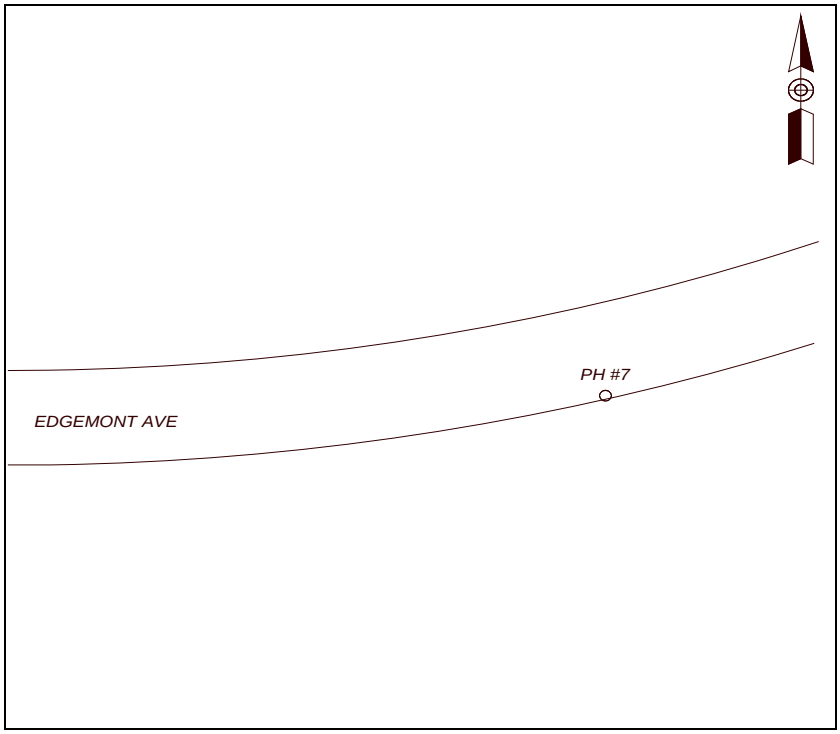
13PB031 Addendum #2 ATTACHMENT #1

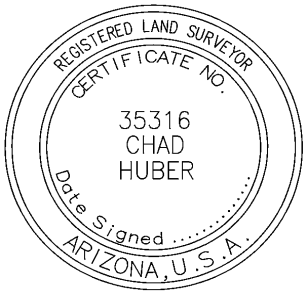
TEST HOLE DATA REPORT

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

Test Hole #	7	SUE Crew	A. Pablo Bello
Date Dug	3/19/2012	Truck #	320
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	58th St and Edgemont Ave		

LOCATION PLAN - NOT TO SCALE





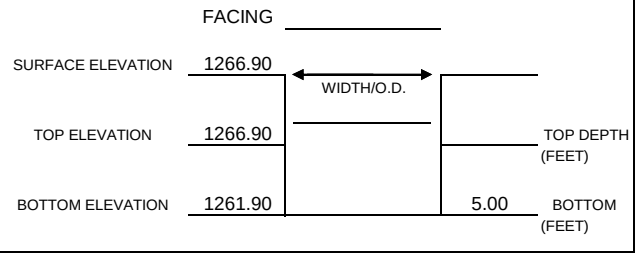
EXPIRES 09/30/2012

SITE BENCHMARK

BM#2 = BCHH @ 56th St and Thomas Rd
Elev = 1256.68

RIBBON COLOR

CROSS SECTION - NOT TO SCALE



COORDINATES: NORTHING 901768.59 EASTING 687251.39

STATIONING: STATION None OFFSET None

PAVING THICKNESS 4" PAVING TYPE Asphalt SOIL CONDITION Dirt

SIZE TYPE FACILITY OWNER City of Scottsdale Water

COMMENTS:

Dug to a depth of 5' in the requested location. No facility found.

PREPARED BY: J. Cherry CHECKED BY: J. Brandt

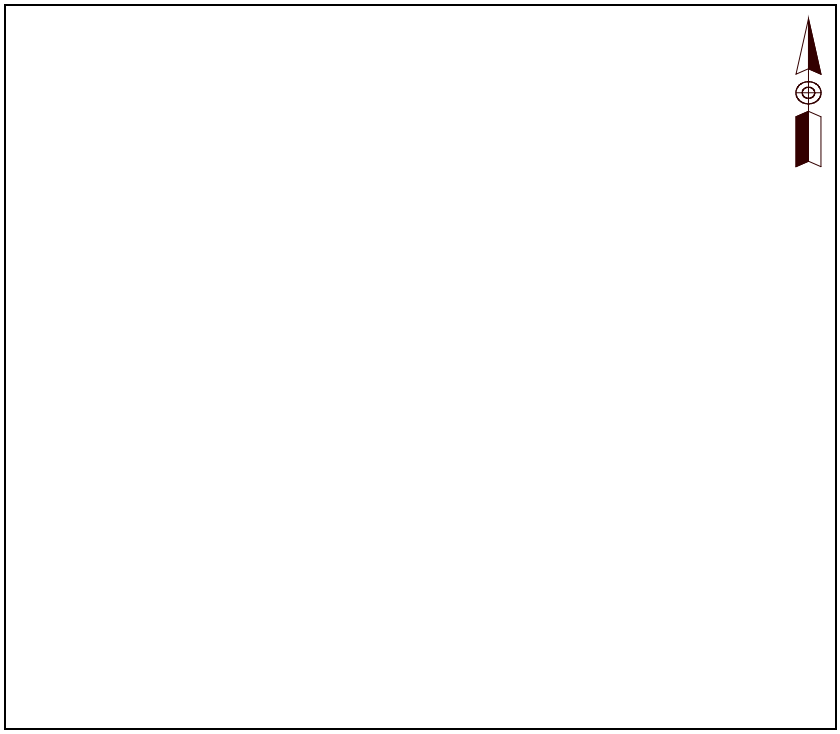
13PB031 Addendum #2 ATTACHMENT #1

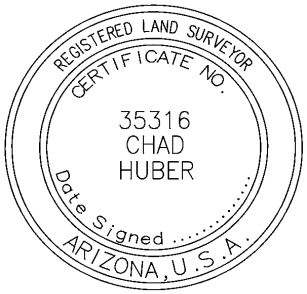
TEST HOLE DATA REPORT

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

Test Hole #	8	SUE Crew	J. Cherry
Date Dug	3/30/2012	Truck #	469
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	57th PL and Thomas Rd		

LOCATION PLAN - NOT TO SCALE





EXPIRES 09/30/2012

SITE BENCHMARK

BM#2 = BCHH @ 56th St and Thomas Rd
Elev = 1256.68

RIBBON COLOR

CROSS SECTION - NOT TO SCALE

FACING

SURFACE ELEVATION

WIDTH/O.D.

TOP ELEVATION 0.00 TOP DEPTH (FEET)

BOTTOM ELEVATION 0.00 BOTTOM (FEET)

COORDINATES: NORTHING EASTING

STATIONING: STATION None OFFSET None

PAVING THICKNESS PAVING TYPE SOIL CONDITION

SIZE TYPE FACILITY OWNER

COMMENTS:

Per ELM Locators, no Century Link in the requested location.

PREPARED BY: J. Cherry CHECKED BY: J. Brandt

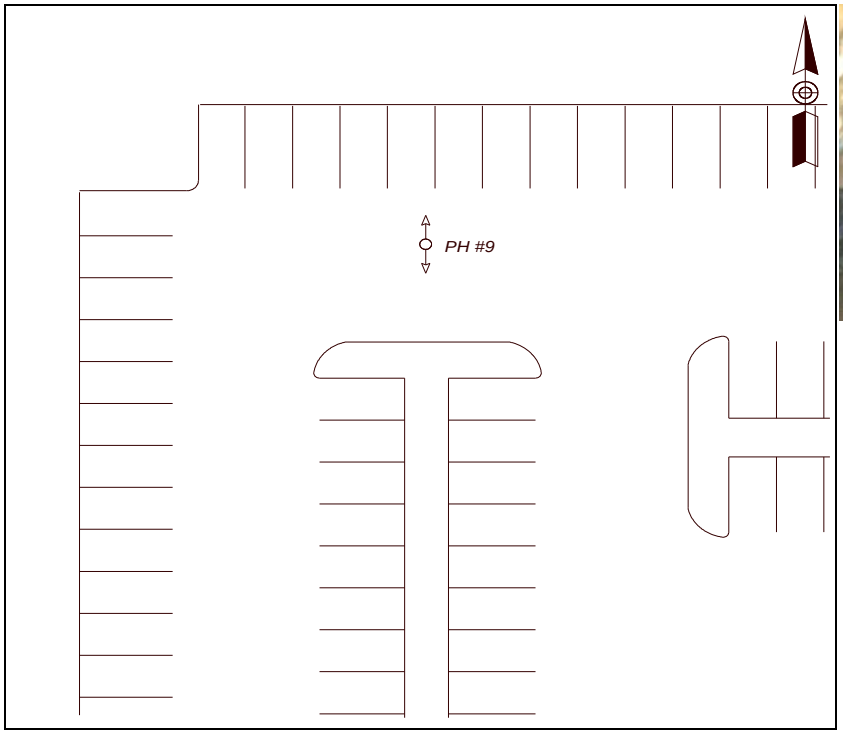
13PB031 Addendum #2 ATTACHMENT #1

TEST HOLE DATA REPORT

Test Hole #	9	SUE Crew	Z. Jubie
Date Dug	3/20/2012	Truck #	320
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	Northwest corner of Starfire parking lot		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE



REGISTERED LAND SURVEYOR
CERTIFICATE NO.
35316
CHAD
HUBER
Date Signed .....
ARIZONA, U.S.A.

EXPIRES 09/30/2012

SITE BENCHMARK	CROSS SECTION - NOT TO SCALE			
BM#1 = BCFL @ Miller Rd and Shea Blvd Elev = 1354.84	FACING	North		
	SURFACE ELEVATION	1375.11	WIDTH/O.D. 9.05"	
	TOP ELEVATION	1372.71	2.40	TOP DEPTH (FEET)
	BOTTOM ELEVATION	1371.96	3.15	BOTTOM (FEET)
RIBBON COLOR Blue				

COORDINATES: NORTHING 942590.57 EASTING 702167.15

STATIONING: STATION None OFFSET None

PAVING THICKNESS 3" PAVING TYPE Asphalt SOIL CONDITION Dirt

SIZE 8" TYPE DIP FACILITY OWNER City of Scottsdale Water

COMMENTS:

PREPARED BY: J. Cherry CHECKED BY: J. Brandt

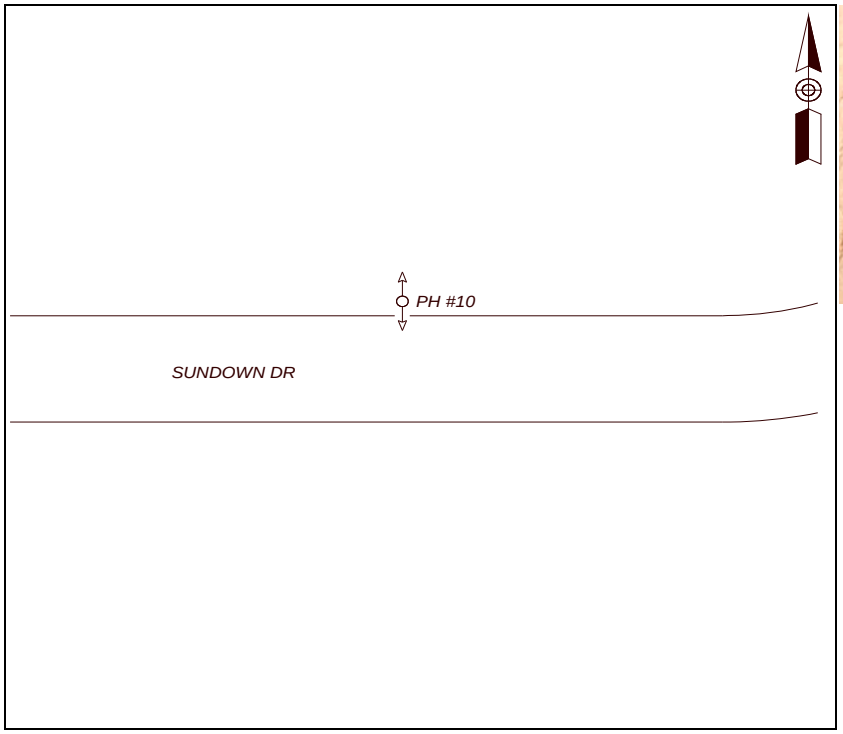
13PB031 Addendum #2 ATTACHMENT #1

TEST HOLE DATA REPORT

Test Hole #	10	SUE Crew	Z. Jubie
Date Dug	3/20/2012	Truck #	320
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	N Sundown Dr		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE



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EXPIRES 09/30/2012

SITE BENCHMARK

BM#1 = BCFL @ Miller Rd and Shea Blvd
Elev = 1354.84

RIBBON COLOR Orange

CROSS SECTION - NOT TO SCALE

FACING North

SURFACE ELEVATION	1374.44	WIDTH/O.D. .75"	
TOP ELEVATION	1371.22	0	3.22 TOP DEPTH (FEET)
BOTTOM ELEVATION	1371.16		3.28 BOTTOM (FEET)

COORDINATES: NORTHING 942393.03 EASTING 701125.92

STATIONING: STATION None OFFSET None

PAVING THICKNESS None PAVING TYPE None SOIL CONDITION Dirt

SIZE 3/4" TYPE PE FACILITY OWNER Century Link Communications

COMMENTS:

PREPARED BY: J. Cherry CHECKED BY: J. Brandt

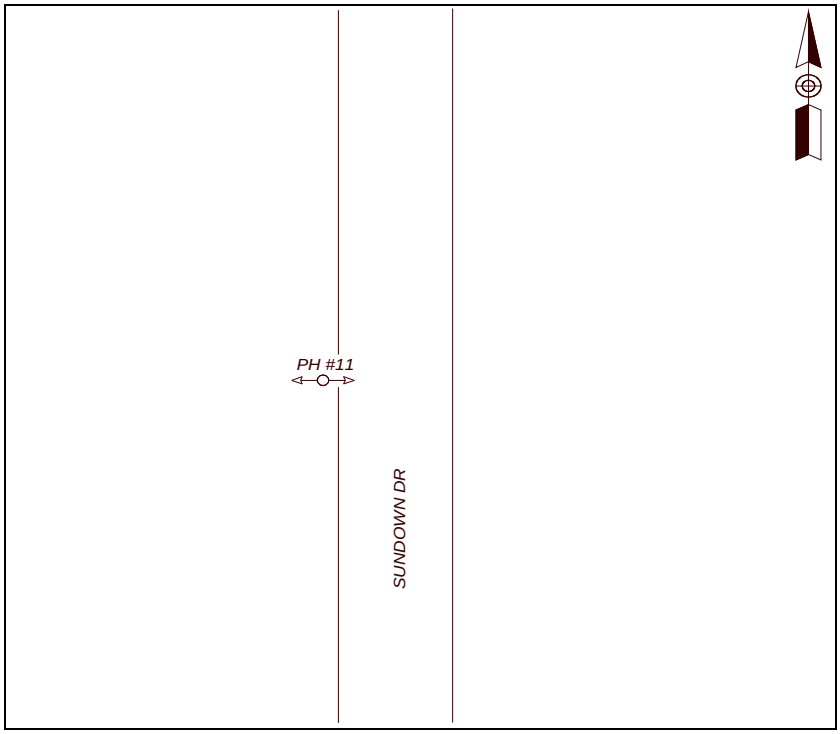
13PB031 Addendum #2 ATTACHMENT #1

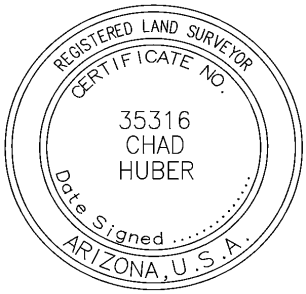
TEST HOLE DATA REPORT

Test Hole #	11	SUE Crew	Z. Jubie
Date Dug	3/20/2012	Truck #	320
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	Sundown Dr s/of Cactus Rd		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE





EXPIRES 09/30/2012

SITE BENCHMARK

BM#1 = BCFL @ Miller Rd and Shea Blvd
Elev = 1354.84

RIBBON COLOR Yellow

CROSS SECTION - NOT TO SCALE

FACING East

SURFACE ELEVATION	1385.09	WIDTH/O.D. 2.38"	
TOP ELEVATION	1380.45	4.64	TOP DEPTH (FEET)
BOTTOM ELEVATION	1380.25	4.84	BOTTOM (FEET)

COORDINATES: NORTHING 943826.83 EASTING 701400.40

STATIONING: STATION None OFFSET None

PAVING THICKNESS 3" PAVING TYPE Asphalt SOIL CONDITION Dirt

SIZE 2" TYPE Steel FACILITY OWNER Southwest Gas

COMMENTS:

PREPARED BY: J. Cherry CHECKED BY: J. Brandt

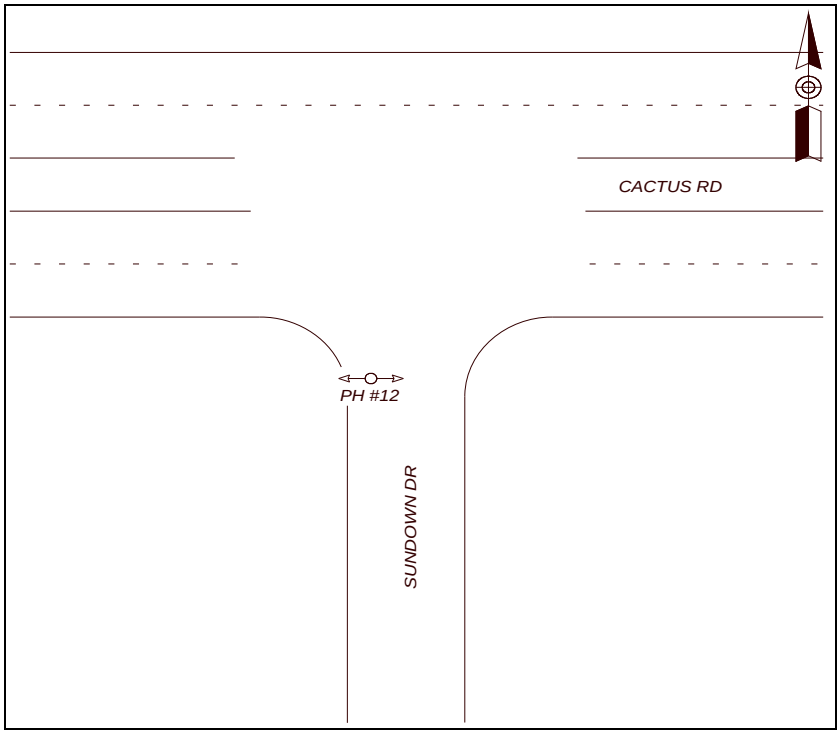
13PB031 Addendum #2 ATTACHMENT #1

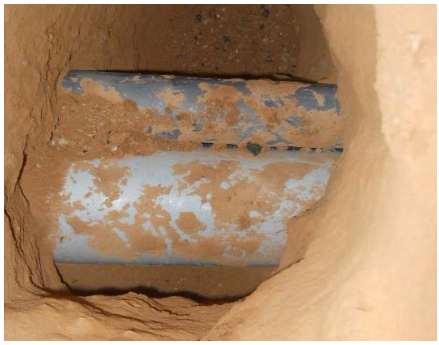
TEST HOLE DATA REPORT

Test Hole #	12	SUE Crew	J. Garcia
Date Dug	3/20/2012	Truck #	558
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	Cactus Rd and Sundown Dr		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE





REGISTERED LAND SURVEYOR
CERTIFICATE NO.
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ARIZONA, U.S.A.

EXPIRES 09/30/2012

SITE BENCHMARK

BM#1 = BCFL @ Miller Rd and Shea Blvd
Elev = 1354.84

RIBBON COLOR Red/Orange

CROSS SECTION - NOT TO SCALE

FACING East

SURFACE ELEVATION	1389.81	WIDTH/O.D. 7"	
TOP ELEVATION	1387.99		1.82 TOP DEPTH (FEET)
BOTTOM ELEVATION	1387.61		2.20 BOTTOM (FEET)

COORDINATES: NORTHING 944544.90 EASTING 701383.69

STATIONING: STATION None OFFSET None

PAVING THICKNESS 5" PAVING TYPE Asphalt SOIL CONDITION Dirt

SIZE See Comments TYPE PVC FACILITY OWNER APS/COX

COMMENTS:

Found one 4" and one 2" PVC in a bundle. Blue Stake marks for both APS and COX, joint trench.

PREPARED BY: J. Cherry CHECKED BY: J. Brandt

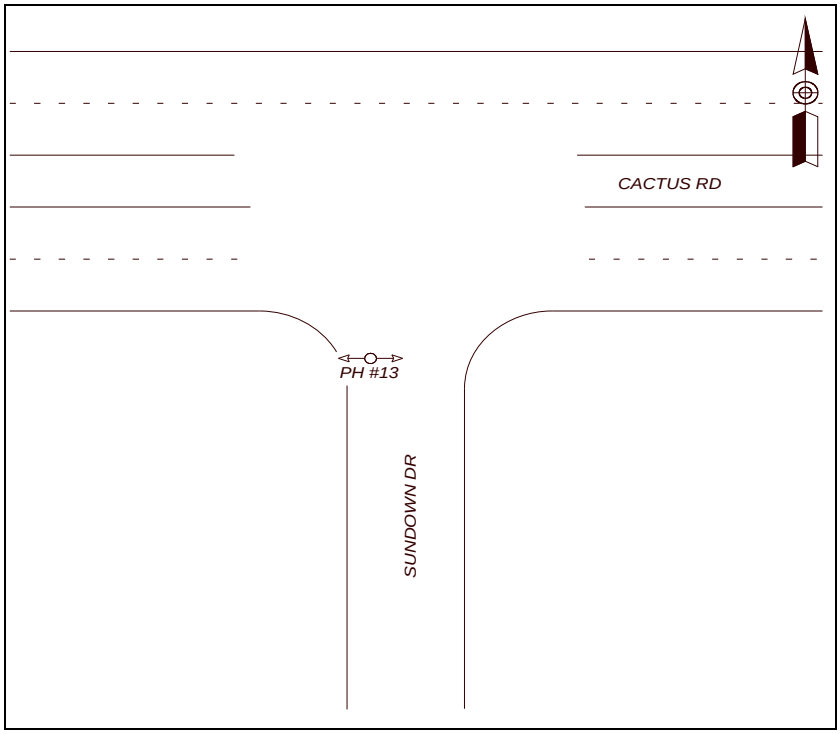
13PB031 Addendum #2 ATTACHMENT #1

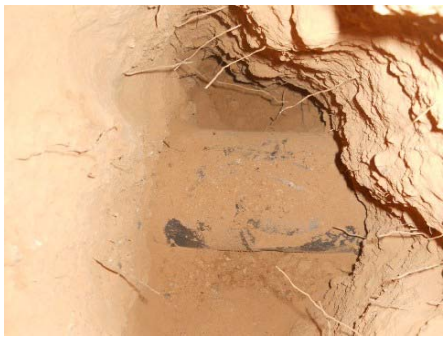
TEST HOLE DATA REPORT

Test Hole #	13	SUE Crew	J. Garcia
Date Dug	3/20/2012	Truck #	558
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	Cactus Rd and Sundown Dr		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE





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EXPIRES 09/30/2012

SITE BENCHMARK

BM#1 = BCFL @ Miller Rd and Shea Blvd
Elev = 1354.84

RIBBON COLOR: Yellow

CROSS SECTION - NOT TO SCALE

FACING: East

SURFACE ELEVATION	1389.60	WIDTH/O.D. 4.5	
TOP ELEVATION	1386.24	3.36	TOP DEPTH (FEET)
BOTTOM ELEVATION	1385.86	3.74	BOTTOM (FEET)

COORDINATES: NORTHING 944552.25 EASTING 701383.72

STATIONING: STATION None OFFSET None

PAVING THICKNESS 5" PAVING TYPE Asphalt SOIL CONDITION Dirt

SIZE 4" TYPE Steel FACILITY OWNER Southwest Gas

COMMENTS:

PREPARED BY: J. Cherry CHECKED BY: J. Brandt

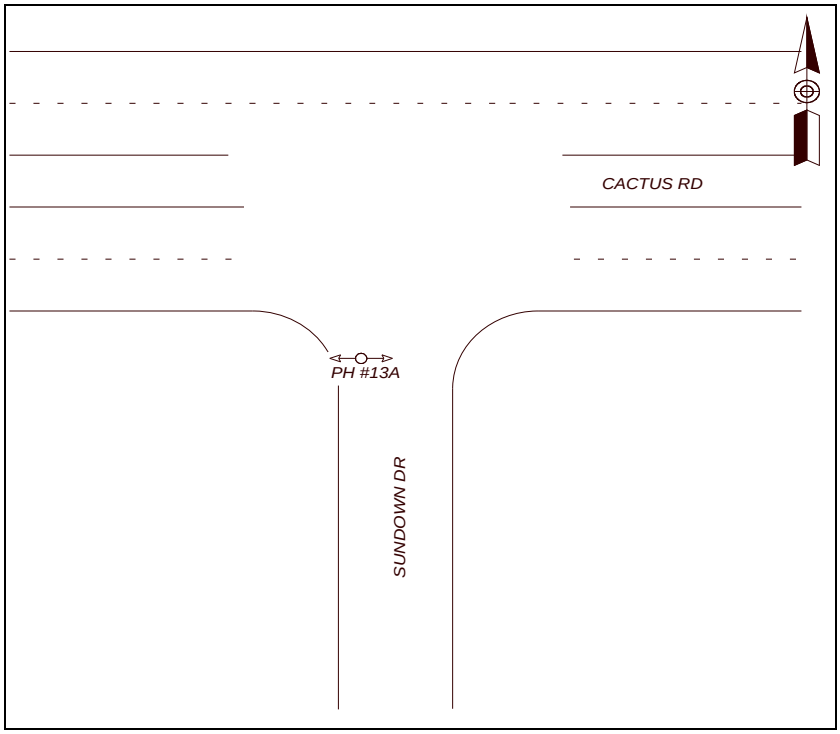
13PB031 Addendum #2 ATTACHMENT #1

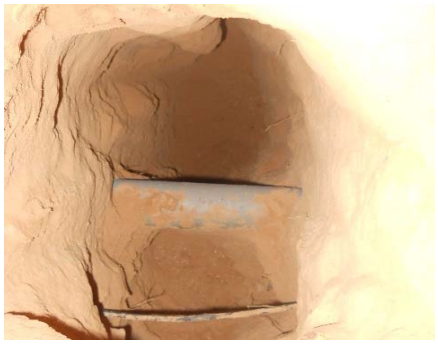
TEST HOLE DATA REPORT

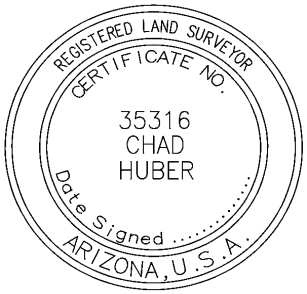
Test Hole #	13A	SUE Crew	J. Garcia
Date Dug	3/20/2012	Truck #	558
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	Cactus Rd and Sundown Dr		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE







EXPIRES 09/30/2012

SITE BENCHMARK

BM#1 = BCFL @ Miller Rd and Shea Blvd
Elev = 1354.84

RIBBON COLOR White

CROSS SECTION - NOT TO SCALE

FACING East

SURFACE ELEVATION	1389.63	WIDTH/O.D. 2.38"	
TOP ELEVATION	1387.13	2.50	TOP DEPTH (FEET)
BOTTOM ELEVATION	1386.93	2.70	BOTTOM (FEET)

COORDINATES: NORTHING 944553.84 EASTING 701383.69

STATIONING: STATION None OFFSET None

PAVING THICKNESS 5" PAVING TYPE Asphalt SOIL CONDITION Dirt

SIZE 2" TYPE PVC FACILITY OWNER Unknown

COMMENTS:

PREPARED BY: J. Cherry CHECKED BY: J. Brandt

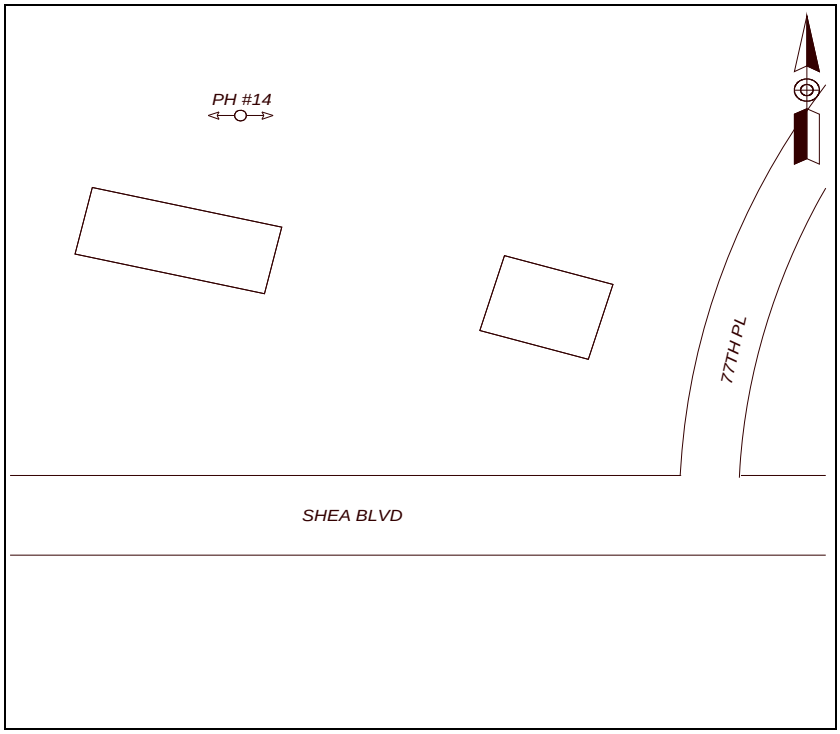
13PB031 Addendum #2 ATTACHMENT #1

TEST HOLE DATA REPORT

Test Hole #	14	SUE Crew	Z. Jubie
Date Dug	3/20/2012	Truck #	320
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	77th Pl and Shea Blvd		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE



REGISTERED LAND SURVEYOR
CERTIFICATE NO.
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ARIZONA, U.S.A.

EXPIRES 09/30/2012

SITE BENCHMARK
BM#1 = BCFL @ Miller Rd and Shea Blvd Elev = 1354.84
RIBBON COLOR: Blue

CROSS SECTION - NOT TO SCALE

FACING: East

SURFACE ELEVATION	1354.96	WIDTH/O.D. 4.81"	
TOP ELEVATION	1351.64	3.32	TOP DEPTH (FEET)
BOTTOM ELEVATION	1351.24	3.72	BOTTOM (FEET)

COORDINATES: NORTHING 939578.04 EASTING 700438.16

STATIONING: STATION None OFFSET None

PAVING THICKNESS None PAVING TYPE None SOIL CONDITION Dirt

SIZE 4" TYPE ACP FACILITY OWNER City of Scottsdale Water

COMMENTS:

PREPARED BY: J. Cherry CHECKED BY: J. Brandt

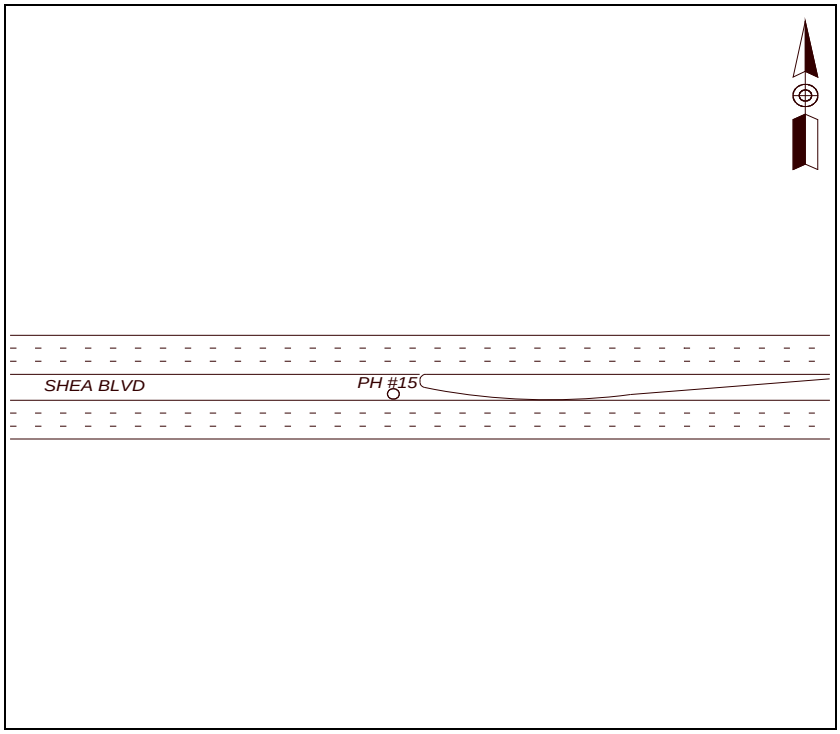
13PB031 Addendum #2 ATTACHMENT #1

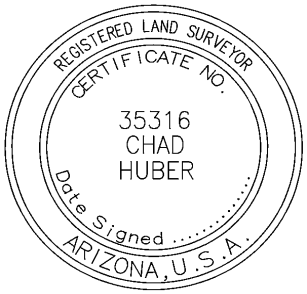
TEST HOLE DATA REPORT

Test Hole #	15	SUE Crew	J. Garcia
Date Dug	3/26/2012	Truck #	558
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	Shea Blvd west of Hayden Rd.		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE





EXPIRES 09/30/2012

SITE BENCHMARK

BM#1 = BCFL @ Miller Rd and Shea Blvd
Elev = 1354.84

RIBBON COLOR

CROSS SECTION - NOT TO SCALE

FACING

SURFACE ELEVATION		WIDTH/O.D.	
TOP ELEVATION	0.00		TOP DEPTH (FEET)
BOTTOM ELEVATION	-8.72	8.72	BOTTOM (FEET)

COORDINATES: NORTHING None EASTING None

STATIONING: STATION None OFFSET None

PAVING THICKNESS 5" PAVING TYPE Asphalt SOIL CONDITION

SIZE None TYPE None FACILITY OWNER None

COMMENTS:

Dug to a depth of 8.72' in the requested location and no facility was found.

PREPARED BY: J. Cherry CHECKED BY: J. Brandt

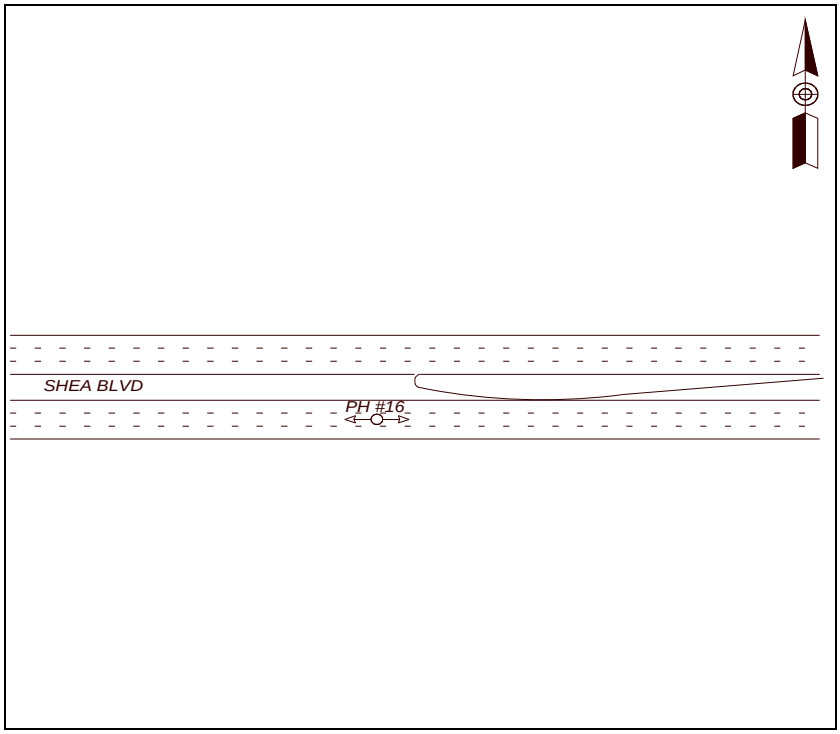
13PB031 Addendum #2 ATTACHMENT #1

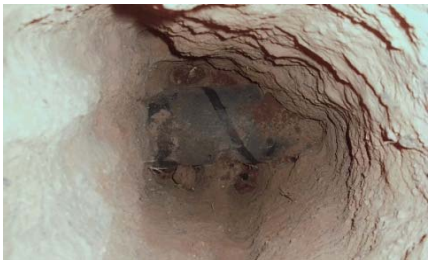
TEST HOLE DATA REPORT

Test Hole #	16	SUE Crew	J. Garcia
Date Dug	3/26/2012	Truck #	558
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	Shea Blvd west of Hayden Rd		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE





REGISTERED LAND SURVEYOR
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EXPIRES 09/30/2012

SITE BENCHMARK

BM#1 = BCFL @ Miller Rd and Shea Blvd
Elev = 1354.84

RIBBON COLOR Yellow

CROSS SECTION - NOT TO SCALE

FACING East

SURFACE ELEVATION	1357.56	WIDTH/O.D. 4.5"	
TOP ELEVATION	1352.64	4.92	TOP DEPTH (FEET)
BOTTOM ELEVATION	1357.56		BOTTOM (FEET)

COORDINATES: NORTHING 939270.52 EASTING 701921.85

STATIONING: STATION None OFFSET None

PAVING THICKNESS 5" PAVING TYPE Asphalt SOIL CONDITION Dirt

SIZE 4" TYPE Steel FACILITY OWNER Southwest Gas

COMMENTS:

PREPARED BY: J. Cherry CHECKED BY: J. Brandt

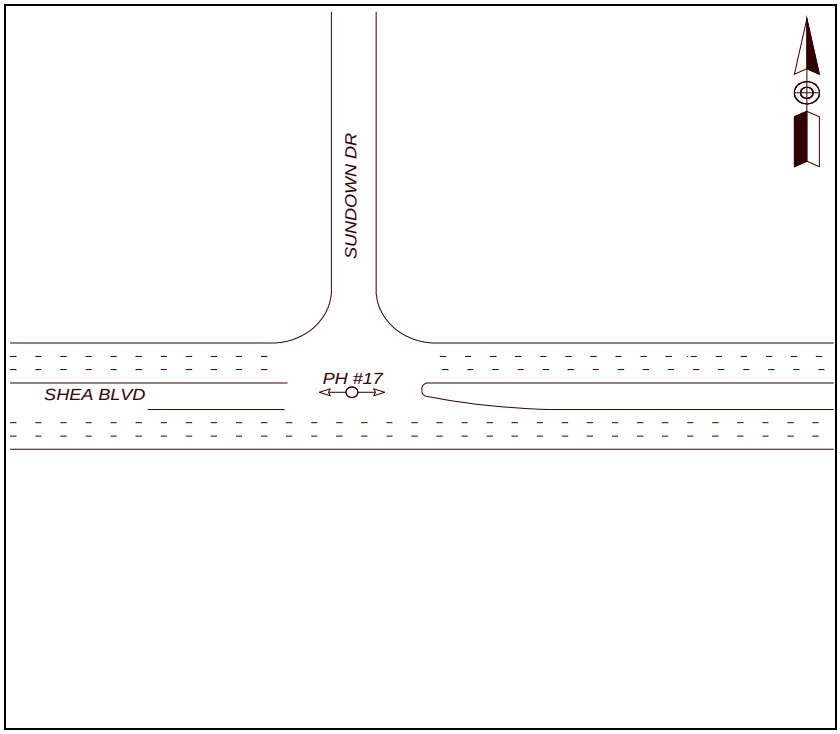
13PB031 Addendum #2 ATTACHMENT #1

TEST HOLE DATA REPORT

Test Hole #	17	SUE Crew	J. Garcia
Date Dug	3/26/2012	Truck #	558
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	Shea Blvd and Sundown Dr		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE



REGISTERED LAND SURVEYOR
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EXPIRES 09/30/2012

SITE BENCHMARK	CROSS SECTION - NOT TO SCALE
BM#1 = BCFL @ Miller Rd and Shea Blvd Elev = 1354.84	FACING: East SURFACE ELEVATION: 1354.98 WIDTH/O.D.: 4" TOP ELEVATION: 1350.40 — 4.58 TOP DEPTH (FEET) BOTTOM ELEVATION: 1350.26 — 4.72 BOTTOM (FEET)
RIBBON COLOR: Orange	

COORDINATES: NORTHING 939313.44 EASTING 700047.96

STATIONING: STATION None OFFSET None

PAVING THICKNESS 4" PAVING TYPE Asphalt SOIL CONDITION Dirt

SIZE Two 1.25" TYPE PE FACILITY OWNER City of Scottsdale Fiber Optic

COMMENTS:

PREPARED BY: J. Cherry CHECKED BY: J. Brandt

Testhole Data Summary

AZTEC www.aztec.us TYPSA group

Date: 6/6/2012

Project Number: AZU1206-001

Project Name: Southwest Waterline Upgrades

EXPIRES 09/30/2012

TH #	Location	Date of Excavation	Utility Owner	Utility Size	Utility Description	Coordinates		Stationing		Ground Elevation	Top Elevation	Bottom Elevation	Depth of Cover	Comments
						Northing	Easting	Stationing	Offset					
1	Sundown Drive & Shea Boulevard	6/4/2012	City of Scottsdale Water	12"	ACP	939288.45	700049.45	None	None	1355.15	1349.71	1348.55	5.44	(listed as 21 on plan set)
2	Sundown Drive north of Shea Boulevard	6/4/2012	City of Scottsdale Water	8"	DIP	942286.30	701134.79	None	None	1373.05	1371.45	1370.70	1.60	
2A	Sundown Drive north of Shea Boulevard	6/4/2012	City of Scottsdale Water	6"	DIP	942286.30	701134.79	None	None	1373.05	1370.45	1369.87	2.60	Found in same hole as #2.
4	77th Place north of Shea Boulevard	6/1/2012	City of Scottsdale Water	8"	ACP	939574.59	700907.95	None	None	1356.26	1352.02	1351.26	4.24	
5	77th Place north of Shea Boulevard	6/4/2012	City of Scottsdale Water	4"	CIP	939569.72	700908.39	None	None	1356.13	1351.83	1351.41	4.30	
5A	77th Place north of Shea Boulevard	6/4/2012	Century Link	2"	PE	939568.36	700907.62	None	None	1355.95	1352.75	1352.58	3.20	
5B	77th Place north of Shea Boulevard	6/4/2012	Arizona Public Service	Three 1"	PE	939568.76	700907.29	None	None	1355.88	1350.76	1350.68	5.12	
6	Shea Boulevard west of Hayden Road	6/4/2012	City of Scottsdale Water	None	None	939267.36	701921.38	None	None	1356.78		1349.78		Dug to a depth of 7 ft in the requested location and no facility was found.

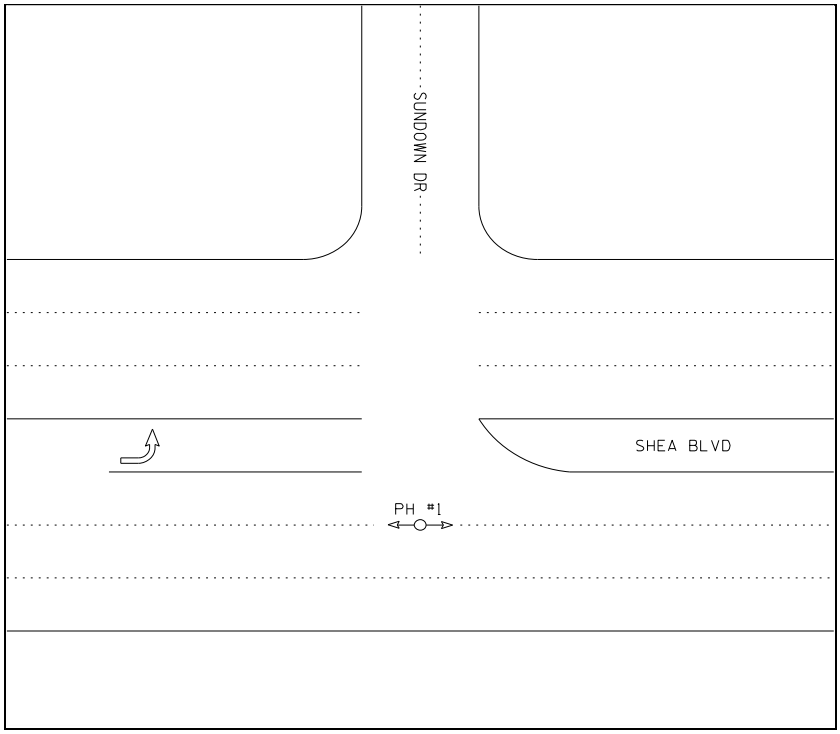
13PB031 Addendum #2 ATTACHMENT #1

TEST HOLE DATA REPORT

Test Hole #	1	SUE Crew	J. Garcia
Date Dug	6/4/2012	Truck #	558
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	Sundown Drive & Shea Boulevard		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE



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EXPIRES 09/30/2012

SITE BENCHMARK

BM#1 = BCFL @ MILLER RD AND SHEA BLVD

ELEV. = 1354.84

CROSS SECTION - NOT TO SCALE

FACING: West

SURFACE ELEVATION	1355.15	WIDTH/O.D. 13.92"	
TOP ELEVATION	1349.71	5.44	TOP DEPTH (FEET)
BOTTOM ELEVATION	1348.55	6.60	BOTTOM (FEET)

RIBBON COLOR: Blue

COORDINATES: NORTHING 939288.45 EASTING 700049.45

STATIONING: STATION None OFFSET None

PAVING THICKNESS 4" PAVING TYPE Asphalt SOIL CONDITION Dirt

SIZE 12" TYPE ACP FACILITY OWNER City of Scottsdale Water

COMMENTS:

PREPARED BY: M. Huber CHECKED BY: A. Mehler

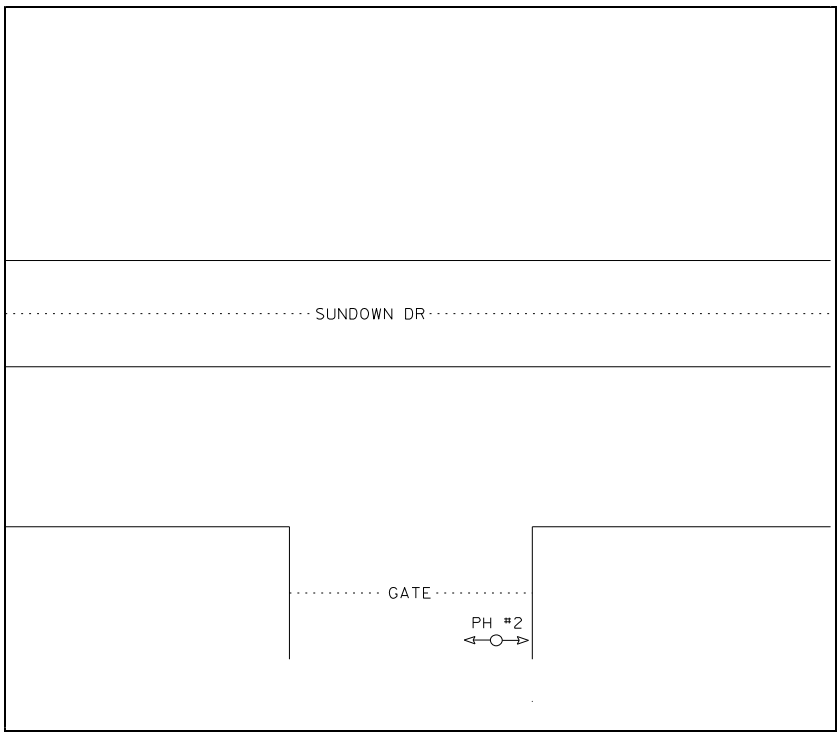
13PB031 Addendum #2 ATTACHMENT #1

TEST HOLE DATA REPORT

Test Hole #	2	SUE Crew	Z. Jubie
Date Dug	6/4/2012	Truck #	557
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	Sundown Drive north of Shea Boulevard		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE



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EXPIRES 09/30/2012

SITE BENCHMARK

BM#1 = BCFL @ MILLER RD AND SHEA BLVD

ELEV. = 1354.84

RIBBON COLOR Blue

CROSS SECTION - NOT TO SCALE

FACING East

SURFACE ELEVATION	1373.05	WIDTH/O.D. 9.05"	
TOP ELEVATION	1371.45	1.60	TOP DEPTH (FEET)
BOTTOM ELEVATION	1370.70	2.35	BOTTOM (FEET)

COORDINATES: NORTHING 942286.30 EASTING 701134.79

STATIONING: STATION None OFFSET None

PAVING THICKNESS None PAVING TYPE None SOIL CONDITION Dirt / Rocks

SIZE 8" TYPE DIP FACILITY OWNER City of Scottsdale Water

COMMENTS:

PREPARED BY: M. Huber CHECKED BY: A. Mehler

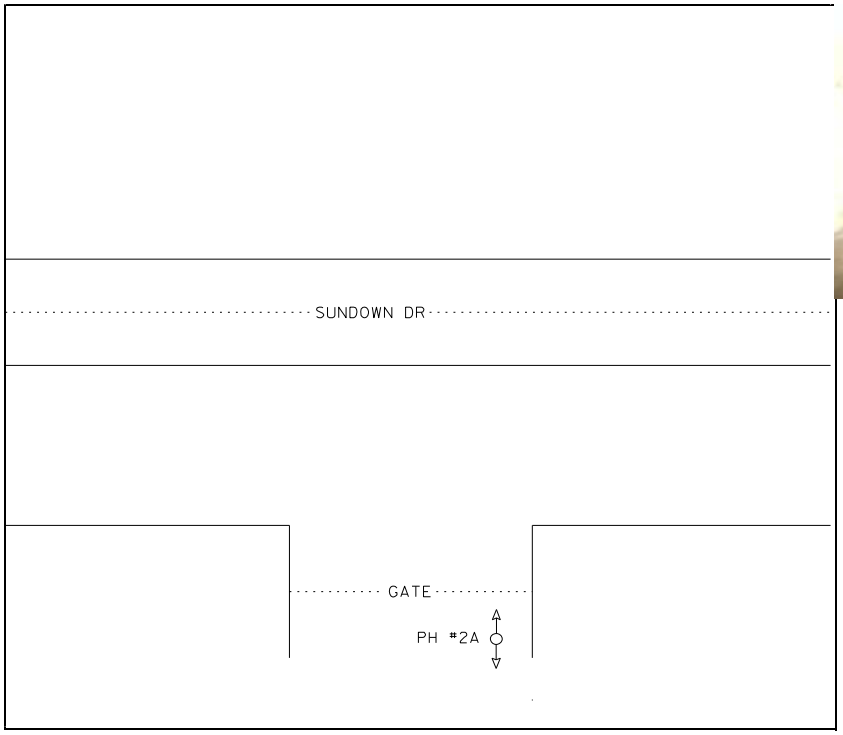
13PB031 Addendum #2 ATTACHMENT #1

TEST HOLE DATA REPORT

Test Hole #	2A	SUE Crew	Z. Jubie
Date Dug	6/4/2012	Truck #	557
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	Sundown Drive north of Shea Boulevard		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE



REGISTERED LAND SURVEYOR
CERTIFICATE NO.
35316
CHAD
HUBER
Date Signed
ARIZONA, U.S.A.

EXPIRES 09/30/2012

SITE BENCHMARK

BM#1 = BCFL @ MILLER RD AND SHEA BLVD

ELEV. = 1354.84

RIBBON COLOR

CROSS SECTION - NOT TO SCALE

FACING: North

SURFACE ELEVATION	1373.05	WIDTH/O.D. 6.9"	
TOP ELEVATION	1370.45	2.60	TOP DEPTH (FEET)
BOTTOM ELEVATION	1369.87	3.18	BOTTOM (FEET)

COORDINATES: NORTHING 942286.30 EASTING 701134.79

STATIONING: STATION None OFFSET None

PAVING THICKNESS None PAVING TYPE None SOIL CONDITION Dirt / Rocks

SIZE 6" TYPE DIP FACILITY OWNER City of Scottsdale Water

COMMENTS:

Found in same hole as #2.

PREPARED BY: M. Huber CHECKED BY: A. Mehler

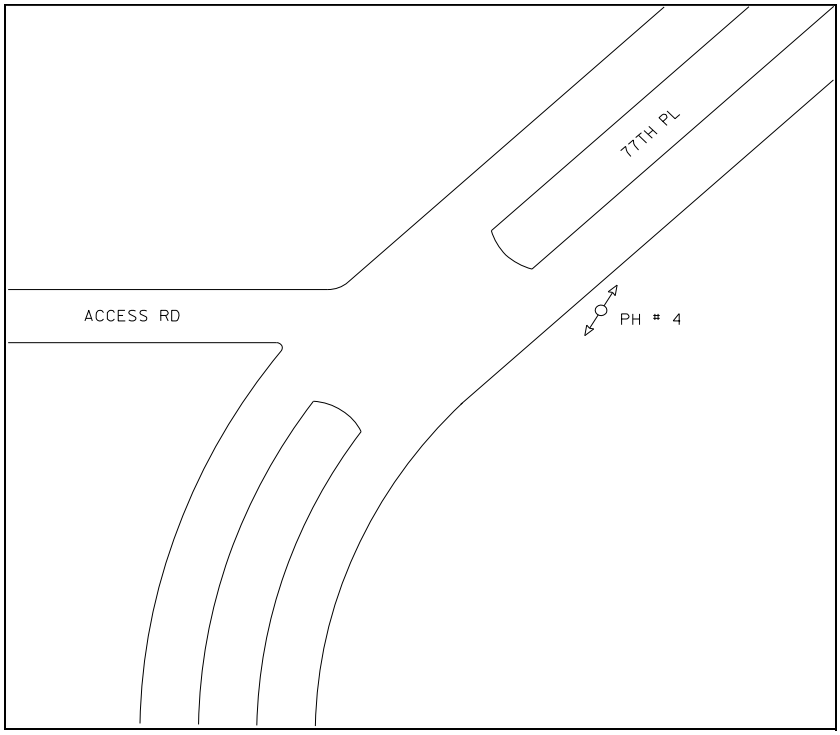
13PB031 Addendum #2 ATTACHMENT #1

TEST HOLE DATA REPORT

Test Hole #	4	SUE Crew	Z. Jubie
Date Dug	6/1/2012	Truck #	557
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	77th Place north of Shea Boulevard		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE



REGISTERED LAND SURVEYOR
CERTIFICATE NO.
35316
CHAD
HUBER
Date Signed .....
ARIZONA, U.S.A.

EXPIRES 09/30/2012

SITE BENCHMARK	CROSS SECTION - NOT TO SCALE			
BM#1 = BCFL @ MILLER RD AND SHEA BLVD	FACING	South		
ELEV. = 1354.84	SURFACE ELEVATION	1356.26	WIDTH/O.D. 9.11"	
	TOP ELEVATION	1352.02	4.24	TOP DEPTH (FEET)
	BOTTOM ELEVATION	1351.26	5.00	BOTTOM (FEET)
RIBBON COLOR White Paint				

COORDINATES:	NORTHING	939574.59	EASTING	700907.95	
STATIONING:	STATION	None	OFFSET	None	
PAVING THICKNESS	3"	PAVING TYPE	Concrete	SOIL CONDITION	Dirt
SIZE	8"	TYPE	ACP	FACILITY OWNER	City of Scottsdale Water

COMMENTS:

PREPARED BY: M. Huber CHECKED BY: A. Mehler

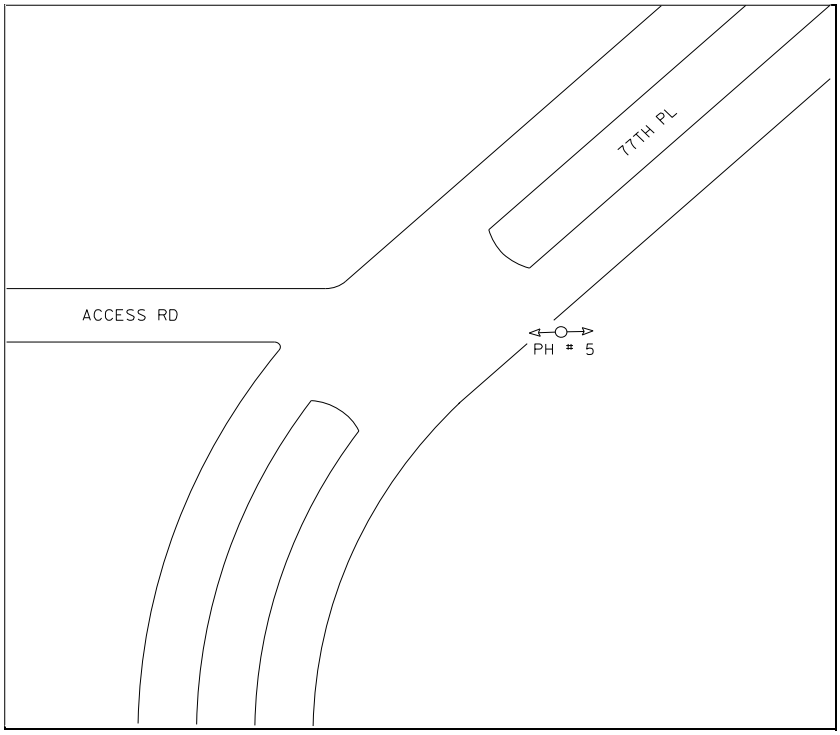
13PB031 Addendum #2 ATTACHMENT #1

TEST HOLE DATA REPORT

Test Hole #	5	SUE Crew	J. Garcia
Date Dug	6/4/2012	Truck #	558
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	77th Place north of Shea Boulevard		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE



N

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
35316
CHAD
HUBER
Date Signed .....
ARIZONA, U.S.A.

EXPIRES 09/30/2012

SITE BENCHMARK	CROSS SECTION - NOT TO SCALE			
BM#1 = BCFL @ MILLER RD AND SHEA BLVD	FACING	East		
ELEV. = 1354.84	SURFACE ELEVATION	1356.13	WIDTH/O.D. 5"	
	TOP ELEVATION	1351.83	4.30	TOP DEPTH (FEET)
	BOTTOM ELEVATION	1351.41	4.72	BOTTOM (FEET)
RIBBON COLOR Blue				

COORDINATES: NORTHING 939569.72 EASTING 700908.39

STATIONING: STATION None OFFSET None

PAVING THICKNESS None PAVING TYPE None SOIL CONDITION Dirt

SIZE 4" TYPE CIP FACILITY OWNER City of Scottsdale Water

COMMENTS:

PREPARED BY: M. Huber CHECKED BY: A. Mehler

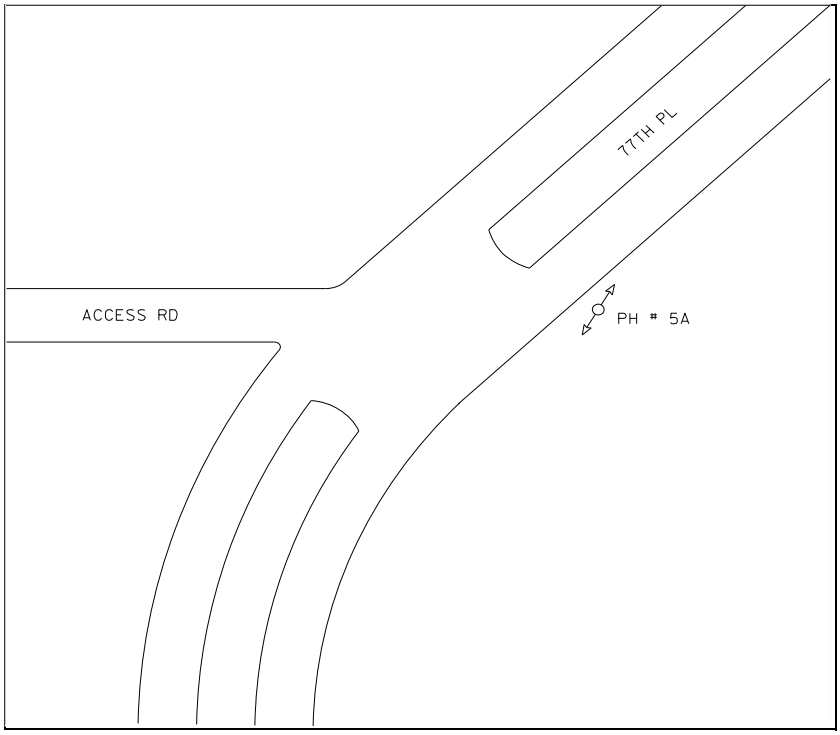
13PB031 Addendum #2 ATTACHMENT #1

TEST HOLE DATA REPORT

AZTEC
www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

Test Hole #	5A	SUE Crew	J. Garcia
Date Dug	6/4/2012	Truck #	558
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	77th Place north of Shea Boulevard		

LOCATION PLAN - NOT TO SCALE



N

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
35316
CHAD
HUBER
Date Signed .....
ARIZONA, U.S.A.

EXPIRES 09/30/2012

SITE BENCHMARK	CROSS SECTION - NOT TO SCALE
BM#1 = BCFL @ MILLER RD AND SHEA BLVD ELEV. = 1354.84	FACING: North SURFACE ELEVATION: 1355.95 WIDTH/O.D.: 2" TOP ELEVATION: 1352.75 — 3.20 TOP DEPTH (FEET) BOTTOM ELEVATION: 1352.58 — 3.37 BOTTOM (FEET)
RIBBON COLOR: Orange	

COORDINATES: NORTHING 939568.36 EASTING 700907.62

STATIONING: STATION None OFFSET None

PAVING THICKNESS None PAVING TYPE None SOIL CONDITION Dirt

SIZE 2" TYPE PE FACILITY OWNER Century Link

COMMENTS:

PREPARED BY: M. Huber CHECKED BY: A. Mehler

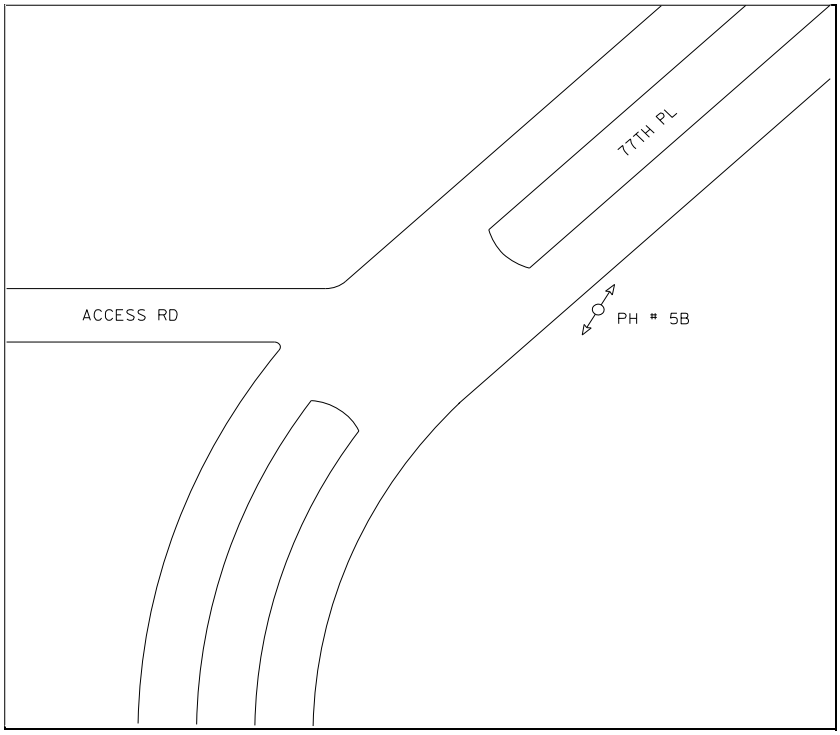
13PB031 Addendum #2 ATTACHMENT #1

TEST HOLE DATA REPORT

Test Hole #	5B	SUE Crew	J. Garcia
Date Dug	6/4/2012	Truck #	558
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	77th Place north of Shea Boulevard		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE



REGISTERED LAND SURVEYOR
CERTIFICATE NO.
35316
CHAD
HUBER
Date Signed .....
ARIZONA, U.S.A.

EXPIRES 09/30/2012

SITE BENCHMARK	CROSS SECTION - NOT TO SCALE			
BM#1 = BCFL @ MILLER RD AND SHEA BLVD	FACING	North		
ELEV. = 1354.84	SURFACE ELEVATION	1355.88	WIDTH/O.D. 8"	
	TOP ELEVATION	1350.76	5.12	TOP DEPTH (FEET)
	BOTTOM ELEVATION	1350.68	5.20	BOTTOM (FEET)
RIBBON COLOR Red				

COORDINATES: NORTHING 939568.76 EASTING 700907.29

STATIONING: STATION None OFFSET None

PAVING THICKNESS None PAVING TYPE None SOIL CONDITION Dirt

SIZE Three 1" TYPE PE FACILITY OWNER Arizona Public Service

COMMENTS:

PREPARED BY: M. Huber CHECKED BY: A. Mehler

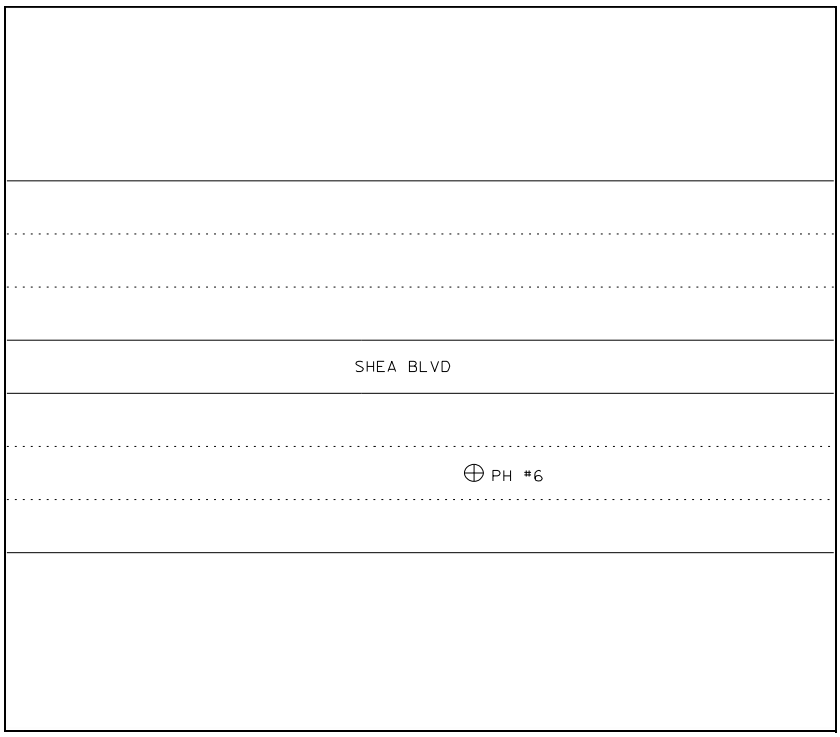
13PB031 Addendum #2 ATTACHMENT #1

TEST HOLE DATA REPORT

Test Hole #	6	SUE Crew	J. Garcia
Date Dug	6/4/2012	Truck #	558
Project #	AZU1206	City	Scottsdale
Phase #	001	County	Maricopa
Location	Shea Boulevard west of Hayden Road		

AZTEC www.aztec.us TYPSA group
4561 East McDowell Road, Phoenix, AZ 85008-4504
Tel. (602) 454-0402 Fax. (602) 458-9359

LOCATION PLAN - NOT TO SCALE



REGISTERED LAND SURVEYOR
CERTIFICATE NO.
35316
CHAD
HUBER
Date Signed .....
ARIZONA, U.S.A.

EXPIRES 09/30/2012

SITE BENCHMARK	CROSS SECTION - NOT TO SCALE		
BM#1 = BCFL @ MILLER RD AND SHEA BLVD	FACING		
ELEV. = 1354.84	SURFACE ELEVATION	1356.78	WIDTH/O.D.
	TOP ELEVATION		TOP DEPTH (FEET)
	BOTTOM ELEVATION	1349.78	7.00 BOTTOM (FEET)
RIBBON COLOR None			

COORDINATES: NORTHING 939267.36 EASTING 701921.38

STATIONING: STATION None OFFSET None

PAVING THICKNESS 4" PAVING TYPE Asphalt SOIL CONDITION Dirt

SIZE None TYPE None FACILITY OWNER City of Scottsdale Water

COMMENTS:

Dug to a depth of 7 ft in the requested location and no facility was found.

PREPARED BY: M. Huber CHECKED BY: A. Mehler

Ninyo & Moore
Geotechnical and Environmental Sciences Consultants

GEOTECHNICAL EVALUATION
56TH STREET AND THOMAS ROAD
WATERLINE IMPROVEMENTS
SCOTTSDALE, ARIZONA

PREPARED FOR:
GHD, Inc.
7600 North 16th Street, Suite 205
Phoenix, Arizona 85020-4447

PREPARED BY:
Ninyo & Moore
Geotechnical and Environmental Sciences Consultants
3202 East Harbour Drive
Phoenix, Arizona 85034

April 26, 2012
Project No. 603635001

Ninyo & Moore
Geotechnical and Environmental Sciences Consultants

April 26, 2012
Project No. 603635001

Mr. Bill D. Roberts
GHD, Inc.
7600 North 16th Street, Suite 205
Phoenix, Arizona 85020-4447

Subject: Geotechnical Evaluation
56th Street and Thomas Road Waterline Improvements
Scottsdale, Arizona

Dear Mr. Roberts:

In accordance with our proposal dated August 24, 2011, and your authorization, Ninyo & Moore has performed a geotechnical evaluation for the above-referenced site. The attached report presents our methodology, findings, conclusions, and recommendations regarding the geotechnical conditions at the project site.

We appreciate the opportunity to be of service to you during this phase of the project.

Sincerely,
NINYO & MOORE

REGISTERED GEOLOGIST
CERTIFICATE NO.
49080
JEFFREY
RODGERS
Date Signed 4-26-12
ARIZONA, U.S.A.

Jeffrey S. Rodgers, RG
Project Geologist
EXPIRES: 03/31/15

Registered Professional Engineer (Civil)
CERTIFICATE NO.
41716
KEVIN L.
PORTER
Date Signed 4-26-12
ARIZONA U.S.A.

Kevin L. Porter, PE
Senior Engineer
EXPIRES 12/31/13

JSR/HAH/KLP/clj

Distribution: (1) Addressee – Electronic Copy

TABLE OF CONTENTS

1. INTRODUCTION

In accordance with our proposal dated August 24, 2011, and your authorization, we have performed a geotechnical evaluation for the proposed 56th Street and Thomas Road Waterline Improvements project in Scottsdale, Arizona. The purpose of our evaluation was to assess the subsurface conditions at the site in order to formulate geotechnical recommendations for design and construction of the project. This report presents the results of our evaluation, conclusions, and recommendations regarding the proposed construction.

2. SCOPE OF SERVICES

The scope of our services for the project included the following:

- Reviewing readily available aerial photographs, and published geologic literature, including maps and reports pertaining to the project site and vicinity.
- Conducting a visual reconnaissance of the project area and marking out boring locations based on the drawings provided by GHD, Inc., and notifying Arizona Blue Stake of the boring locations prior to drilling.
- Drilling, logging, and sampling two small-diameter exploratory borings to depths of approximately 10 feet below ground surface (bgs). The boring logs are presented in Appendix A.
- Performing laboratory tests on selected samples obtained from the borings to evaluate in-situ moisture content and dry density, gradation analysis, Atterberg limits, and corrosivity characteristics (including pH, minimum electrical resistivity, and soluble sulfates, and chloride contents). The results of the laboratory testing are presented on the boring logs and/or in Appendix B.
- Preparing this report presenting our findings, conclusions, and recommendations regarding the design and construction of the project.

Our scope of services did not include environmental consulting services such as hazardous waste sampling or analytical testing at the site. A detailed scope of services and estimated fee for such services can be provided upon request.

3. SITE DESCRIPTION

The project site is located in Section 33 of Township 2 North, Range 4 East in Scottsdale, Arizona. The approximate location of the site is depicted on Figure 1. The project alignment generally traverses along Edgemont Avenue, 58th Street, Cambridge Avenue, and 56th Place. At the time of our evaluation, the project alignment traversed along paved roadways surrounded by residential development. The Papago Military Reservation is approximately ¼-mile south of the site.

According to the *Tempe, Arizona-Maricopa Co., 7.5-Minute United States Geological Survey (USGS) Topographic Quadrangle Map (1982),* the elevation along the planned pipeline alignment ranges from approximately 1,270 to 1,275 feet relative to mean sea level (MSL). Based on the information from this quadrangle map the project site slopes from the southeast down to the northwest.

Seven aerial photographs from the Flood Control District of Maricopa County were reviewed for this project. Aerial photographs from 1937 and 1949 depicted the site as undeveloped desert land dissected with northwest traversing natural drainages. A 1959 photograph depicted Edgemont Avenue, 58th Street, Cambridge Avenue, and 56th Place as paved residential roadways with scattered residential structures adjacent to the roadways. An aerial photograph from 1969 depicted an increase in residential development at the site. Photographs from 1979, 2001, and 2009 depicted an increase in residential and commercial development around the project site, and depicted the site as being similar to its current condition.

4. PROPOSED CONSTRUCTION

The project consists of the design and construction of a new pressurized 8-inch diameter ductile-iron pipe (DIP) waterline. Based on plans from GHD Inc., the invert elevation will be on the order of 10 feet bgs or less, and will be installed using traditional cut-and-cover techniques. We understand that the pavement over the trench will be restored to match the existing pavement on site.

5. FIELD EXPLORATION AND LABORATORY TESTING

On March 26, 2012, Ninyo & Moore conducted a subsurface exploration at the site in order to observe the existing subsurface conditions and to collect soil samples for laboratory testing. Our exploration consisted of the drilling, logging, and sampling of two small-diameter borings, denoted as B-1 and B-2. The borings were advanced using a Diedrich D-50 truck-mounted drill rig equipped with hollow-stem augers and extended to depths of approximately 9 feet bgs. The approximate locations of our borings are presented on Figure 2. Bulk and relatively undisturbed soil samples were collected at selected intervals. Detailed descriptions of the soils encountered are presented on the boring logs in Appendix A.

Ninyo & Moore personnel logged the borings in general accordance with the Unified Soil Classification System (USCS) and American Society for Testing and Materials (ASTM) D 2488 by observing cuttings and drive samples. Collected ring samples were trimmed in the field, wrapped in plastic bags, and placed in cylindrical plastic containers to retain in-place moisture conditions. Similarly, the Standard Penetration Test (SPT) and bulk samples were sealed in plastic bags to retain their approximate in-place moisture.

The soil samples collected from our drilling activities were transported to the Ninyo & Moore laboratory in Phoenix, Arizona for geotechnical laboratory testing. The testing included in-situ moisture content and dry density, gradation analysis, Atterberg limits, and corrosivity characteristics (including pH, minimum electrical resistivity, and soluble sulfate, and chloride content). The results of the in-situ moisture content and dry density testing are presented on the boring logs in Appendix A. A description of each laboratory test method and the remainder of the test results are presented in Appendix B.

6. GEOLOGY AND SUBSURFACE CONDITIONS

The geology and subsurface conditions at the site are described in the following sections.

6.1. Geologic Setting

The project site is located in the Sonoran Desert Section of the Basin and Range physiographic province, which is typified by broad alluvial valleys separated by steep, discontinuous, sub parallel mountain ranges. The mountain ranges generally trend north-south and northwest-southeast. The basin floors consist of alluvium with thickness extending to several thousands of feet.

The basins and surrounding mountains were formed approximately 10 to 18 million years ago during the mid- to late-Tertiary. Extensional tectonics resulted in the formation of horsts (mountains) and grabens (basins) with vertical displacement along high-angle normal faults. Intermittent volcanic activity also occurred during this time. The surrounding basins filled with alluvium from the erosion of the surrounding mountains as well as from deposition from rivers. Coarser-grained alluvial material was deposited at the margins of the basins near the mountains.

The surficial geology of the site generally consists of Holocene-age (less than 10,000 years) to Late Pleistocene-age (approximately 2 million years) alluvial fan and basin fill deposits that generally consist of clay, silt, and sand and gravel. Stage III (coated grain size) to Stage V (calcic cemented layers) caliche nodules and cementation have been described in these soils (Pearthree, 1994). Fanglomerate bedrock associated with the Papago Buttes has been mapped near the project site, and while not encountered at the surface or within our borings, it may underlie the project site in some areas along the alignment.

6.2. Subsurface Conditions

Our knowledge of the subsurface conditions at the project site is based on our field exploration and laboratory testing, and our understanding of the general geology of the area. The following sections provide generalized descriptions of the materials encountered. More detailed descriptions are presented on the boring logs in Appendix A.

6.2.1. Asphalt Concrete and Aggregate Base

Asphalt concrete (AC) was encountered at the surface of our borings and was approximately 2 inches thick. The AC was underlain by aggregate base (AB) material, which ranged in thickness from approximately 5 to 6.5 inches in our borings.

6.2.2. Fill

Man-placed fill was encountered underlying the pavement section described above in boring B-2. The fill was approximately 2 feet thick and generally consisted of clayey sand in our boring.

6.2.3. Alluvium

Native alluvium was encountered underlying the fill and/or pavement sections described above, and extended to the total explored depth in our borings. The alluvium generally consisted of clayey sand and silty sand in our borings. Elastic silt was observed in some of the silty sand in our borings. Varying amounts of gravel were observed in the alluvial material. In addition, scattered to numerous caliche nodules were observed in our borings.

6.3. Groundwater

Groundwater was not encountered in any of our borings during drilling. Well data provided by the Arizona Department of Water Resources (ADWR) indicates groundwater historically has been encountered at approximately 15 feet bgs. It should be noted that groundwater levels could fluctuate due to seasonal variations, irrigation, groundwater withdrawal or recharge, and in areas adjacent to, and in ephemeral streams, and other factors not apparent at the time of our fieldwork. In addition, due to the geologic conditions at the site, groundwater may be perched on shallow bedrock in the area. Groundwater near the project site has been known historically to be contaminated. An analysis of the groundwater, if encountered, should be conducted for contamination.

6.4. Surface Water

Based on the information presented on the Federal Emergency Management Agency (FEMA) Online Map Viewer, the pipe alignment lies within flood zone AO with a small segment being within Zone X, which is described as an area with 0.2 percent or more chance of flooding each year, in the form of sheet flow with average depths less than 1 foot.

As such, surface water flows and/or shallower groundwater levels may be encountered within the project limits during rain events, and may need to be mitigated during construction.

7. GEOLOGIC HAZARDS

The following sections describe potential geologic hazards at the site, including land subsidence and earth fissures, and faulting and seismicity.

7.1. Land Subsidence and Earth Fissures

Groundwater depletion, due to groundwater pumping, has caused land subsidence and earth fissures in numerous alluvial basins in Arizona. It has been estimated that subsidence has affected more than 3,000 square miles and has caused damage to a variety of engineered structures and agricultural land (Schumann and Genualdi, 1986). From 1948 to 1983, excessive groundwater withdrawal has been documented in several alluvial valleys where groundwater levels have been reportedly lowered by up to 500 feet. With such large depletions of groundwater, the alluvium has undergone consolidation resulting in large areas of land subsidence.

In Arizona, earth fissures are generally associated with land subsidence and pose an on-going geologic hazard. Earth fissures generally form near the margins of geomorphic basins where significant amounts of groundwater depletion have occurred. Reportedly, earth fissures have also formed due to tensional stress caused by differential subsidence of the unconsolidated alluvial materials over buried bedrock ridges and irregular bedrock surfaces.

Differential subsidence can also be caused by facies changes within unconsolidated alluvial deposits, also causing tensional stress (Schumann and Genualdi, 1986).

Based on our field reconnaissance, aerial photograph review, and our review of published literature, earth fissures are not underlying, or adjacent to the property. The closest documented earth fissure to the site is approximately 8 miles to the north. While the future occurrence of earth fissures cannot accurately be predicted, it is our opinion that earth fissures are not expected to be a constraint to this project.

7.2. Faulting and Seismicity

The site lies within the Sonoran zone, which is a relatively stable tectonic region located in southwestern Arizona, southeastern California, southern Nevada, and northern Mexico (Euge et al., 1992). This zone is characterized by sparse seismicity and few Quaternary faults. Based on our field observations, review of pertinent geologic data, and analysis of aerial photographs, faults are not located on or adjacent to the property. The closest fault to the site is the Carefree Fault zone, located approximately 20 miles to the northeast of the site (Pearthree, 1998). Approximately 2 meters of displacement has occurred along this fault within middle Pleistocene deposits (<750,000 years), but the upper Pleistocene and Holocene deposits (<250,000 years) are not displaced. Seismic parameters recommended for the design of the proposed improvements are presented in Section 9.2.

8. CONCLUSIONS

Based on the results of our subsurface evaluation, laboratory testing, and data analysis, it is our opinion that the proposed construction is feasible from a geotechnical standpoint, provided that the recommendations of this report are incorporated into the design and construction of the proposed project, as appropriate. Geotechnical considerations include the following:

- In general, the near surface soils are considered to be rippable with heavy-duty excavation equipment in good working condition. However, numerous caliche nodules were encountered in our borings, which may be more difficult to excavate and/or will slow the rate of excavation. In addition, sampler refusal was encountered at depth in our borings.

- Fanglomerate bedrock may be encountered underlying the project alignment at the site. Further evaluation of the depth of bedrock and rippability using geophysical techniques (e.g. seismic refraction surveys) is recommended.

- Due to the heterogeneity of the site soil conditions, sloughing of soils during construction may occur where the alignment crosses existing or relict natural drainages. In addition, fill soils from adjacent utilities may be subject to sloughing due to the new excavations and under the influence of vibration from traffic.

- Pipes and connections to lift stations should be designed with sufficient flexibility to avoid damage at connections due to settlement of backfill.

- We estimate an earthwork (shrinkage) factor of approximately 5 to 15 percent if the on-site soils are re-used as fill.

- Imported soils and soils generated from on-site excavation activities that exhibit a very low- to low expansion potential can generally be used as engineered fill, provided any oversized or heavily cemented materials are either broken down or wasted. Many of the on-site soils observed may meet this criterion.

- Groundwater was not observed in our borings, and depth to groundwater in the area is estimated at 15 feet bgs. However, since the project site is situated in a documented floodplain, the site may be subject to groundwater within the trench zone and/or surface water flow. Depending on the construction schedule and season(s) in which construction takes place, groundwater or surface flows may need to be mitigated during construction.

- Our corrosivity test results suggest that subgrade soils at the site are considered to be corrosive to ferrous metals and the sulfate content of the soils presents a negligible sulfate exposure to concrete. A corrosion specialist should be consulted for recommendations to protect the pipe.

- No geologic hazards were observed adjacent to, or underlying the project site.

9. RECOMMENDATIONS

The following sections present our geotechnical recommendations for the proposed construction. If the proposed construction is changed from that discussed in this report, Ninyo & Moore should be contacted for additional recommendations.

9.1. Earthwork

The following sections provide our earthwork recommendations for this project. In general, the earthwork specifications contained in the Maricopa Association of Governments (MAG), *Uniform Standard Specifications and Details for Public Works Construction*, and/or any City of Scottsdale amendments, are expected to apply, except as noted.

9.1.1. Excavation Characteristics

Our evaluation of the excavation characteristics of the on-site materials is based on the results of two exploratory borings, our site observations, and our experience on similar projects. In our opinion, excavation of the near surface on-site materials can generally be accomplished with heavy-duty earthmoving equipment in good operating condition. However, numerous caliche nodules were observed in our borings, and may be more difficult to excavate and/or slow the rate of excavation depending on the actual degree of cementation encountered during construction. In addition, sample refusal was encountered in our borings. Shallow bedrock could be encountered during excavation. The evaluation of the depth and rippability of the bedrock can be conducted prior to construction using geophysical techniques (e.g. seismic refraction surveys).

Due to the heterogeneous nature of the site, and the wide spacing between our borings, soils different than encountered in our borings should be anticipated during construction.

9.1.2. Temporary Slope Stability

Excavations that are 20 feet deep or less could be constructed using a sloped excavation in accordance with Occupational Safety and Health Administration ([OSHA], 2011) Standards, based on the soil types encountered.

Soils of low cohesion were encountered during our field exploration. Due to the presence of these soils, we recommend that the OSHA soil "*Type C*" be used for the fill and alluvial soils along the alignment. Based on OSHA standards, this corresponds to a

temporary side slope of 1.5:1 (horizontal to vertical), or flatter, in sloped excavations that are less than 20 feet.

Temporary excavations that encounter surface or groundwater seepage may need shoring and/or stabilization by placing sandbags or gravel along the base of the seepage zone. Excavations encountering seepage should be evaluated on a case-by-case basis. Slope stability for trenches deeper than 20 feet should be designed by the contractor's engineer based on alignment-specific soil properties and settlement-sensitive features.

9.1.3. Temporary Shoring

Due to the close proximity of the adjacent roadway and underground utilities, and because of the proposed configurations of the planned excavations, we recommend that a temporary earth retention system be utilized for this project. Temporary earth retention systems may include braced systems, such as trench boxes or shields with internal supports or cantilever systems (e.g. soldier piles and lagging); however, the risk of excessive lateral deflection may render the cantilever shoring system inappropriate for the project.

Braced temporary earth retention systems should be designed using the lateral earth pressure parameters presented on Figure 3, depending on the soil conditions. The recommended design earth pressures are based on the assumptions that the shoring system will be constructed without raising the ground surface elevation behind the shoring system, that there are no surcharge loads, such as soil stockpiles and construction materials, and that no loads act above a 1:1 (horizontal to vertical) plane extending up and back from the dredge line. For earth retention systems subjected to the above-mentioned surcharge loads, the contractor should include the effect of these loads on the design lateral earth pressures.

We anticipate that settlement of the ground surface will occur behind shoring systems during excavation. The amount of settlement depends on the type of shoring system used, the contractor's workmanship, and soil conditions. We recommend that roadways,

utilities, and other structures in the vicinity of the planned excavation be evaluated with regard to foundation support and tolerance to settlement. To reduce the potential for distress to these structures, we recommend that the shoring system be designed to limit the ground settlement behind it to ½-inch or less. Possible causes of settlement that should be addressed include settlement during excavation, construction vibrations, de-watering (if needed), and removal of the shoring system. We recommend that shoring installation be evaluated carefully by the contractor prior to construction and that ground vibration and settlement monitoring be performed during construction.

The contractor should retain a qualified and experienced engineer to design the shoring system. The contractor should evaluate the adequacy of the shoring parameters presented in this report, and make the appropriate modifications for their design. We recommend that the contractor take appropriate measures to protect the workers. OSHA requirements pertaining to workers' safety should be observed.

9.1.4. Protection of Existing Structures/Utilities

Lateral movement of a shored excavation will depend on the type and relative stiffness of the system used and other factors beyond the scope of this study. The shoring designer should perform a deflection analysis for the proposed shoring system. A survey of existing utilities, pavements, and structures adjacent to those portions of the proposed excavation that will be shored should also be performed prior to construction. The purpose of the analysis and survey would be to evaluate the ability of existing structures, pavements, pipelines, or conduits to withstand anticipated horizontal and vertical movements associated with a shored excavation. If movements exceed the tolerance of existing project features (utilities, pavements, structures, etc.), alternative shoring systems employing the at-rest earth pressure, tie-backs, dead-man anchors, or cross bracing may be needed to reduce deflections to acceptable levels. The Contractor should anticipate repairing cracks in pavements adjacent to shored portions of the excavation due to anticipated lateral displacements of the shoring system. Horizontal

and vertical movements of the shoring system should be monitored by a surveyor and the results reviewed by the project Geotechnical Engineer.

9.1.5. Bottom Stability

The proposed excavations are not anticipated to encounter significant groundwater (with the possible exception of surface run-off or perched zones) during construction. Therefore, trench bottom stability problems during construction are generally not anticipated at this site. However, if excavations are located near drainage ditches, or near a known wash, arroyo, or drainage area that are open during a heavy rain event, or near any leaking utilities, the trench material(s) might become saturated and unstable and a dewatering system may be needed for these conditions. Should this occur, remedial measures will be needed.

9.1.6. Construction Dewatering

Stream flow, surface run-off, and perched groundwater will vary seasonally depending on rainfall in the site vicinity. Excavations that do encounter surface run-off (if any) could be dewatered by pumping the water out from the bottom and away from the excavation. However, heavily saturated units or perched groundwater zones, if encountered, may call for more aggressive means of dewatering and consultation with a qualified expert. Discharge of water from the excavations to natural drainage channels may entail securing a special permit. In addition, an evaluation of the water should be conducted prior to discharge.

9.1.7. Grading, Fill Placement, and Compaction

The geotechnical consultant should carefully evaluate any areas of soft or wet soils prior to placement of grade-raise fill or other construction. Drying or overexcavation of some materials may be appropriate.

On-site and imported soils that exhibit relatively low plasticity indices and very low to low expansive potential are generally suitable for re-use as engineered fill. Relatively

low plasticity indices are defined as a plasticity index ([PI] ASTM D 4318) value of 20 or less. Very low to low expansive potential soils are defined as having an expansion index ([EI] per ASTM D 4829) of 50 or less. The Atterberg limits tests performed on selected samples indicated that the samples tested ranged in PI values from 12 to 22. As such, it is our opinion that some of the on-site soils are not suitable for re-use as engineered fill during construction. Additional field sampling and laboratory testing should be conducted by the contractor prior to construction to better evaluate the suitability of on-site soils for re-use as engineered fill.

Suitable fill should not include organic material, construction debris, or other non-soil fill materials. Rock particles and clay lumps should not be larger than 4 inches in dimension. Unsuitable fill material should be disposed of off-site or in non-structural areas.

We recommend that the pipeline be supported on 4 inches, or more, (or 1/12 of the outside diameter of the pipe, whichever is more) of granular material that has particle sizes no more than 1-1/2 inches in diameter, and has 3 to 15 percent passing the No. 200 sieve. This bedding/pipe-zone backfill should extend 1 foot above the pipe crown. Care should be taken not to allow voids to form beneath the pipe (i.e., the pipe haunches should be supported) to avoid damaging the pipeline. This may involve fill placement by hand or small compaction equipment. The bedding/pipe zone should be placed in horizontal lifts no more than approximately 8 inches in loose thickness and compacted by appropriate mechanical methods, to a relative compaction of 95 percent (as evaluated by ASTM D 698) and at a moisture content slightly above laboratory optimum. Pipe Bedding Guidelines are presented on Figure 4.

Following the improvement as described above, and prior to the placement of any new fill, the resulting exposed surface should be carefully evaluated by the geotechnical consultant for the presence of soft, loose or wet native soils. Based on this evaluation, additional remediation, which could include scarification of the exposed surface, may be needed. This additional remediation, if needed, should be addressed by the

geotechnical consultant during the earthwork operations. An earthwork (shrinkage) factor of 5 to 15 percent for the on-site soils is estimated.

Trench backfill zone, as discussed in this report, refers to the zone above the pipe zone/bedding backfill material in the trench. Backfill material in this zone should be moisture-conditioned to within 2 percent of its laboratory optimum and mechanically compacted to a relative compaction of 95 percent as evaluated by ASTM D 698. Lift thickness for backfill will be dependent upon the type of compaction equipment utilized, but should generally be placed in lifts not exceeding 8 inches in loose thickness. Special care should be exercised to avoid damaging the pipe or other structures during the compaction of the backfill. Compaction should be accomplished in a manner that discourages surface water infiltration, as well as conveyance of subsurface moisture due to the intersection of natural drainages along the alignment.

The upper 2-foot zone, located below existing or proposed pavement/flatwork sections, should also be moisture-conditioned to slightly above its laboratory optimum; however, in this zone the material should be mechanically compacted to a relative compaction of 100 percent, for granular backfill, as evaluated by ASTM D 698.

Backfilling should be accomplished by mechanical methods; compaction by flooding or jetting should not be permitted. In addition, particle sizes should not exceed 4 inches in diameter. Generated excavation materials that contain this oversize fraction shall not be used as backfill unless the material meets the criteria given above and/or the oversize fraction has been processed and removed from the material. Imported backfill material, if utilized, should meet the criteria for imported fill as presented in Section 9.1.8 of this report. Pipes and connections to lift stations should be designed with flexibility to avoid damage at connections due to possible settlement of backfill.

9.1.8. Imported Fill Material

Imported fill, if utilized, should consist of granular material with a very low or low expansion potential as discussed in Section 9.1.7. Import material in contact with

ferrous metals should preferably have low corrosion potential (minimum electrical resistivity more than 2,000 ohm-cm, chloride content less than 25 parts per million [ppm]). In lieu of this, corrosion protection techniques (e.g. cathodic protection, pipe wrapping, etc.), can be implemented. Imported material in contact with concrete should have a soluble sulfate content of less than 0.1 percent. The geotechnical consultant should evaluate such materials and details of their placement prior to importation. A corrosion specialist should be consulted for recommendations.

9.1.9. Modulus of Soil Reaction (E')

The modulus of soil reaction (E′) is used to characterize the stiffness of soil backfill placed on the sides of buried pipelines for the purpose of evaluating deflection caused by the weight of the backfill over the pipe. We anticipate that the invert depth of the water line will generally be less than 10 feet bgs. For granular backfill bedding soils for pipes, we recommend using an E′ value of 1,500 pounds per square inch (psi).

9.1.10. Controlled Low Strength Material (CLSM)

It is our opinion that the backfill zone may be filled with either CLSM or acceptable on-site soils. CLSM consists of a fluid, workable mixture of aggregate, Portland cement, and water. The use of CLSM has some advantages:

- A narrower backfill zone can be used, thereby minimizing the quantity of soil to be excavated and possibly reducing disturbance to the near-by traffic;
- Relatively higher E' values may be used (E'= 3,000 psi);
- The support given to the connecting pipes is generally better;
- Because little compaction is needed to place CLSM, there is less risk of damaging the connecting pipes; and
- CLSM can be batched to flow into irregularities in the trench bottom and walls.

The CLSM design mix should be in accordance with the MAG (2011) or Standard Specifications for Public Works Construction (Public Works Standards, Inc. [PWSI],

2009). Additional mix design information can be provided upon request. The 28-day strength of the material should be no less than 50 psi and no more than 120 psi.

Buoyant or uplift forces on the piping should be considered when using CLSM and prudent construction techniques may result in multiple pours to avoid inducing excessive uplift forces. Multiple pours may also be desirable to avoid excessive lateral fluid pressure on vault walls if used as wall backfill. Sufficient time should be provided to allow the CLSM to cure before placing additional lifts of CLSM or trench backfill.

9.1.11. T-Top Pavement Replacement

In asphalt concrete paved areas over trench excavations, we recommend the use of MAG "T-Top" Type Trench Backfill (MAG detail 200-1) with respect to the asphalt and aggregate replacement at the surface of the trench excavations, in order to reduce the potential for distress due to differential settlement and water infiltration into the subsurface. This includes the removal of asphalt and aggregate base to 1 foot or more beyond the extent of each side of the installation trench, extending to 1 foot or more below the bottom of the asphalt layer. In the T-Top, the thickness of AB should be 12 inches or match either existing or design thickness, whichever is deeper. Periodic maintenance of the pavement should be performed. The asphalt concrete thickness should be in accordance with any City of Scottsdale design requirements, or match the existing thickness, whichever is thicker.

9.2. Seismic Design Considerations

Based on a Probabilistic Seismic Hazard Assessment for the conterminous United States, issued by the USGS (2002 data), the site is located in a zone where the peak ground accelerations having 10, 5, and 2 percent probability of being exceeded in 50 years are 0.04g, 0.05g, and 0.08g, respectively. These ground motion values are calculated for "firm rock" sites, which correspond to a shear-wave velocity of approximately 2,500 feet per second in approximately the top 100 feet bgs. Different soil or rock types may amplify or de-amplify these values. The proposed improvements should be designed in accordance with

the requirements of governing jurisdictions and applicable building codes. Table 1 presents the seismic design parameters for the site in accordance with International Building Code (ICC, 2009) guidelines and mapped spectral acceleration parameters (USGS, 2011).

Table 1 – 2009 International Building Code Seismic Design Criteria

Seismic Design Factors	Value
Site Class	C
Site Coefficient, F_a	1.2
Site Coefficient, F_v	1.7
Mapped Spectral Acceleration at 0.2-second Period, S_s	0.188 g
Mapped Spectral Acceleration at 1.0-second Period, S_1	0.063 g
Spectral Acceleration at 0.2-second Period Adjusted for Site Class, S_{MS}	0.225 g
Spectral Acceleration at 1.0-second Period Adjusted for Site Class, S_{M1}	0.106 g
Design Spectral Response Acceleration at 0.2-second Period, S_{DS}	0.150 g
Design Spectral Response Acceleration at 1.0-second Period, S_{D1}	0.071 g

9.3. Corrosion

The corrosion potential of the on-site materials was analyzed to evaluate its potential effect on the ferrous metals used for this project. Corrosion potential was evaluated using the results of laboratory testing on a sample obtained during our subsurface evaluation that was considered representative of soils along the project alignment.

Laboratory testing consisted of pH, minimum electrical resistivity, and chloride and soluble sulfate contents. The pH and minimum electrical resistivity tests were performed in general accordance with Arizona Test 236b, while sulfate and chloride content tests were performed in accordance with Arizona Test Method 733 and 736, respectively. The results of the corrosivity tests are presented in Appendix B.

The soil pH value of the selected sample was 7.9, which is considered to be alkaline. The minimum electrical resistivity measured to be 1,676 ohm-cm, which is considered to be corrosive to ferrous materials. The chloride content of the sample tested was measured to be 960 ppm, which also is considered to be corrosive to ferrous metals. The soluble sulfate

content of the soil sample was measured to be 0.083 percent by weight, which is considered to represent negligible sulfate exposure for concrete.

The results of the laboratory testing indicate that the on-site materials are considered to be corrosive to ferrous metals, and represent a negligible sulfate exposure for concrete.

Since ductile-iron pipes are proposed to be installed along a portion of the alignment, we recommend that topsoil, organic soils, existing fill soils, and mixtures of sand and clay not be placed adjacent to buried metallic utilities. Rather, we suggest a relatively clean sand and/or gravel, or CLSM, be placed around buried metal piping. Also, buried utilities of different metallic construction should be electrically isolated from each other to minimize galvanic corrosion problems. In addition, new piping should be electrically isolated from old piping so that the old metal will not increase the corrosion rate of the new metal. Due to the relatively high level of soluble chlorides in the soil, a corrosion specialist should be consulted for further recommendations.

9.4. Concrete

Laboratory chemical tests performed on selected samples of on-site soils indicated a sulfate content of 0.083 percent by weight. Based on the following American Concrete Institute (ACI) table, the on-site soils should be considered to have a negligible sulfate exposure to concrete.

Table 2 – ACI Requirements for Concrete Exposed to Sulfate-Containing Soil

Sulfate Exposure	Water-Soluble Sulfate (SO_4) in Soil, Percentage by Weight	Cement Type	Water-Cementitious Materials Ratio, by Weight, Normal-Weight Aggregate Concrete[1]	f'_c, Normal-Weight and Lightweight Aggregate Concrete, psi x 0.00689 for MPa
Negligible	0.00 - 0.10	--	--	--
Moderate[2]	0.10 - 0.20	II, IP(MS), IS (MS)	0.50 or less	4,000 or more

Table 2 – ACI Requirements for Concrete Exposed to Sulfate-Containing Soil

Sulfate Exposure	Water-Soluble Sulfate (SO_4) in Soil, Percentage by Weight	Cement Type	Water-Cementitious Materials Ratio, by Weight, Normal-Weight Aggregate Concrete[1]	f'_c, Normal-Weight and Lightweight Aggregate Concrete, psi x 0.00689 for MPa
Severe	0.20 - 2.00	V	0.45 or less	4,500 or more
Very severe	Over 2.00	V plus pozzolan[3]	0.45 or less	4,500 or more

[1] A lower water-cementitious materials ratio or higher strength may be needed for low permeability or for protection against corrosion of embedded items or freezing and thawing (ACI Table 4.2.2).
[2] Seawater.
[3] Pozzolan that has been evaluated by test or service record to improve sulfate resistance when used in concrete containing Type V cement.

Notwithstanding the sulfate test results and due to the limited number of chemical tests performed, as well as our experience with similar soil conditions, we recommend the use of Type II cement for construction of concrete structures at this site. Due to potential uncertainties as to the use of reclaimed irrigation water, or topsoil that may contain higher sulfate contents, pozzolan or admixtures designed to increase sulfate resistance may be considered.

The concrete should have a water-cementitious materials ratio no more than 0.50 percent by weight for normal weight aggregate concrete. The structural engineer should ultimately select the concrete design strength based on the project specific loading conditions. Higher strength concrete may be selected for increased durability and resistance to shrinkage cracking.

9.5. Site Drainage

Positive surface drainage should be provided to divert water away from the trench zone and pavements. Surface water should not be permitted to pond over the trench zone or on

pavement surfaces after construction. Water that is pumped out of the trench should be done so in an area that drains the water away from the trench.

9.6. Pre-Construction Conference

We recommend that a pre-construction conference be held. Representatives of the owner, civil engineer, the geotechnical consultant, and the contractor should be in attendance to discuss the project plans and schedule. Our office should be notified if the project description included herein is incorrect, or if the project characteristics are significantly changed.

9.7. Construction Observation and Testing

During construction operations, we recommend that a qualified geotechnical consultant perform observation and testing services for the project. These services should be performed to evaluate exposed subgrade conditions, to evaluate the suitability of proposed borrow materials for use as fill and to observe and test placement of compacted fill soils. If another geotechnical consultant is selected to perform observation and testing services for the project, we request that the selected consultant provide a letter to the owner, with a copy to Ninyo & Moore, indicating that they fully understand our recommendations and that they are in full agreement with the recommendations contained in this report. Qualified subcontractors utilizing appropriate techniques and construction materials should perform construction of the proposed foundations.

10. LIMITATIONS

The field evaluation, laboratory testing, and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be

encountered during construction. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluation will be performed upon request. Please also note that our evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

This report is intended for design purposes only. It does not provide sufficient data to prepare an accurate bid by contractors. It is suggested that the bidders and their geotechnical consultant perform an independent evaluation of the subsurface conditions in the project areas. The independent evaluations may include, but not be limited to, review of other geotechnical reports prepared for the adjacent areas, site reconnaissance, and additional exploration and laboratory testing.

Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

11. SELECTED REFERENCES

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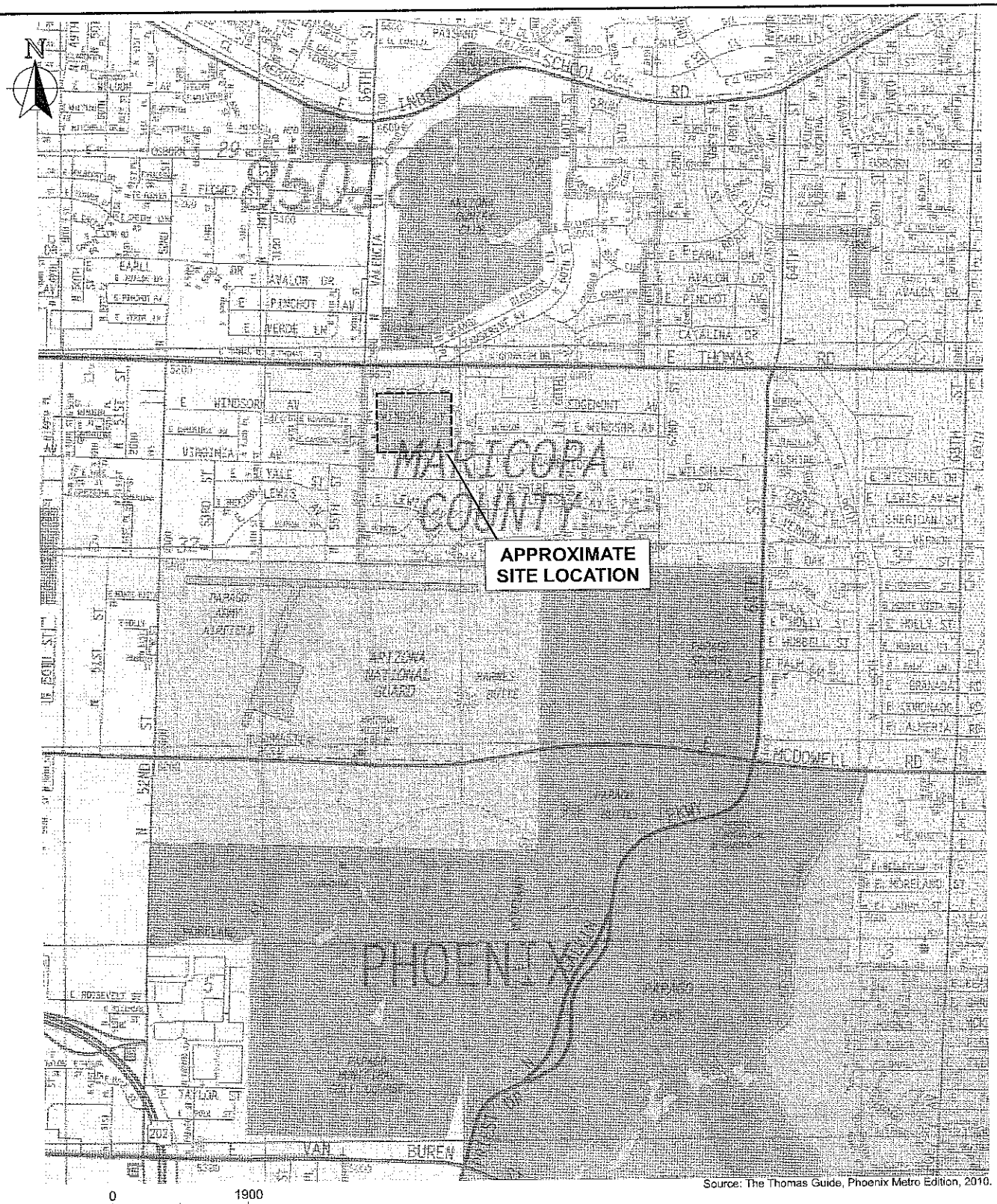
Aerial Photographs Reviewed

Source	Date(s)
Flood Control District of Maricopa County	1937, 1949, 1959, 1969, 1979, 2001, 2009

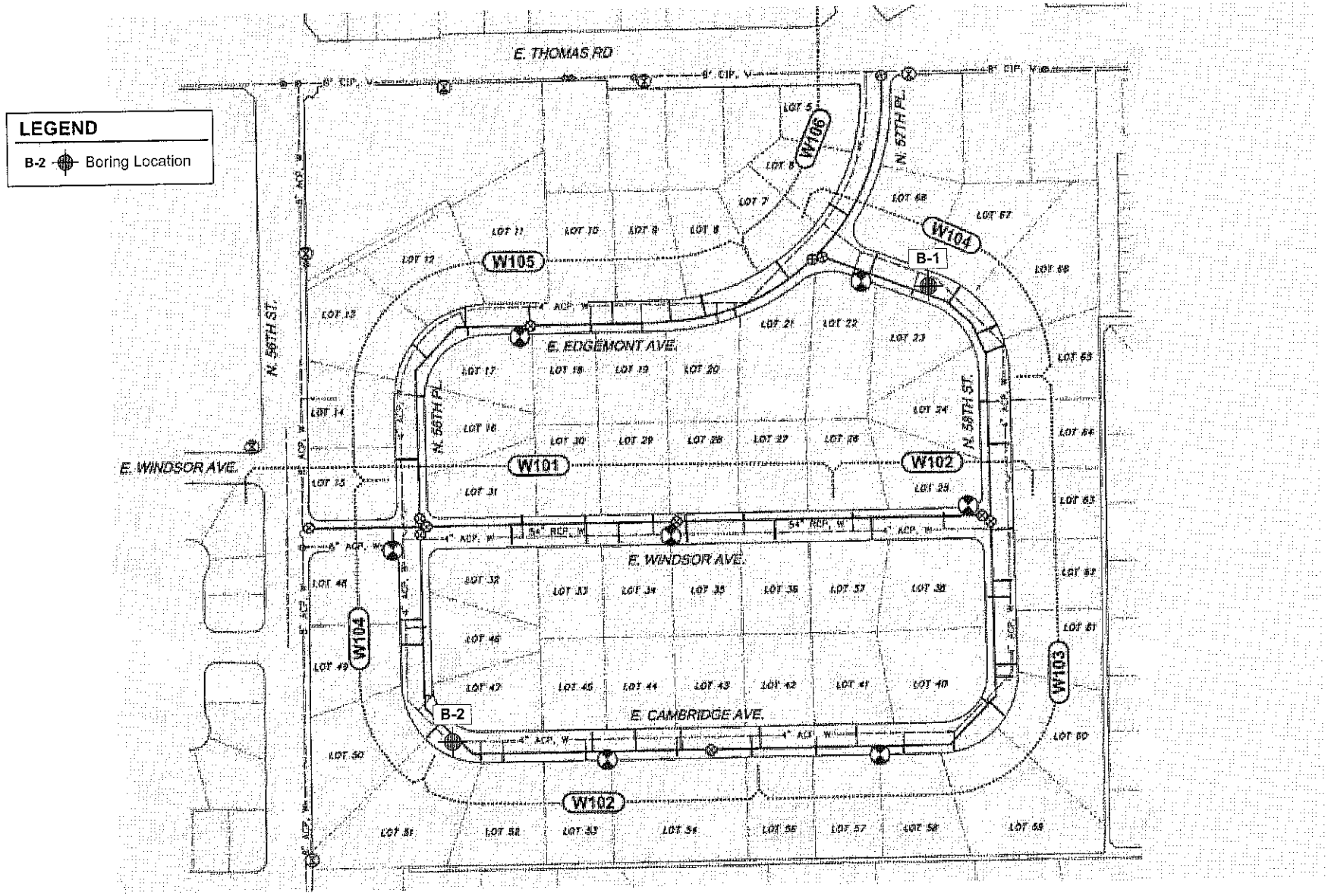


Source: The Thomas Guide, Phoenix Metro Edition, 2010.

Note: Dimensions, directions, and locations are approximate.

Ninyo & Moore	SITE LOCATION	FIGURE 1
PROJECT NO: 603635001	DATE: 4/12	56TH STREET AND THOMAS ROAD WATERLINE IMPROVEMENTS SCOTTSDALE, ARIZONA

file no: 3635vmap0412



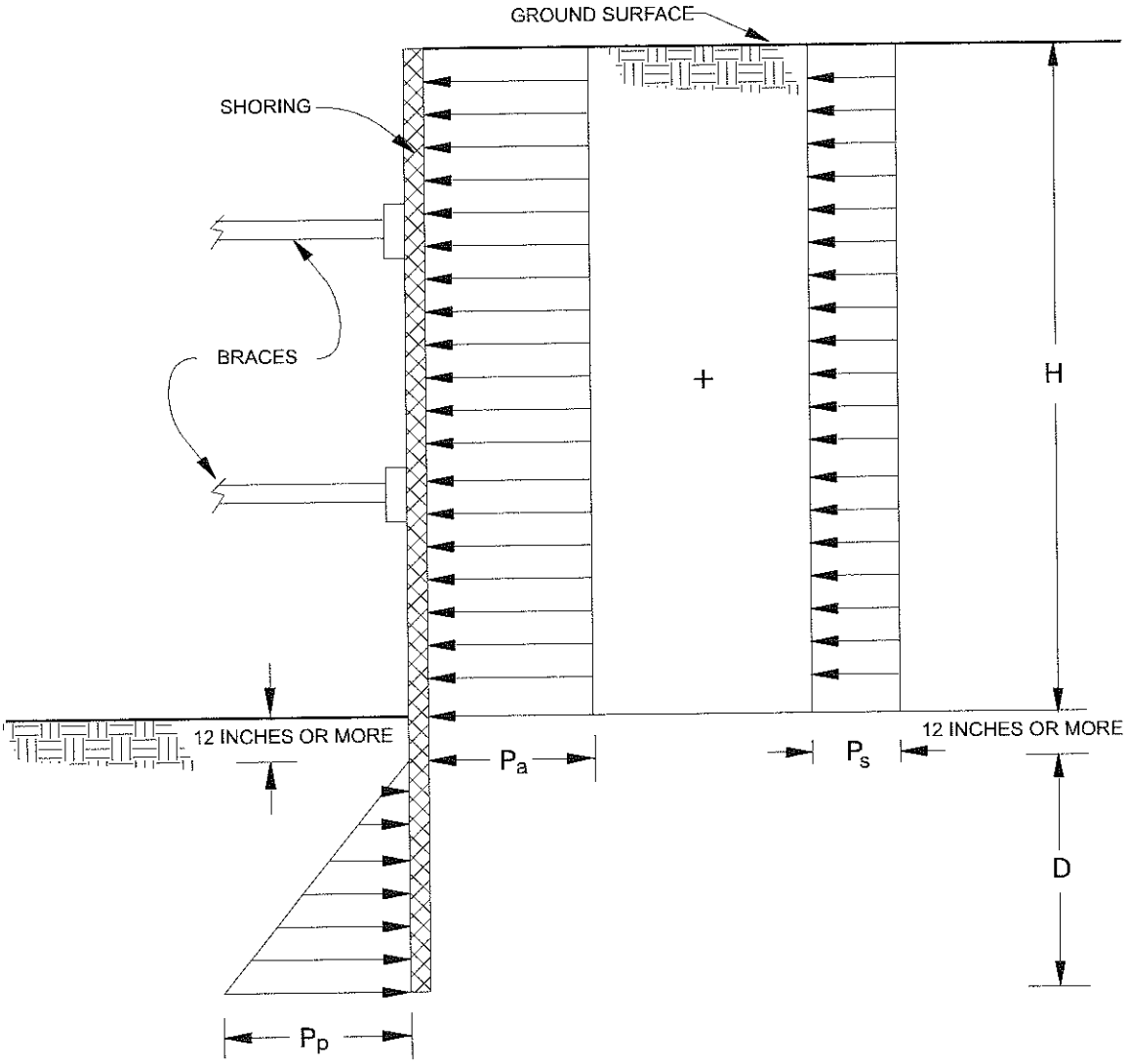
N

NOT TO SCALE

Source: GHD, 11/11.
Note: Dimensions, directions, and locations are approximate.

Ninyo & Moore	BORING LOCATIONS	FIGURE
PROJECT NO: 603635001	DATE: 4/12	56TH STREET AND THOMAS ROAD WATERLINE IMPROVEMENTS SCOTTSDALE, ARIZONA	2

file no: 3635blm0412



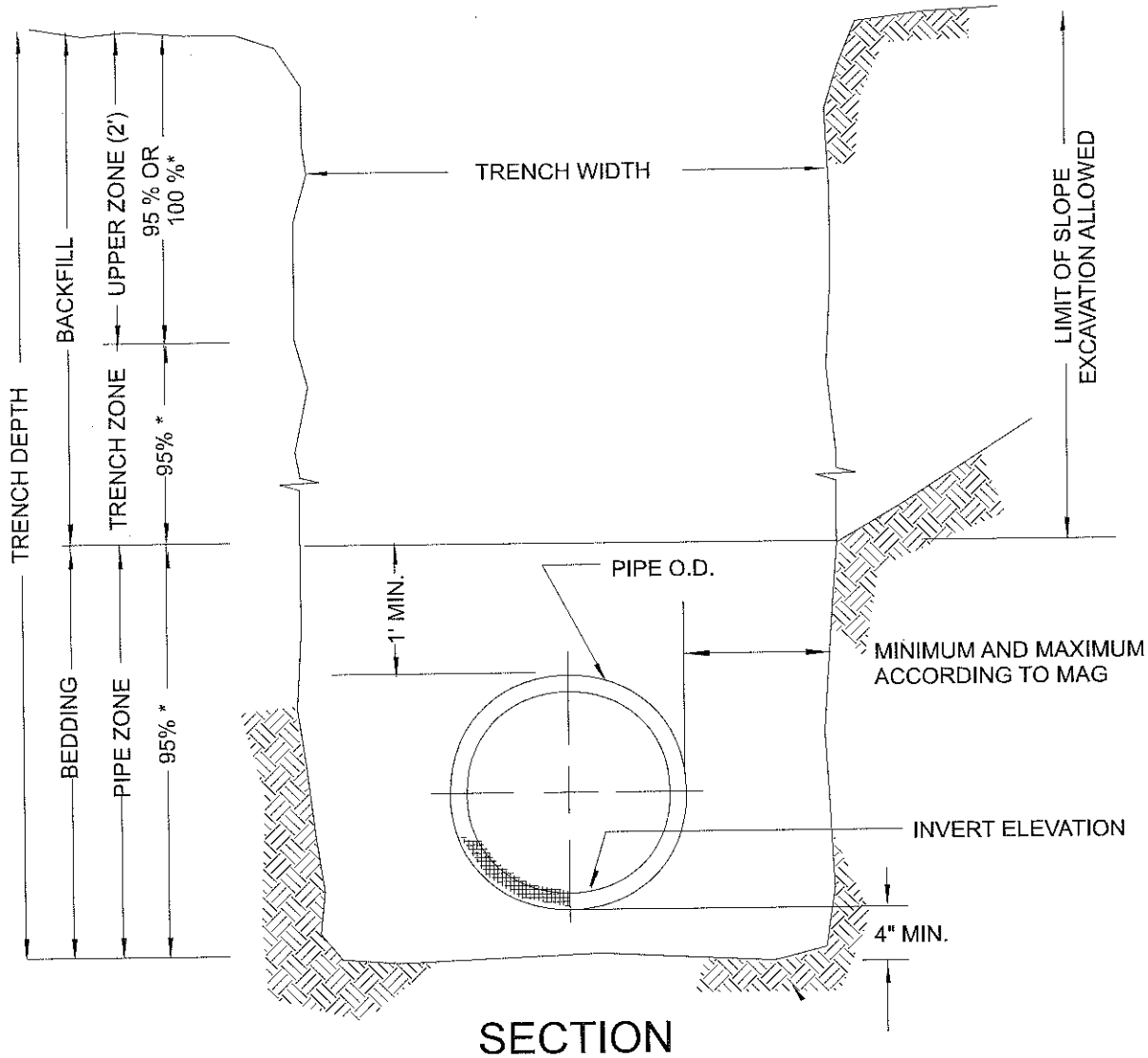
NOTES:

1. APPARENT LATERAL EARTH PRESSURE, P_a
   P_a = 25 H psf
2. CONSTRUCTION TRAFFIC INDUCED SURCHARGE PRESSURE, P_s
   P_s = 120 psf
3. PASSIVE LATERAL EARTH PRESSURE, P_p
   P_p = 300 D psf
4. ASSUMES GROUNDWATER IS NOT PRESENT
5. SURCHARGES FROM EXCAVATED SOIL OR CONSTRUCTION MATERIALS ARE NOT INCLUDED
6. H AND D ARE IN FEET

NOT TO SCALE

Ninyo & Moore	LATERAL EARTH PRESSURES FOR BRACED EXCAVATION	FIGURE 3
PROJECT NO: 603635001 / DATE: 4/12	56TH STREET AND THOMAS ROAD WATERLINE IMPROVEMENTS SCOTTSDALE, ARIZONA	

file no: 3635lep0412



SECTION

NOTE

* Indicates minimum relative compaction (see report for details).

Upper zone required for pavement areas only.

Diagram not drawn to scale.

Ninyo & Moore	PIPE BEDDING GUIDELINES	FIGURE
PROJECT NO: 603635001 / DATE: 4/12	56TH STREET AND THOMAS ROAD WATERLINE IMPROVEMENTS SCOTTSDALE, ARIZONA	4

file no: 3635pbg0412.

APPENDIX A

BORING LOGS

Field Procedure for the Collection of Disturbed Samples

Disturbed soil samples were obtained in the field using the following methods.

Bulk Samples

Bulk samples of representative earth materials were obtained from the exploratory borings. The samples were bagged and transported to the laboratory for testing.

The Standard Penetration Test Spoon

Disturbed drive samples of earth materials were obtained by means of a Standard Penetration Test spoon sampler. The sampler is composed of a split barrel with an external diameter of 2 inches and an unlined internal diameter of 1-3/8 inches. The spoon was driven up to 18 inches into the ground with a 140-pound hammer free-falling from a height of 30 inches in general accordance with ASTM D 1586. The blow counts were recorded for every 6 inches of penetration; the blow counts reported on the logs are those for the last 12 inches of penetration. Soil samples were observed and removed from the spoon, bagged, sealed, and transported to the laboratory for testing.

Field Procedure for the Collection of Relatively Undisturbed Samples

Relatively undisturbed soil samples were obtained in the field using the following method.

The Modified Split-Barrel Drive Sampler

The sampler, with an external diameter of 3.0 inches, was lined with 1-inch long, thin brass rings with inside diameters of approximately 2.4 inches. The sample barrel was driven into the ground with a 140-pound hammer free-falling from a height of 30 inches in general accordance with ASTM D 1586. The samples were removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

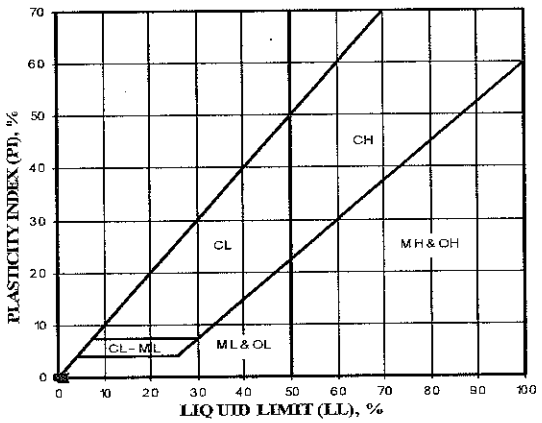
U.S.C.S. METHOD OF SOIL CLASSIFICATION

MAJOR DIVISIONS		SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS (More than 1/2 of soil >No. 200 sieve size)	GRAVELS (More than 1/2 of coarse fraction > No. 4 sieve size)	GW	Well graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS (More than 1/2 of coarse fraction <No. 4 sieve size)	SW	Well graded sands or gravelly sands, little or no fines
		SP	Poorly graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (More than 1/2 of soil <No. 200 sieve size)	SILTS & CLAYS Liquid Limit <50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean
		OL	Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS Liquid Limit >50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils

GRAIN SIZE CHART

CLASSIFICATION	RANGE OF GRAIN SIZE	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL Coarse Fine	3" to No. 4 3" to 3/4" 3/4" to No. 4	76.2 to 4.76 76.2 to 19.1 19.1 to 4.76
SAND Coarse Medium Fine	No. 4 to No. 200 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200	4.76 to 0.075 4.76 to 2.00 2.00 to 0.420 0.420 to 0.075
SILT & CLAY	Below No. 200	Below 0.075

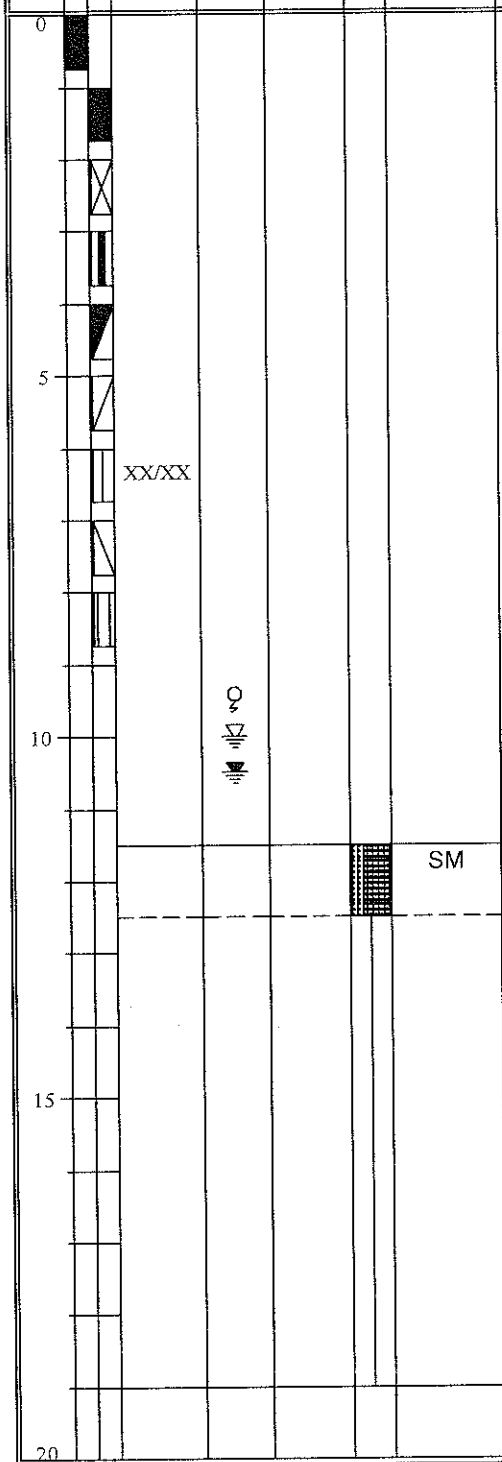
PLASTICITY CHART



Ninyo & Moore

U.S.C.S. METHOD OF SOIL CLASSIFICATION

BORING LOG EXPLANATION SHEET



Bulk sample.

Modified split-barrel drive sampler.

No recovery with modified split-barrel drive sampler.

Sample retained by others.

Standard Penetration Test (SPT).

No recovery with a SPT.

Shelby tube sample. Distance pushed in inches/length of sample recovered in inches.

No recovery with Shelby tube sampler.

Continuous Push Sample.

Seepage.

Groundwater encountered during drilling.

Groundwater measured after drilling.

ALLUVIUM:
Solid line denotes unit change.

Dashed line denotes material change.

Attitudes: Strike/Dip
b: Bedding
c: Contact
j: Joint
f: Fracture
F: Fault
cs: Clay Seam
s: Shear
bss: Basal Slide Surface
sf: Shear Fracture
sz: Shear Zone
sbs: Sheared Bedding Surface

The total depth line is a solid line that is drawn at the bottom of the boring.

Ninyo & Moore

BORING LOG

EXPLANATION OF BORING LOG SYMBOLS

PROJECT NO.	DATE	FIGURE
	Rev. 01/03	

DATE DRILLED 3/26/12 BORING NO. B-1

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Diedrich D-50, 8" Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ASPHALT CONCRETE: Approximately 2 inches thick.
							AGGREGATE BASE: Approximately 5 inches thick.
						SM	Brown, damp, medium dense, poorly graded GRAVEL with sand.
		30					ALLUVIUM: Brown, damp, dense, elastic silty SAND with gravel; scattered caliche nodules.
		50/5"					Very dense.
5		50/5"					Decrease in gravel content.
		50/2"					Total Depth = 8.7 feet. Groundwater not encountered during drilling. Backfilled and asphalt patched on 3/26/12 promptly after completion of drilling. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
10							
15							
20							

Ninyo & Moore

BORING LOG

56th & Thomas Waterline Improvements
Scottsdale, Arizona

PROJECT NO.	DATE	FIGURE
603635001	4/12	A-1

DATE DRILLED 3/26/12 BORING NO. B-2

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Diedrich D-50, 8" Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ASPHALT CONCRETE: Approximately 2 inches thick.
							AGGREGATE BASE: Approximately 6.5 inches thick.
						SM	Brown, damp, medium dense, poorly graded GRAVEL with sand.
		39					FILL: Brown, damp, medium dense, clayey SAND; trace gravel; scattered caliche nodules.
						SC	ALLUVIUM: Brown, damp, very dense, clayey SAND with gravel; numerous caliche nodules.
5		61					
		50/5"					
		50/2"					
							Total Depth = 8.7 feet. Groundwater not encountered during drilling. Backfilled and asphalt patched on 3/26/12 promptly after completion of drilling. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
10							
15							
20							

Ninyo & Moore

BORING LOG

56th & Thomas Waterline Improvements
Scottsdale, Arizona

PROJECT NO.	DATE	FIGURE
603635001	4/12	A-2

APPENDIX B

LABORATORY TESTING

Classification

Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488. Soil classifications are indicated on the logs of the exploratory excavations in Appendix A.

In-Place Moisture and Density Tests

The moisture content and dry density of relatively undisturbed samples obtained from the exploratory excavations were evaluated in general accordance with ASTM D 2937. The test results are presented on the logs of the exploratory excavations in Appendix A.

Gradation Analysis

Gradation analysis tests were performed on selected representative soil samples in general accordance with ASTM D 422. The grain-size distribution curves are shown on Figures B-1 and B-2. These test results were utilized in evaluating the soil classifications in accordance with the Unified Soil Classification System.

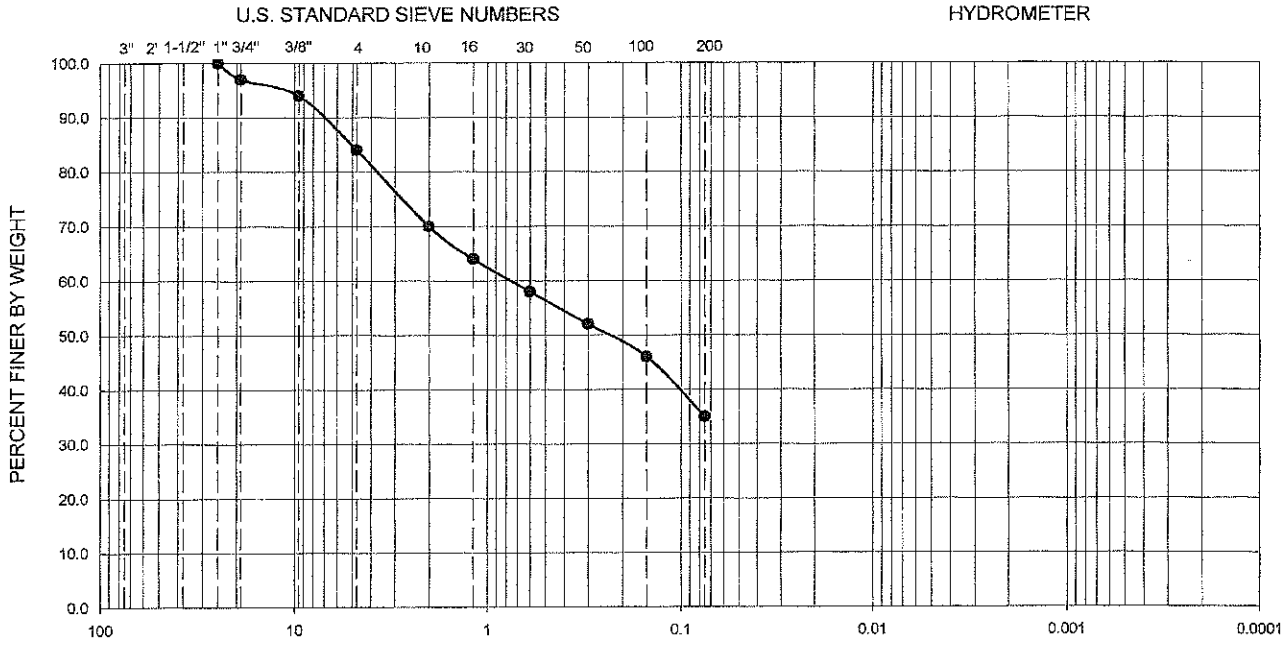
Atterberg Limits

Tests were performed on selected representative fine-grained soil samples to evaluate the liquid limit, plastic limit, and plasticity index in general accordance with ASTM D 4318. These test results were utilized to evaluate the soil classification in accordance with the Unified Soil Classification System. The test results and classifications are shown on Figure B-3.

Soil Corrosivity Tests

Soil pH and minimum resistivity tests were performed on representative sample in general accordance with Arizona Test 236b. The chloride content of a selected sample was evaluated in general accordance with Arizona Test 736. The sulfate content of a selected sample was evaluated in general accordance with Arizona Test 733. The test results are presented on Figure B-4.

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY

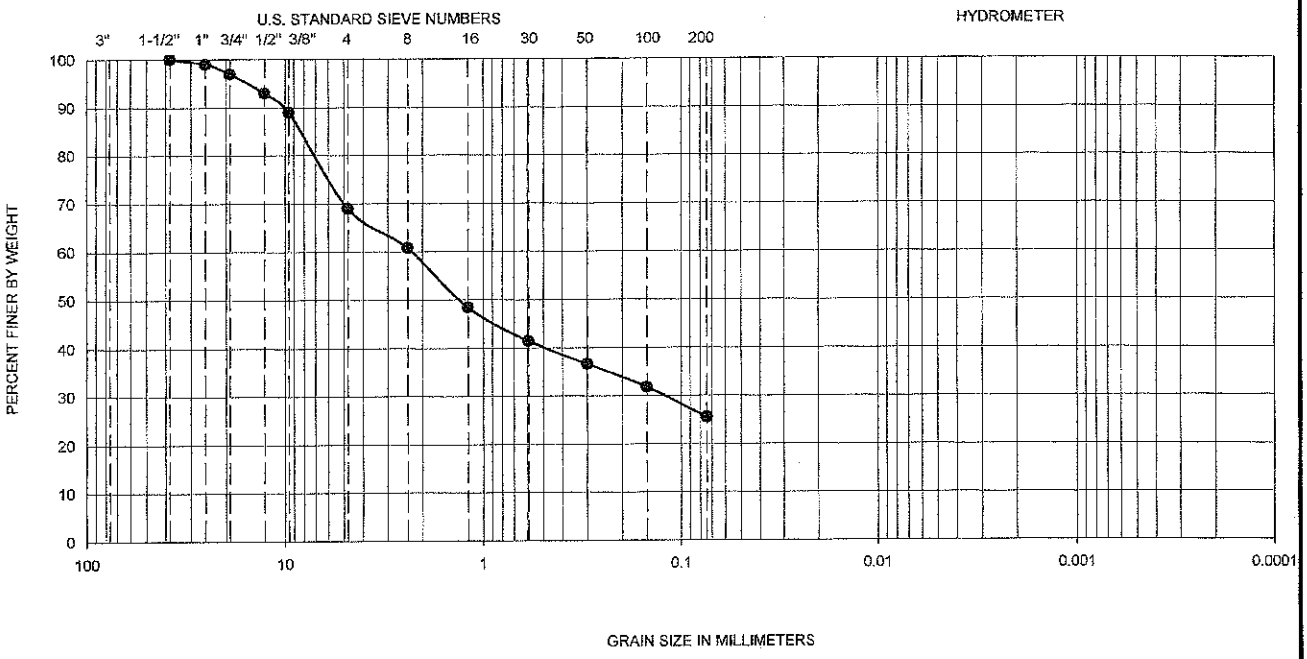


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	B-1	3.5-4.4	60	38	22	--	--	--	--	--	35	SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. 603635001 / DATE 4/12	56TH & THOMAS WATERLINE IMPROVEMENTS SCOTTSDALE, ARIZONA	B-1

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay

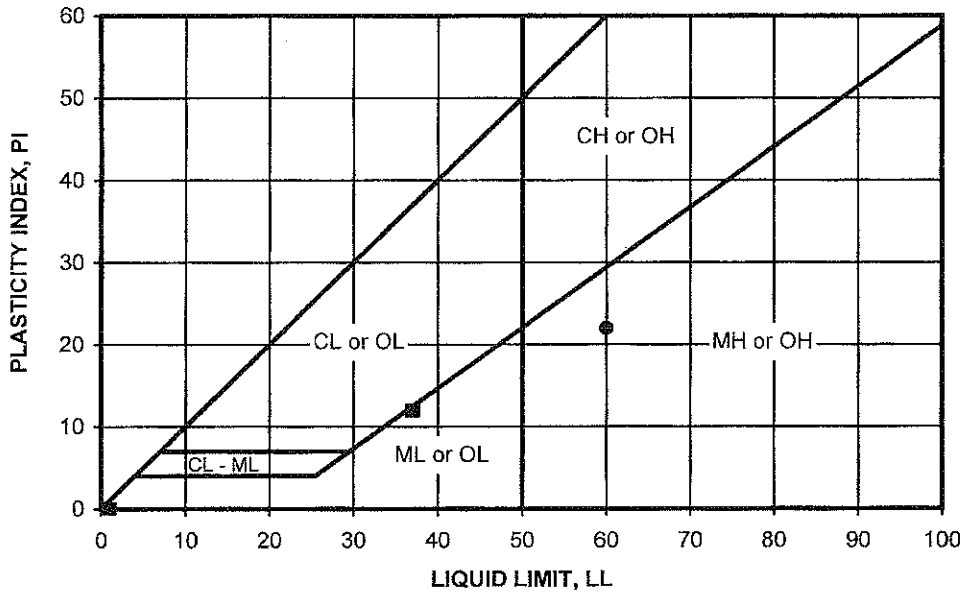


Symbol	Hole No.	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	U.S.C.S
●	B-2	1-5	37	25	12	--	--	--	--	--	26	SC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. 603635001 / DATE 4/12	56TH & THOMAS WATERLINE IMPROVEMENTS SCOTTSDALE, ARIZONA	B-2

SYMBOL	LOCATION	DEPTH (FT)	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	USCS CLASSIFICATION (Fraction Finer Than No. 40 Sieve)	USCS (Entire Sample)
●	B-1	3.5-4.4	60	38	22	MH	SM
■	B-2	1-5	37	25	12	CL	SC



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318

Ninyo & Moore	ATTERBERG LIMITS TEST RESULTS	FIGURE
PROJECT NO. 603635001 / DATE 4/12	56TH & THOMAS WATERLINE IMPROVEMENTS SCOTTSDALE, ARIZONA	B-3

SAMPLE LOCATION	SAMPLE DEPTH (FT)	pH [1]	RESISTIVITY [1] (Ohm-cm)	SULFATE CONTENT [2]		CHLORIDE CONTENT [3] (ppm)
				(ppm)	(%)	
B-1	1-5	7.9	1,676	834	0.083	960

[1] PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 236b
[2] PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 733
[3] PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 736

Ninyo & Moore	CORROSIVITY TEST RESULTS	FIGURE
PROJECT NO. 603635001 / DATE 4/12	56TH & THOMAS WATERLINE IMPROVEMENTS SCOTTSDALE, ARIZONA	B-4

Ninyo & Moore
Geotechnical and Environmental Sciences Consultants

GEOTECHNICAL EVALUATION
STARFIRE GOLF COURSE
WATERLINE IMPROVEMENTS
SCOTTSDALE, ARIZONA

PREPARED FOR:
GHD, Inc.
7600 North 16th Street, Suite 205
Phoenix, Arizona 85020-4447

PREPARED BY:
Ninyo & Moore
Geotechnical and Environmental Sciences Consultants
3202 East Harbour Drive
Phoenix, Arizona 85034

April 26, 2012
Project No. 603635001

Ninyo & Moore
Geotechnical and Environmental Sciences Consultants

April 26, 2012
Project No. 603635001

Mr. Bill D. Roberts
GHD, Inc.
7600 North 16th Street, Suite 205
Phoenix, Arizona 85020-4447

Subject: Geotechnical Evaluation
Starfire Golf Course Waterline Improvements
Scottsdale, Arizona

Dear Mr. Roberts:

In accordance with our proposal dated August 24, 2011, and your authorization, Ninyo & Moore has performed a geotechnical evaluation for the above-referenced site. The attached report presents our methodology, findings, conclusions, and recommendations regarding the geotechnical conditions at the project site.

We appreciate the opportunity to be of service to you during this phase of the project.

Sincerely,
NINYO & MOORE

REGISTERED GEOLOGIST CERTIFICATE NO. 49080 JEFFREY RODGERS Date Signed 4-26-12 ARIZONA, U.S.A.

Jeffrey S. Rodgers, RG
Project Geologist

EXPIRES: 03/31/15

Registered Professional Engineer (Civil) CERTIFICATE NO. 41716 KEVIN L. PORTER Date Signed 4-26-12 ARIZONA U.S.A.

Kevin L. Porter, PE
Senior Engineer

EXPIRES 12/31/13

JSR/HAH/KLP/clj

Distribution: (1) Addressee – Electronic Copy

TABLE OF CONTENTS

1. INTRODUCTION

In accordance with our proposal dated August 24, 2011, and your authorization, we have performed a geotechnical evaluation for the proposed Starfire Golf Course Waterline Improvements project in Scottsdale, Arizona. The purpose of our evaluation was to assess the subsurface conditions at the site in order to formulate geotechnical recommendations for design and construction of the project. This report presents the results of our evaluation, conclusions, and recommendations regarding the proposed construction.

2. SCOPE OF SERVICES

The scope of our services for the project included the following:

- Reviewing readily available aerial photographs and published geologic literature, including maps and reports pertaining to the project site and vicinity.
- Conducting a visual reconnaissance of the project area and marking out boring locations based on the drawings provided by GHD, Inc., and notifying Arizona Blue Stake of the boring locations prior to drilling.
- Drilling, logging, and sampling seven, small-diameter exploratory borings to depths of approximately 10 feet below ground surface (bgs). The boring logs are presented in Appendix A.
- Performing laboratory tests on selected samples obtained from the borings to evaluate in-situ moisture content and dry density, gradation analysis, Atterberg limits, consolidation (response-to-wetting), and corrosivity characteristics (including pH, minimum electrical resistivity, soluble sulfates, and chlorides). The results of the laboratory testing are presented on the boring logs and/or in Appendix B.
- Compiling the data obtained and performing engineering analysis.
- Preparing this report presenting our findings, conclusions, and recommendations regarding the design and construction of the project.

Our scope of services did not include environmental consulting services such as hazardous waste sampling or analytical testing at the site. A detailed scope of services and estimated fee for such services can be provided upon request.

3. SITE DESCRIPTION

The project site is located in Section 23 of Township 3 North, Range 4 East, in Scottsdale, Arizona. The approximate location of the site is depicted on Figure 1. The project limits generally extended along Sundown Drive between Shea Boulevard and Cactus Road. Portions of the project alignment will cross along the southern limits of the Starfire Golf Course. At the time of our evaluation, Sundown Drive consisted of a paved residential street. Starfire Golf Course was situated to the east of the project alignment.

According to the *Paradise Valley, Arizona-Maricopa Co., 7.5-Minute United States Geological Survey (USGS) Topographic Quadrangle Map (1982),* the elevation along the planned pipeline alignment ranges from approximately 1,350 to 1,380 feet relative to mean sea level (MSL). Based on the information from this quadrangle map the project site slopes from the north down to the south.

Seven aerial photographs from the Flood Control District of Maricopa County were reviewed for this project. A 1949 aerial photograph depicted the site as undeveloped desert land dissected by northeast-southwest traversing natural drainages. Shea Boulevard was depicted as an unpaved roadway. A 1959 photograph depicted construction of the golf course. Sundown Drive was a paved roadway with scattered residential development on the east and west sides. Shea Boulevard was depicted as a paved roadway. A 1962 photograph depicted the construction of the golf course as being completed. Aerial photographs from 1979, 1993, 2004, and 2009 depicted an increase in residential development at the site. The 2009 photograph depicted the site as being similar to its current condition.

4. PROPOSED CONSTRUCTION

The project consists of the design and construction of a new pressurized 8-inch diameter ductile-iron pipe (DIP) waterline that will run parallel to Sundown Drive between Shea Boulevard and Cactus Road, and into parts of the adjacent golf course (See Figure 2). Based on the plan sheets provided by GHD, the invert elevation of the pipeline will be 10 feet bgs, or less, and will be

installed using traditional cut-and-cover techniques. We understand that the existing pavement will be restored to match the existing pavement on site.

5. FIELD EXPLORATION AND LABORATORY TESTING

On March 26, 2012, Ninyo & Moore conducted a subsurface exploration at the site in order to observe the existing subsurface conditions and to collect soil samples for laboratory testing. Our exploration consisted of the drilling, logging, and sampling of seven small-diameter borings, denoted as B-1 through B-7. The borings were advanced using a Diedrich D-50 truck-mounted drill rig equipped with hollow-stem augers and extended to depths ranging from approximately 9 to 10 feet bgs. The approximate locations of our borings are presented on Figure 2. Bulk and relatively undisturbed soil samples were collected at selected intervals. Detailed descriptions of the soils encountered are presented on the boring logs in Appendix A.

Ninyo & Moore personnel logged the borings in general accordance with the Unified Soil Classification System (USCS) and American Society for Testing and Materials (ASTM) D 2488 by observing cuttings and drive samples. Collected ring samples were trimmed in the field, wrapped in plastic bags, and placed in cylindrical plastic containers to retain in-place moisture conditions. Similarly, the Standard Penetration Test (SPT) and bulk samples were sealed in plastic bags to retain their approximate in-place moisture.

The soil samples collected from our drilling activities were transported to the Ninyo & Moore laboratory in Phoenix, Arizona for geotechnical laboratory testing. The testing included in-situ moisture content and dry density, gradation analysis, Atterberg limits, consolidation (response-to-wetting), and corrosivity characteristics (including pH, minimum electrical resistivity, soluble sulfates, and chlorides). The results of the in-situ moisture content and dry density testing are presented on the boring logs in Appendix A. A description of each laboratory test method and the remainder of the test results are presented in Appendix B.

6. GEOLOGY AND SUBSURFACE CONDITIONS

The geology and subsurface conditions at the site are described in the following sections.

6.1. Geologic Setting

The project site is located in the Sonoran Desert Section of the Basin and Range physiographic province, which is typified by broad alluvial valleys separated by steep, discontinuous, sub parallel mountain ranges. The mountain ranges generally trend north-south and northwest-southeast. The basin floors consist of alluvium with thickness extending to several thousands of feet.

The basins and surrounding mountains were formed approximately 10 to 18 million years ago during the mid- to late-Tertiary. Extensional tectonics resulted in the formation of horsts (mountains) and grabens (basins) with vertical displacement along high-angle normal faults. Intermittent volcanic activity also occurred during this time. The surrounding basins filled with alluvium from the erosion of the surrounding mountains as well as from deposition from rivers. Coarser-grained alluvial material was deposited at the margins of the basins near the mountains.

The surficial geology of the site generally consists of Holocene-age (less than 10,000 years) channel and alluvial fan deposits that generally consist of clay, silt, and sand with scattered amounts of gravel (Pearthree, 1997). The deposits are lower-piedmont deposits. These young, unconsolidated deposits can be settlement prone if not mitigated.

6.2. Subsurface Conditions

Our knowledge of the subsurface conditions at the project site is based on our field exploration and laboratory testing, and our understanding of the general geology of the area. The following sections provide generalized descriptions of the materials encountered. More detailed descriptions are presented on the boring logs in Appendix A.

6.2.1. Asphalt Concrete and Aggregate Base

Asphalt concrete (AC) was encountered at the surface of our borings and ranged from approximately 2 to 4.5 inches thick. The AC was underlain by aggregate base (AB) material, which ranged in thickness from approximately 3 to 6.5 inches in our borings.

6.2.2. Fill

Man-placed fill was encountered underlying the pavement section described above in borings B-1, B-3, and B-6. The fill was approximately 2 to 4 feet thick and generally consisted of silty sand in our borings.

6.2.3. Alluvium

Native alluvium was encountered underlying the fill and/or pavement sections described above, and extended to the total explored depths in our borings. The alluvium generally consisted of sandy clay, sandy silt, clayey sand, and silty sand in our borings. Varying amounts of gravel were observed in the alluvial material. In addition, scattered to numerous caliche nodules were observed in our borings.

6.3. Groundwater

Groundwater was not encountered in any of our borings during drilling. Well data provided by the Arizona Department of Water Resources (ADWR) indicates groundwater historically has been encountered at approximately 250 feet bgs. It should be noted that groundwater levels could fluctuate due to seasonal variations, golf course and other sources of irrigation, groundwater withdrawal or recharge, and in areas adjacent to, and in ephemeral streams, and other factors not apparent at the time of our fieldwork. In addition, perched zones of groundwater from irrigation may be encountered due to the close proximity of the golf course. In general, groundwater is not expected to be a constraint to the construction of the project, except possibly after periods of precipitation and/or heavy irrigation.

6.4. Surface Water

Based on the information presented on the Federal Emergency Management Agency (FEMA) Online Map Viewer, the pipe alignment lies within flood zone AO with a small segment being within Zone X, which is described as an area with 0.2 percent or more chance of flooding each year, in the form of sheet flow with average depths less than 1 foot.

As such, surface water flows and/or shallower groundwater levels may be encountered within the project limits during rain events, and may be a constraint during construction. Surface water diversion may need to be considered during construction to mitigate surface water flows.

7. GEOLOGIC HAZARDS

The following sections describe potential geologic hazards at the site, including land subsidence and earth fissures, and faulting and seismicity.

7.1. Land Subsidence and Earth Fissures

Groundwater depletion, due to groundwater pumping, has caused land subsidence and earth fissures in numerous alluvial basins in Arizona. It has been estimated that subsidence has affected more than 3,000 square miles and has caused damage to a variety of engineered structures and agricultural land (Schumann and Genualdi, 1986). From 1948 to 1983, excessive groundwater withdrawal has been documented in several alluvial valleys where groundwater levels have been reportedly lowered by up to 500 feet. With such large depletions of groundwater, the alluvium has undergone consolidation resulting in large areas of land subsidence.

In Arizona, earth fissures are generally associated with land subsidence and pose an on-going geologic hazard. Earth fissures generally form near the margins of geomorphic basins where significant amounts of groundwater depletion have occurred. Reportedly, earth fissures have also formed due to tensional stress caused by differential subsidence of the unconsolidated alluvial materials over buried bedrock ridges and irregular bedrock surfaces.

Differential subsidence can also be caused by facies changes within unconsolidated alluvial deposits, also causing tensional stress (Schumann and Genualdi, 1986).

Based on our field reconnaissance, aerial photograph review, and our review of published literature, earth fissures are not underlying, or adjacent to the property. The closest documented earth fissure to the site is approximately 4 miles to the east. An unconfirmed fissure has been documented approximately 3 miles to the west of the site. Based on ADWR Subsidence maps, documented subsidence bowls are mapped to the northeast and to the west of the site; however, the project site is not within a documented subsidence bowl. While the future occurrence of earth fissures cannot accurately be predicted, it is our opinion that land subsidence and earth fissures are not expected to be a constraint to this project.

7.2. Faulting and Seismicity

The site lies within the Sonoran zone, which is a relatively stable tectonic region located in southwestern Arizona, southeastern California, southern Nevada, and northern Mexico (Euge et al., 1992). This zone is characterized by sparse seismicity and few Quaternary faults. Based on our field observations, review of pertinent geologic data, and analysis of aerial photographs, faults are not located on or adjacent to the property. The closest fault to the site is the Carefree Fault zone, located approximately 13 miles to the northeast of the site (Pearthree, 1998). Approximately 2 meters of displacement has occurred along this fault within middle Pleistocene deposits (<750,000 years), but the upper Pleistocene and Holocene deposits (<250,000 years) are not displaced. Seismic parameters recommended for the design of the proposed improvements are presented in Section 9.2.

8. CONCLUSIONS

Based on the results of our subsurface evaluation, laboratory testing, and data analysis, it is our opinion that the proposed construction is feasible from a geotechnical standpoint, provided that the recommendations of this report are incorporated into the design and construction of the proposed project, as appropriate. Geotechnical considerations include the following:

- In general, the on-site soils are considered to be rippable with heavy-duty excavation equipment in good working condition. However numerous caliche nodules were encountered in our borings, which may be more difficult to excavate and/or will slow the rate of excavation.

- Due to the heterogeneity of the site soil conditions, sloughing of soils during construction may occur where the alignment crosses existing or relict natural drainages. In addition, fill soils from adjacent utilities may be subject to sloughing due to the new excavations and under the influence of vibration from traffic.

- We noted the presence of hydrocollapsible soils beneath the pipe and manhole locations. As such, partial mitigation of the risk of wetting-induced settlement is recommended. This will consist of evaluation and improvement of the soil in the approximate 6-inch zone below the bedding or manhole.

- The pipeline trench may capture surface or subsurface flows because the bedding material will probably be more pervious than the adjacent native soils. Also, as noted above, we observed hydrocollapsible soils below the proposed pipe invert elevation. Accordingly, we recommend that trench backfill be well-compacted to discourage the movement of water into and through the trench.

- Pipes and connections to lift stations should be designed with sufficient flexibility to avoid damage at connections due to settlement of backfill.

- We estimate an earthwork (shrinkage) factor of approximately 5 to 15 percent if the on-site soils are re-used as fill.

- Imported soils and soils generated from on-site excavation activities that exhibit a very low- to low expansion potential can generally be used as engineered fill, provided any oversized or heavily cemented materials are either broken down or wasted. Many of the on-site soils observed may meet this criterion.

- Groundwater was not observed in our borings, and depth to groundwater in the area is estimated at 250 feet bgs. However, since the project site is situated in a documented floodplain, and is adjacent to an irrigated golf course, the site may be subject to groundwater within the trench zone and/or surface water flow. Depending on the construction schedule and season(s) in which construction takes place, groundwater or surface flows may need to be mitigated during construction.

- Our limited corrosivity test results suggest that subgrade soils at the site are considered to be corrosive to ferrous metals and the sulfate content of the soils presents a negligible sulfate exposure to concrete. Corrosion protection should be provided as appropriate.

- No geologic hazards were observed adjacent to, or underlying the project site.

9. RECOMMENDATIONS

The following sections present our geotechnical recommendations for the proposed construction. If the proposed construction is changed from that discussed in this report, Ninyo & Moore should be contacted for additional recommendations.

9.1. Earthwork

The following sections provide our earthwork recommendations for this project. In general, the earthwork specifications contained in the Maricopa Association of Governments (MAG), *Uniform Standard Specifications and Details for Public Works Construction*, and/or any City of Scottsdale amendments, are expected to apply, except as noted.

9.1.1. Excavation Characteristics

Our evaluation of the excavation characteristics of the on-site materials is based on the results of seven exploratory borings, our site observations, and our experience on similar projects. In our opinion, excavation of the surficial on-site materials can generally be accomplished with heavy-duty earthmoving equipment in good operating condition. However numerous caliche nodules were observed in our borings, and may be more difficult to excavate and/or slow the rate of excavation depending on the actual degree of cementation encountered during construction.

Due to the heterogeneous nature of the site, and the wide spacing between our borings, soils different than encountered in our borings should be anticipated during construction.

9.1.2. Temporary Slope Stability

Excavations that are 20 feet deep or less could be constructed using a sloped excavation in accordance with Occupational Safety and Health Administration ([OSHA], 2011) Standards, based on the soil types encountered.

Soils of low cohesion were encountered during our field exploration. Due to the presence of these soils, we recommend that the OSHA soil "*Type C*" be used for the fill and alluvial soils along the alignment. Based on OSHA standards, this corresponds to a temporary side slope of 1.5:1 (horizontal to vertical), or flatter, in sloped excavations that are less than 20 feet.

Temporary excavations that encounter surface or groundwater seepage may need shoring and/or stabilization by placing sandbags or gravel along the base of the seepage zone. Excavations encountering seepage should be evaluated on a case-by-case basis. Slope stability for trenches deeper than 20 feet, though not anticipated, should be designed by the contractor's engineer based on alignment-specific soil properties and settlement-sensitive features.

9.1.3. Temporary Shoring

Due to the close proximity of the adjacent roadway and underground utilities, and because of the proposed configurations of the planned excavations, we recommend that a temporary earth retention system be utilized for this project. Temporary earth retention systems may include braced systems, such as trench boxes or shields with internal supports or cantilever systems (e.g., soldier piles and lagging); however, the risk of excessive lateral deflection may render the cantilever shoring system inappropriate for the project.

Braced temporary earth retention systems should be designed using the lateral earth pressure parameters presented on Figure 3, depending on the soil conditions. The recommended design earth pressures are based on the assumptions that the shoring system will be constructed without raising the ground surface elevation behind the shoring system, that there are no surcharge loads, such as soil stockpiles and construction materials, and that no loads act above a 1:1 (horizontal to vertical) plane extending up and back from the dredge line. For earth retention systems subjected to the

above-mentioned surcharge loads, the contractor should include the effect of these loads on the design lateral earth pressures.

We anticipate that settlement of the ground surface will occur behind shoring systems during excavation. The amount of settlement will depend on the type of shoring system used, the contractor's workmanship, and soil conditions. We recommend that roadways, utilities, and other structures in the vicinity of the planned excavation be evaluated with regard to foundation support and tolerance to settlement. To reduce the potential for distress to these structures, we recommend that the shoring system be designed to limit the ground settlement behind it to ½-inch or less. Possible causes of settlement that should be addressed include settlement during excavation, construction vibrations, de-watering (if needed), and removal of the shoring system. We recommend that shoring installation be evaluated carefully by the contractor prior to construction and that ground vibration and settlement monitoring be performed during construction.

The contractor should retain a qualified and experienced engineer to design the shoring system. The contractor should evaluate the adequacy of the shoring parameters presented in this report, and make the appropriate modifications for their design. We recommend that the contractor take appropriate measures to protect the workers. OSHA requirements pertaining to workers' safety should be observed.

9.1.4. Protection of Existing Structures/Utilities

Lateral movement of a shored excavation will depend on the type and relative stiffness of the system used and other factors beyond the scope of this study. The shoring designer should perform a deflection analysis for the proposed shoring system. A survey of existing utilities, pavements, and structures adjacent to those portions of the proposed excavation that will be shored should also be performed prior to construction. The purpose of the analysis and survey would be to evaluate the ability of existing structures, pavements, pipelines, or conduits to withstand anticipated horizontal and vertical movements associated with a shored excavation. If movements exceed the

tolerance of existing project features (utilities, pavements, structures, etc.), alternative shoring systems employing the at-rest earth pressure, tie-backs, dead-man anchors, or cross bracing may be needed to reduce deflections to acceptable levels. The Contractor should anticipate repairing cracks in pavements adjacent to shored portions of the excavation due to anticipated lateral displacements of the shoring system. Horizontal and vertical movements of the shoring system should be monitored by a surveyor and the results reviewed by the project Geotechnical Engineer.

9.1.5. Bottom Stability

The proposed excavations are not anticipated to encounter significant groundwater (with the possible exception of surface run-off or perched zones) during construction. Therefore, trench bottom stability problems during construction are generally not anticipated at this site. However, if excavations are located near drainage ditches, or near a known wash, arroyo, or drainage area that are open during a heavy rain event, or near any leaking utilities, the trench material(s) might become saturated and unstable and a dewatering system may be needed for these conditions. Should this occur, remedial measures will be needed.

9.1.6. Construction Dewatering

Stream flow, surface run-off, and perched groundwater will vary seasonally depending on rainfall in the site vicinity. In addition, due to the close proximity of the golf course, perched groundwater conditions could exist from irrigation. Excavations that do encounter surface run-off (if any) could be dewatered by pumping the water out from the bottom and away from the excavation. However, heavily saturated units or perched groundwater zones, if encountered, may call for more aggressive means of dewatering and consultation with a qualified expert. Discharge of water from the excavations to natural drainage channels may entail securing a special permit.

9.1.7. Grading, Fill Placement, and Compaction

The geotechnical consultant should carefully evaluate any areas of soft or wet soils prior to placement of grade-raise fill or other construction. Drying or overexcavation of some materials may be appropriate.

On-site and imported soils that exhibit relatively low plasticity indices and very low to low expansive potential are generally suitable for re-use as engineered fill. Relatively low plasticity indices are defined as a plasticity index ([PI] ASTM D 4318) value of 20 or less. Very low to low expansive potential soils are defined as having an expansion index ([EI] per ASTM D 4829) of 50 or less. The Atterberg limits tests performed on selected samples indicated that the samples tested ranged in PI values from 0 (non-plastic) to 18. As such, it is our opinion that many of the on-site soils can be re-used as engineered fill during construction. Additional field sampling and laboratory testing should be conducted by the contractor prior to construction to better evaluate the suitability of on-site soils for re-use as engineered fill.

Suitable fill should not include organic material, construction debris, or other non-soil fill materials. Rock particles and clay lumps should not be larger than 4 inches in dimension. Unsuitable fill material should be disposed of off-site or in non-structural areas.

We recommend that the pipeline be supported on 4 inches, or more, (or 1/12 of the outside diameter of the pipe, whichever is more) of granular material that has particle sizes no more than 1-1/2 inches in diameter, and has 3 to 15 percent passing the No. 200 sieve. This bedding/pipe-zone backfill should extend 1 foot above the pipe crown. Care should be taken not to allow voids to form beneath the pipe (i.e., the pipe haunches should be supported) to avoid damaging the pipeline. This may involve fill placement by hand or small compaction equipment. The bedding/pipe zone should be placed in horizontal lifts no more than approximately 8 inches in loose thickness and compacted by appropriate mechanical methods, to a relative compaction of 95 percent (as

evaluated by ASTM D 698) and at a moisture content slightly above laboratory optimum. Pipe Bedding Guidelines are presented on Figure 4.

Following the improvement described above, and prior to the placement of any new fill, the resulting exposed surface should be carefully evaluated by the geotechnical consultant for the presence of soft, loose or wet native soils. Based on this evaluation, additional remediation may be needed. This additional remediation, if needed, should be addressed by the geotechnical consultant during the earthwork operations. An earthwork (shrinkage) factor of 5 to 15 percent for the on-site soils is estimated.

Trench backfill zone, as discussed in this report, refers to the zone above the pipe zone/bedding backfill material in the trench. Backfill material in this zone should be moisture-conditioned to within 2 percent of its laboratory optimum and mechanically compacted to a relative compaction of 95 percent as evaluated by ASTM D 698. Lift thickness for backfill will be dependent upon the type of compaction equipment utilized, but should generally be placed in lifts not exceeding 8 inches in loose thickness. Due to the clayey nature of the site-soils, compaction may be difficult to achieve. Special care should be exercised to avoid damaging the pipe or other structures during the compaction of the backfill. Compaction should be accomplished in a manner that discourages surface water infiltration, as well as conveyance of subsurface moisture due to the intersection of natural drainages along the alignment.

The upper 2-foot zone, located below existing or proposed pavement/flatwork sections, should also be moisture-conditioned to slightly above its laboratory optimum; however, in this zone the material should be mechanically compacted to a relative compaction of 100 percent, for granular backfill, as evaluated by ASTM D 698.

Backfilling should be accomplished by mechanical methods; compaction by flooding or jetting should not be permitted. In addition, particle sizes should not exceed 4 inches in diameter. Generated excavation materials that contain this oversize fraction shall not be used as backfill unless the material meets the criteria given above and/or the oversize

fraction has been processed and removed from the material. Imported backfill material, if utilized, should meet the criteria for imported fill as presented in Section 9.1.8 of this report.

9.1.8. Imported Fill Material

Imported fill, if utilized, should consist of granular material with a very low or low expansion potential as discussed in Section 9.1.7. Import material in contact with ferrous metals should preferably have low corrosion potential (minimum electrical resistivity more than 2,000 ohm-cm, chloride content less than 25 parts per million [ppm]). In lieu of this, corrosion protection techniques (e.g. cathodic protection, pipe wrapping, etc.), can be implemented. Imported material in contact with concrete should have a soluble sulfate content of less than 0.1 percent. The geotechnical consultant should evaluate such materials and details of their placement prior to importation. A corrosion specialist should be consulted for recommendations.

9.1.9. Modulus of Soil Reaction (E')

The modulus of soil reaction (E′) is used to characterize the stiffness of soil backfill placed on the sides of buried pipelines for the purpose of evaluating deflection caused by the weight of the backfill over the pipe. We anticipate that the invert depth of the waterline will generally be less than 10 feet bgs. For granular backfill bedding soils for pipes, we recommend using an E′ value of 1,500 pounds per square inch (psi).

9.1.10. Controlled Low Strength Material (CLSM)

It is our opinion that the backfill zone may be filled with either CLSM or acceptable on-site soils. CLSM consists of a fluid, workable mixture of aggregate, Portland cement, and water. The use of CLSM has some advantages:

- A narrower backfill zone can be used, thereby minimizing the quantity of soil to be excavated and possibly reducing disturbance to the near-by traffic;
- Relatively higher E' values may be used (E'= 3,000 psi);

- The support given to the connecting pipes is generally better;
- Because little compaction is needed to place CLSM, there is less risk of damaging the connecting pipes; and
- CLSM can be batched to flow into irregularities in the trench bottom and walls.

The CLSM design mix should be in accordance with the MAG (2012) or Standard Specifications for Public Works Construction (Public Works Standards, Inc. [PWSI], 2009). Additional mix design information can be provided upon request. The 28-day strength of the material should be no less than 50 psi and no more than 120 psi.

Buoyant or uplift forces on the piping should be considered when using CLSM and prudent construction techniques may result in multiple pours to avoid inducing excessive uplift forces. Multiple pours may also be desirable to avoid excessive lateral fluid pressure on vault walls if used as wall backfill. Sufficient time should be provided to allow the CLSM to cure before placing additional lifts of CLSM or trench backfill.

9.1.11. T-Top Pavement Replacement

In asphalt concrete paved areas over trench excavations, we recommend the use of MAG "T-Top" Type Trench Backfill (MAG detail 200-1) with respect to the asphalt and aggregate replacement at the surface of the trench excavations, in order to reduce the potential for distress due to differential settlement and water infiltration into the subsurface. This includes the removal of asphalt and aggregate base to 1 foot or more beyond the extent of each side of the installation trench, extending to 1 foot or more below the bottom of the asphalt layer. In the T-Top, the thickness of AB should be 12 inches or match either existing or design thickness, whichever is deeper. We recommend a seal be placed at the cold joint between the patch and the existing AC. Periodic maintenance of the pavement should be performed. The asphalt concrete thickness should be in accordance with any City of Scottsdale design requirements, or match the existing thickness, whichever is thicker.

9.2. Seismic Design Considerations

Based on a Probabilistic Seismic Hazard Assessment for the conterminous United States, issued by the USGS (2002 data), the site is located in a zone where the peak ground accelerations having 10, 5, and 2 percent probability of being exceeded in 50 years are 0.04g, 0.06g, and 0.09g, respectively. These ground motion values are calculated for "firm rock" sites, which correspond to a shear-wave velocity of approximately 2,500 feet per second in approximately the top 100 feet bgs. Different soil or rock types may amplify or de-amplify these values. The proposed improvements should be designed in accordance with the requirements of governing jurisdictions and applicable building codes. Table 1 presents the seismic design parameters for the site in accordance with International Building Code (ICC, 2009) guidelines and mapped spectral acceleration parameters (USGS, 2011).

Table 1 – 2009 International Building Code Seismic Design Criteria

Seismic Design Factors	Value
Site Class	D
Site Coefficient, F_a	1.6
Site Coefficient, F_v	2.4
Mapped Spectral Acceleration at 0.2-second Period, S_s	0.207 g
Mapped Spectral Acceleration at 1.0-second Period, S_1	0.066 g
Spectral Acceleration at 0.2-second Period Adjusted for Site Class, S_{MS}	0.331 g
Spectral Acceleration at 1.0-second Period Adjusted for Site Class, S_{M1}	0.159 g
Design Spectral Response Acceleration at 0.2-second Period, S_{DS}	0.221 g
Design Spectral Response Acceleration at 1.0-second Period, S_{D1}	0.106 g

9.3. Corrosion

The corrosion potential of the on-site materials was analyzed to evaluate its potential effect on the ferrous metals used for this project. Corrosion potential was evaluated using the results of laboratory testing on a sample obtained during our subsurface evaluation that was considered representative of soils along the project alignment.

Laboratory testing consisted of pH, minimum electrical resistivity, and chloride and soluble sulfate contents. The pH and minimum electrical resistivity tests were performed in general

accordance with Arizona Test 236b, while sulfate and chloride content tests were performed in accordance with Arizona Test Method 733 and 736, respectively. The results of the corrosivity tests are presented in Appendix B.

The soil pH values of the tested samples ranged from 7.9 to 8.0, which are considered to be alkaline. The minimum electrical resistivity ranged from 1,170 to 2,257 ohm-cm, which is considered to be corrosive to ferrous materials. The chloride content was 26 ppm on both samples tested, which is also considered to be corrosive to ferrous metals. The soluble sulfate content of the soil samples ranged from 0.005 to 0.038 percent by weight, which is considered to represent negligible sulfate exposure for concrete.

The results of the laboratory testing indicate that the on-site materials are generally considered to be corrosive to ferrous metals; however, present a negligible sulfate exposure for concrete.

Since ductile iron pipes are proposed to be installed along a portion of the alignment, we recommend that topsoil, organic soils, existing fill soils, and mixtures of sand and clay not be placed adjacent to buried metallic utilities. Rather, we suggest a relatively clean sand and/or gravel, or CLSM, be placed around buried metal piping. Also, buried utilities of different metallic construction should be electrically isolated from each other to minimize galvanic corrosion problems. In addition, new piping should be electrically isolated from old piping so that the old metal will not increase the corrosion rate of the new metal. A corrosion specialist should be consulted for further recommendations.

9.4. Concrete

Laboratory chemical tests performed on selected samples of on-site soils indicated sulfate contents ranging from 0.005 to 0.038 percent by weight. Based on the following American Concrete Institute (ACI) table, the on-site soils should be considered to have a negligible sulfate exposure to concrete.

Table 2 – ACI Requirements for Concrete Exposed to Sulfate-Containing Soil

Sulfate Exposure	Water-Soluble Sulfate (SO_4) in Soil, Percentage by Weight	Cement Type	Water-Cementitious Materials Ratio, by Weight, Normal-Weight Aggregate Concrete[1]	f'_c, Normal-Weight and Lightweight Aggregate Concrete, psi x 0.00689 for MPa
Negligible	0.00 - 0.10	--	--	--
Moderate[2]	0.10 - 0.20	II, IP(MS), IS (MS)	0.50 or less	4,000 or more
Severe	0.20 - 2.00	V	0.45 or less	4,500 or more
Very severe	Over 2.00	V plus pozzolan[3]	0.45 or less	4,500 or more

[1] A lower water-cementitious materials ratio or higher strength may be needed for low permeability or for protection against corrosion of embedded items or freezing and thawing (ACI Table 4.2.2).
[2] Seawater.
[3] Pozzolan that has been evaluated by test or service record to improve sulfate resistance when used in concrete containing Type V cement.

Notwithstanding the sulfate test results and due to the limited number of chemical tests performed, as well as our experience with similar soil conditions, we recommend the use of Type II cement for construction of concrete structures at this site. Due to potential uncertainties as to the use of reclaimed irrigation water (possibly from the golf course), or topsoil that may contain higher sulfate contents, pozzolan or admixtures designed to increase sulfate resistance may be considered.

The concrete should have a water-cementitious materials ratio no more than 0.50 percent by weight for normal weight aggregate concrete. The structural engineer should ultimately select the concrete design strength based on the project specific loading conditions. Higher strength concrete may be selected for increased durability and resistance to shrinkage cracking.

9.5. Site Drainage

Positive surface drainage should be provided to divert water away from the trench zone and pavements. Surface water should not be permitted to pond over the trench zone or on pavement surfaces after construction. Water that is pumped out of the trench should be done so in an area that drains the water away from the trench.

9.6. Pre-Construction Conference

We recommend that a pre-construction conference be held. Representatives of the owner, civil engineer, the geotechnical consultant, and the contractor should be in attendance to discuss the project plans and schedule. Our office should be notified if the project description included herein is incorrect, or if the project characteristics are significantly changed.

9.7. Construction Observation and Testing

During construction operations, we recommend that a qualified geotechnical consultant perform observation and testing services for the project. These services should be performed to evaluate exposed subgrade conditions, to evaluate the suitability of proposed borrow materials for use as fill and to observe and test placement of compacted fill soils. If another geotechnical consultant is selected to perform observation and testing services for the project, we request that the selected consultant provide a letter to the owner, with a copy to Ninyo & Moore, indicating that they fully understand our recommendations and that they are in full agreement with the recommendations contained in this report. Qualified subcontractors utilizing appropriate techniques and construction materials should perform construction of the proposed foundations.

10. LIMITATIONS

The field evaluation, laboratory testing, and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty,

expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be encountered during construction. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluation will be performed upon request. Please also note that our evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

This report is intended for design purposes only. It does not provide sufficient data to prepare an accurate bid by contractors. It is suggested that the bidders and their geotechnical consultant perform an independent evaluation of the subsurface conditions in the project areas. The independent evaluations may include, but not be limited to, review of other geotechnical reports prepared for the adjacent areas, site reconnaissance, and additional exploration and laboratory testing.

Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

11. SELECTED REFERENCES

American Concrete Institute, 2005, Building Code Requirements for Structural Concrete (ACI 318-05) and Commentary (ACI 318R-05).

American Concrete Institute, 1991a, Guidelines for Concrete Floor and Slab Construction (ACI 302.1R).

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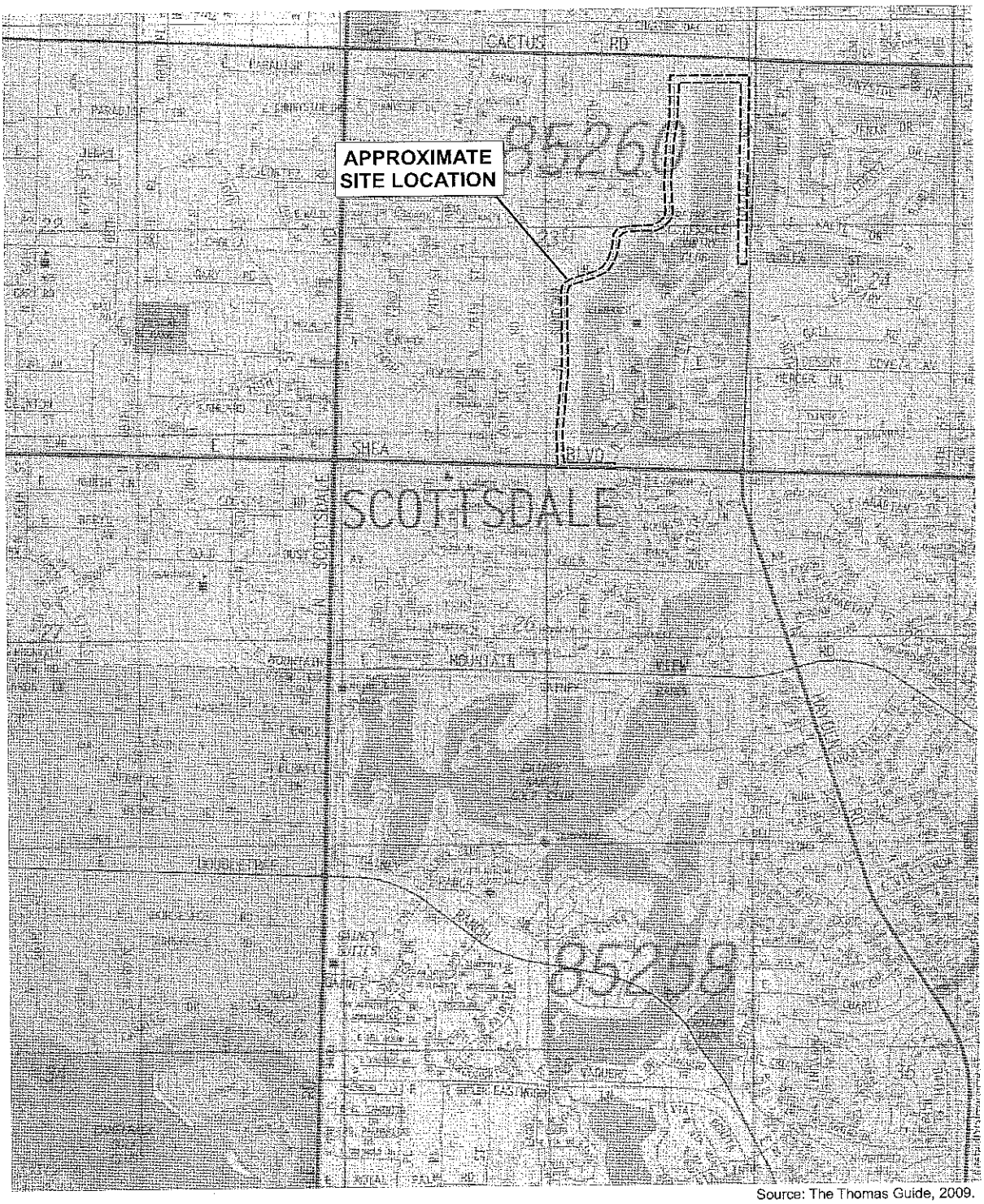
Aerial Photographs Reviewed

Source	Date(s)
Flood Control District of Maricopa County	1949, 1959, 1962, 1979, 1993, 2004, 2009



Source: The Thomas Guide, 2009.

0 1900

Approximate Scale:
1 inch = 1900 feet

Note: All dimensions, directions and locations are approximate.

Ninyo & Moore	SITE LOCATION	FIGURE 1
PROJECT NO: 603635001 / DATE: 4/12	STARFIRE GOLF COURSE WATERLINE IMPROVEMENTS SHEA BOULEVARD AND HAYDEN ROAD SCOTTSDALE, ARIZONA	

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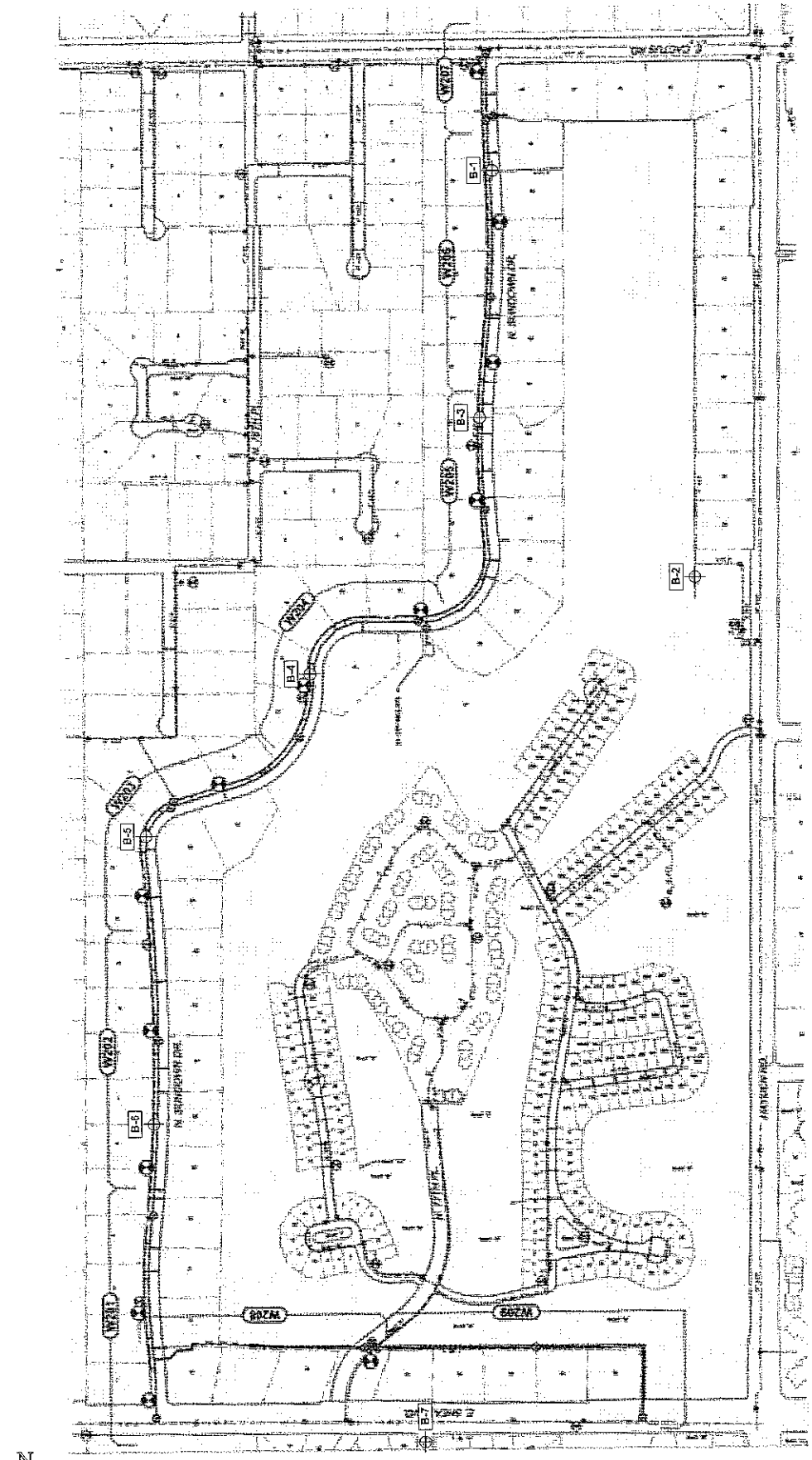


LEGEND

B-7 Boring Location

NOT TO SCALE

Source: Basemap modified after GHD, 11/2011.

Note: Dimensions, directions, and locations are approximate.

Ninyo & Moore

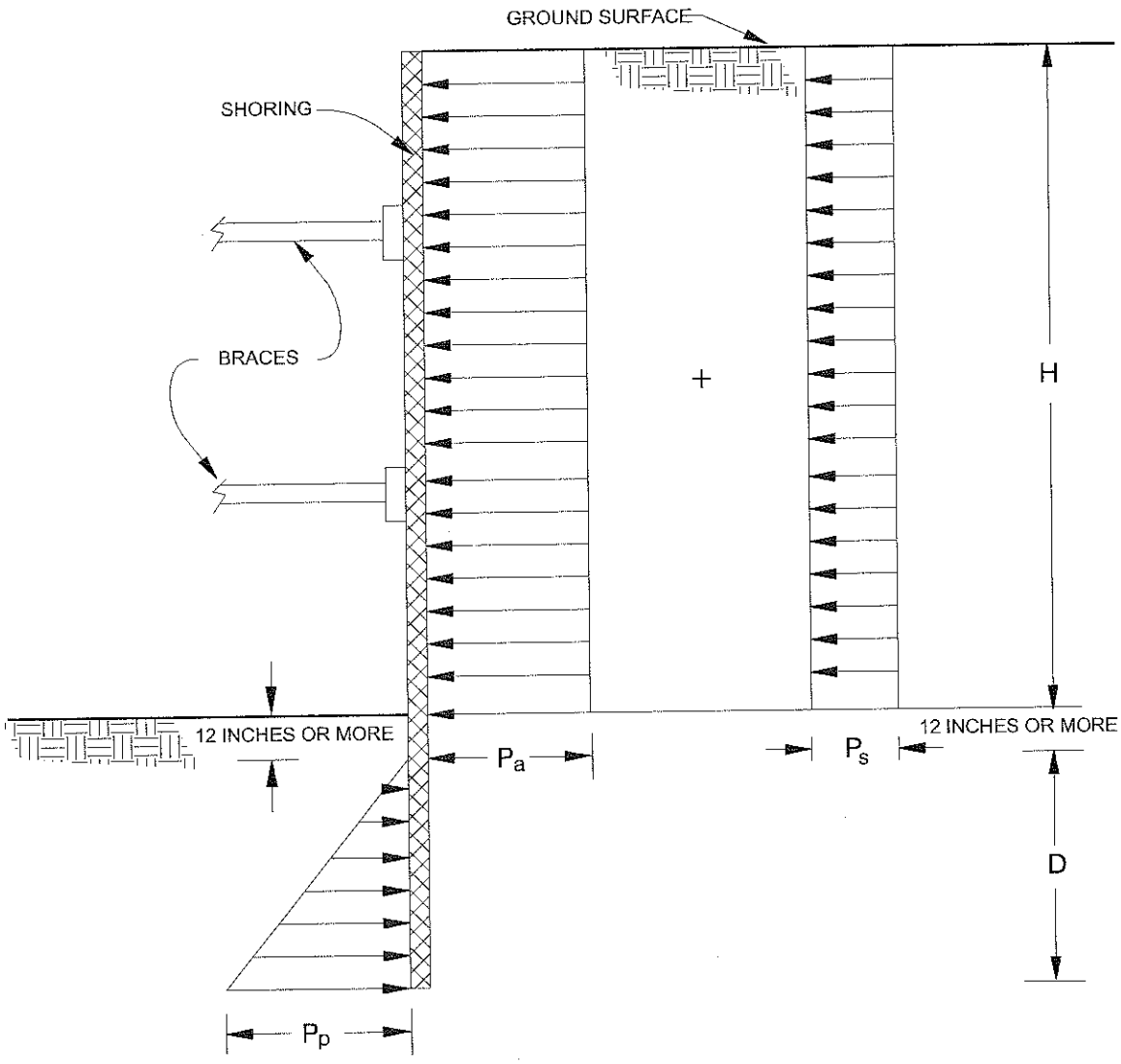
PROJECT NO:	DATE:
609635001	4/12

BORING LOCATIONS

STARFIRE GOLF COURSE WATERLINE IMPROVEMENTS
SHEA BOULEVARD AND HAYDEN ROAD
SCOTTSDALE, ARIZONA

FIGURE 2

File no: 365blm0412



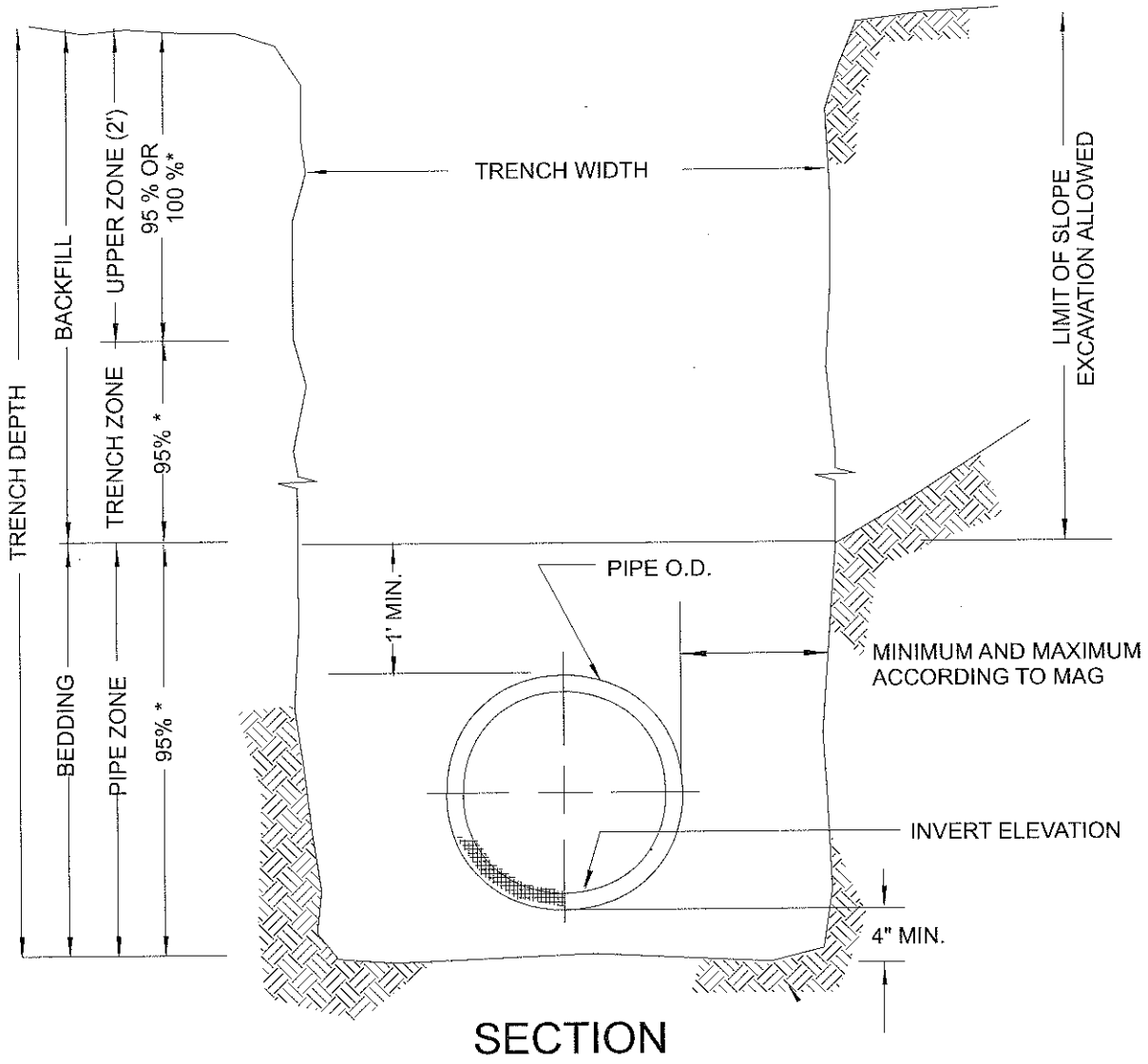
NOTES:

1. APPARENT LATERAL EARTH PRESSURE, P_a
   P_a = 25 H psf
2. CONSTRUCTION TRAFFIC INDUCED SURCHARGE PRESSURE, P_s
   P_s = 120 psf
3. PASSIVE LATERAL EARTH PRESSURE, P_p
   P_p = 300 D psf
4. ASSUMES GROUNDWATER IS NOT PRESENT
5. SURCHARGES FROM EXCAVATED SOIL OR CONSTRUCTION MATERIALS ARE NOT INCLUDED
6. H AND D ARE IN FEET

NOT TO SCALE

Ninyo & Moore	LATERAL EARTH PRESSURES FOR BRACED EXCAVATION	FIGURE 3
PROJECT NO: 603635001 / DATE: 4/12	STARFIRE GOLF COURSE WATERLINE IMPROVEMENTS SHEA BOULEVARD AND HAYDEN ROAD SCOTTSDALE, ARIZONA	

file no: 3635lep0412



SECTION

NOTE

* Indicates minimum relative compaction (see report for details).

Upper zone required for pavement areas only.

Diagram not drawn to scale.

Ninyo & Moore	PIPE BEDDING GUIDELINES	FIGURE
PROJECT NO: 603635001 / DATE: 4/12	STARFIRE GOLF COURSE WATERLINE IMPROVEMENTS SHEA BOULEVARD AND HAYDEN ROAD SCOTTSDALE, ARIZONA	4

file no: 3635pbg0412

APPENDIX A

BORING LOGS

Field Procedure for the Collection of Disturbed Samples

Disturbed soil samples were obtained in the field using the following methods.

Bulk Samples

Bulk samples of representative earth materials were obtained from the exploratory borings. The samples were bagged and transported to the laboratory for testing.

The Standard Penetration Test Spoon

Disturbed drive samples of earth materials were obtained by means of a Standard Penetration Test spoon sampler. The sampler is composed of a split barrel with an external diameter of 2 inches and an unlined internal diameter of 1-3/8 inches. The spoon was driven up to 18 inches into the ground with a 140-pound hammer free-falling from a height of 30 inches in general accordance with ASTM D 1586. The blow counts were recorded for every 6 inches of penetration; the blow counts reported on the logs are those for the last 12 inches of penetration. Soil samples were observed and removed from the spoon, bagged, sealed, and transported to the laboratory for testing.

Field Procedure for the Collection of Relatively Undisturbed Samples

Relatively undisturbed soil samples were obtained in the field using the following method.

The Modified Split-Barrel Drive Sampler

The sampler, with an external diameter of 3.0 inches, was lined with 1-inch long, thin brass rings with inside diameters of approximately 2.4 inches. The sample barrel was driven into the ground with a 140-pound hammer free-falling from a height of 30 inches in general accordance with ASTM D 1586. The samples were removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

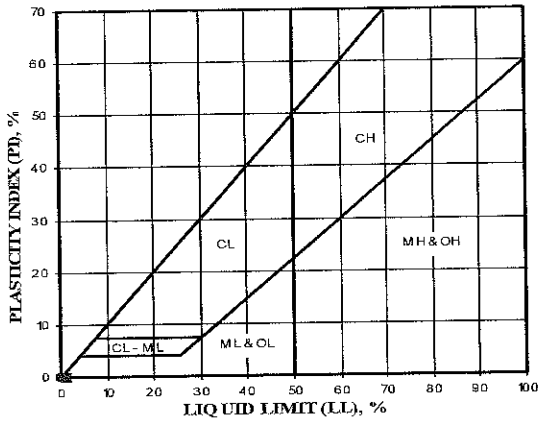
U.S.C.S. METHOD OF SOIL CLASSIFICATION

MAJOR DIVISIONS		SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS (More than 1/2 of soil >No. 200 sieve size)	GRAVELS (More than 1/2 of coarse fraction > No. 4 sieve size)	GW	Well graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS (More than 1/2 of coarse fraction <No. 4 sieve size)	SW	Well graded sands or gravelly sands, little or no fines
		SP	Poorly graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (More than 1/2 of soil <No. 200 sieve size)	SILTS & CLAYS Liquid Limit <50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean
		OL	Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS Liquid Limit >50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils

GRAIN SIZE CHART

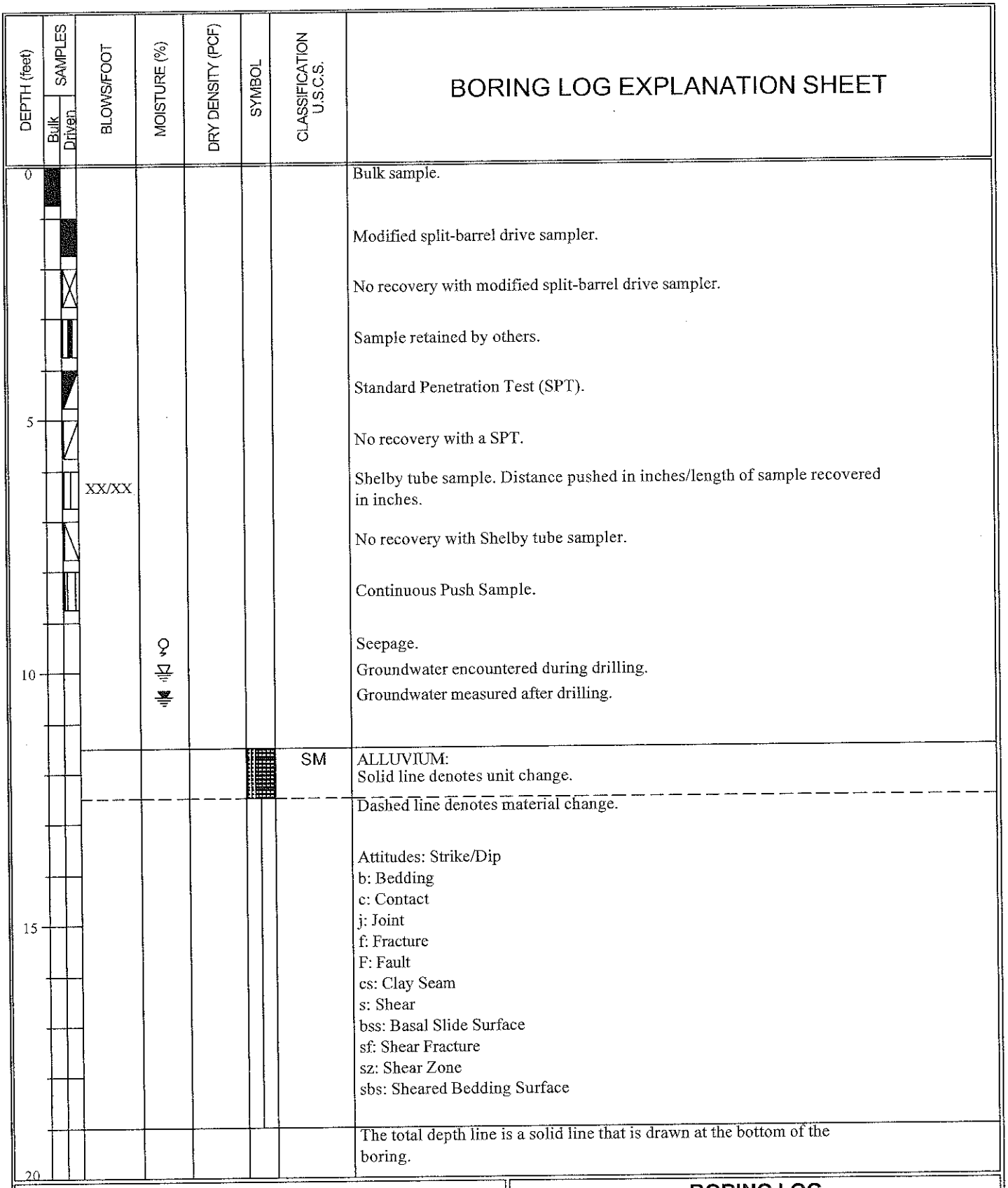
CLASSIFICATION	RANGE OF GRAIN SIZE	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL	3" to No. 4	76.2 to 4.76
Coarse	3" to 3/4"	76.2 to 19.1
Fine	3/4" to No. 4	19.1 to 4.76
SAND	No. 4 to No. 200	4.76 to 0.075
Coarse	No. 4 to No. 10	4.76 to 2.00
Medium	No. 10 to No. 40	2.00 to 0.420
Fine	No. 40 to No. 200	0.420 to 0.075
SILT & CLAY	Below No. 200	Below 0.075

PLASTICITY CHART



Ninyo & Moore

U.S.C.S. METHOD OF SOIL CLASSIFICATION


DEPTH (feet)
SAMPLES
Bulk
Driven
BLOWS/FOOT
MOISTURE (%)
DRY DENSITY (PCF)
SYMBOL
CLASSIFICATION U.S.C.S.
BORING LOG EXPLANATION SHEET
0
5
10
15
20
XX/XX
SM
Bulk sample.
Modified split-barrel drive sampler.
No recovery with modified split-barrel drive sampler.
Sample retained by others.
Standard Penetration Test (SPT).
No recovery with a SPT.
Shelby tube sample. Distance pushed in inches/length of sample recovered in inches.
No recovery with Shelby tube sampler.
Continuous Push Sample.
Seepage.
Groundwater encountered during drilling.
Groundwater measured after drilling.
ALLUVIUM:
Solid line denotes unit change.
Dashed line denotes material change.
Attitudes: Strike/Dip
b: Bedding
c: Contact
j: Joint
f: Fracture
F: Fault
cs: Clay Seam
s: Shear
bss: Basal Slide Surface
sf: Shear Fracture
sz: Shear Zone
sbs: Sheared Bedding Surface
The total depth line is a solid line that is drawn at the bottom of the boring.
Ninyo & Moore
BORING LOG
EXPLANATION OF BORING LOG SYMBOLS
PROJECT NO.
DATE
Rev. 01/03
FIGURE

DATE DRILLED 3/26/12 BORING NO. B-1

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Diedrich D-50, 8" Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ASPHALT CONCRETE: Approximately 3 inches thick.
						SM	AGGREGATE BASE: Approximately 3 inches thick. Brown, damp, medium dense, poorly graded GRAVEL with sand.
		10	4.2	111.7			FILL: Brown, damp, loose, silty SAND; trace gravel.
		15					Medium dense.
5						SC	ALLUVIUM: Brown, damp, dense, clayey SAND with gravel; scattered caliche nodules.
		57	2.6	116.4			
		41					Very dense; numerous caliche nodules.
10							Total Depth = 10 feet. Groundwater not encountered during drilling. Backfilled and asphalt patched on 3/26/12 promptly after completion of drilling. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
15							
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BORING LOG

Starfire Golf Course Waterline Improvements
Scottsdale, Arizona

PROJECT NO.	DATE	FIGURE
603635001	4/12	A-1

DATE DRILLED 3/26/12 BORING NO. B-2

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Diedrich D-50, 8" Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ASPHALT CONCRETE: Approximately 3 inches thick.
						SM	AGGREGATE BASE: Approximately 4 inches thick. Brown, damp, medium dense, poorly graded GRAVEL with sand.
		7					ALLUVIUM: Brown, damp, loose to medium dense, silty SAND.
						SC	Brown, damp, very dense, clayey SAND; scattered caliche nodules.
		50/5"					
5		32					Dense.
		59	7.8	120.9			Numerous caliche nodules.
10							Total Depth = 10 feet. Groundwater not encountered during drilling. Backfilled and asphalt patched on 3/26/12 promptly after completion of drilling. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
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BORING LOG

Starfire Golf Course Waterline Improvements
Scottsdale, Arizona

PROJECT NO.	DATE	FIGURE
603635001	4/12	A-2

DATE DRILLED 3/26/12 BORING NO. B-3

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Diedrich D-50, 8" Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ASPHALT CONCRETE: Approximately 4 inches thick.
							AGGREGATE BASE: Approximately 5 inches thick.
						SM	Brown, damp, medium dense, poorly graded GRAVEL with sand.
		3					FILL: Brown, moist, very loose to loose, silty fine SAND.
						CL	ALLUVIUM: Brown, damp, hard, sandy CLAY; trace gravel.
5		73	11.0	110.5			
		19					Very stiff.
		50/5"					Hard; scattered caliche nodules.
10							Total Depth = 9.4 feet. Groundwater not encountered during drilling. Backfilled and asphalt patched on 3/26/12 promptly after completion of drilling. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
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Ninyo & Moore

BORING LOG

Starfire Golf Course Waterline Improvements
Scottsdale, Arizona

PROJECT NO.	DATE	FIGURE
603635001	4/12	A-3

DATE DRILLED 3/26/12 BORING NO. B-4

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Diedrich D-50, 8" Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ASPHALT CONCRETE: Approximately 4.5 inches thick.
							AGGREGATE BASE: Approximately 3.5 inches thick.
						SC	Brown, damp, medium dense, poorly graded GRAVEL with sand.
		16					ALLUVIUM: Brown, damp, medium dense, clayey SAND.
						SM	Brown, damp, medium dense, silty fine to medium SAND; trace clay.
		18					
5						SC	Brown, damp, very dense, clayey SAND; scattered caliche filaments.
		50/5"					
		50/5"					
10							Total Depth = 9.4 feet. Groundwater not encountered during drilling. Backfilled and asphalt patched on 3/26/12 promptly after completion of drilling. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
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Ninyo & Moore

BORING LOG

Starfire Golf Course Waterline Improvements
Scottsdale, Arizona

PROJECT NO.	DATE	FIGURE
603635001	4/12	A-4

DATE DRILLED 3/26/12 BORING NO. B-5

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Diedrich D-50, 8" Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ASPHALT CONCRETE: Approximately 4 inches thick.
							AGGREGATE BASE: Approximately 3.5 inches thick.
						CL	Brown, damp, medium dense, poorly graded GRAVEL with sand.
		4					ALLUVIUM: Brown, damp, firm, sandy CLAY.
		40	5.3	105.4		ML	Brown, damp, medium dense, sandy SILT; trace gravel.
5							
						SC	Brown, damp, very dense, clayey SAND; scattered caliche nodules.
		41					
		50/5"					
							Total Depth = 8.9 feet. Groundwater not encountered during drilling. Backfilled and asphalt patched on 3/26/12 promptly after completion of drilling. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
10							
15							
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BORING LOG

Starfire Golf Course Waterline Improvements
Scottsdale, Arizona

PROJECT NO.	DATE	FIGURE
603635001	4/12	A-5

DATE DRILLED 3/26/12 BORING NO. B-6

GROUND ELEVATION – SHEET 1 OF 1

METHOD OF DRILLING Diedrich D-50, 8" Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ASPHALT CONCRETE: Approximately 4 inches thick.
							AGGREGATE BASE: Approximately 3 inches thick.
						SM	Brown, damp, medium dense, fine to coarse GRAVEL with sand; few silt.
		9					FILL: Brown, damp, loose, silty SAND; few gravel.
		10					Medium dense.
5						CL	ALLUVIUM: Brown, damp, hard sandy CLAY; trace gravel; numerous caliche nodules.
		60	10.0	109.6			
						SC	Brown, damp, very dense, clayey SAND; few gravel; scattered caliche nodules.
		87					
10							Total Depth = 10 feet. Groundwater not encountered during drilling. Backfilled and asphalt patched on 3/26/12 promptly after completion of drilling. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
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BORING LOG

Starfire Golf Course Waterline Improvements
Scottsdale, Arizona

PROJECT NO.	DATE	FIGURE
603635001	4/12	A-6

DATE DRILLED 3/26/12 BORING NO. B-7

GROUND ELEVATION -- SHEET 1 OF 1

METHOD OF DRILLING Diedrich D-50, 8" Hollow-Stem Auger (D&S Drilling)

DRIVE WEIGHT 140 lbs. (Automatic) DROP 30"

SAMPLED BY DM LOGGED BY DM REVIEWED BY JSR

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ASPHALT CONCRETE: Approximately 1.5 inches thick.
							AGGREGATE BASE: Approximately 6.5 inches thick.
						SC	ALLUVIUM: Brown, damp, medium dense, clayey SAND; trace gravel.
		12					
		44					Dense.
5							
		24					
						SM	Brown, damp, dense, silty SAND; scattered caliche nodules.
		50	7.9	110.7			
10							Total Depth = 10 feet. Groundwater not encountered during drilling. Backfilled and asphalt patched on 3/26/12 promptly after completion of drilling. Note: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.
15							
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Ninyo & Moore

BORING LOG

Starfire Golf Course Waterline Improvements
Scottsdale, Arizona

PROJECT NO.	DATE	FIGURE
603635001	4/12	A-7

APPENDIX B

LABORATORY TESTING

Classification

Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488. Soil classifications are indicated on the logs of the exploratory excavations in Appendix A.

In-Place Moisture and Density Tests

The moisture content and dry density of relatively undisturbed samples obtained from the exploratory excavations were evaluated in general accordance with ASTM D 2937. The test results are presented on the logs of the exploratory excavations in Appendix A.

Gradation Analysis

Gradation analysis tests were performed on selected representative soil samples in general accordance with ASTM D 422. The grain-size distribution curves are shown on Figures B-1 through B-4. These test results were utilized in evaluating the soil classifications in accordance with the Unified Soil Classification System.

Atterberg Limits

Tests were performed on selected representative fine-grained soil samples to evaluate the liquid limit, plastic limit, and plasticity index in general accordance with ASTM D 4318. These test results were utilized to evaluate the soil classification in accordance with the Unified Soil Classification System. The test results and classifications are shown on Figure B-5.

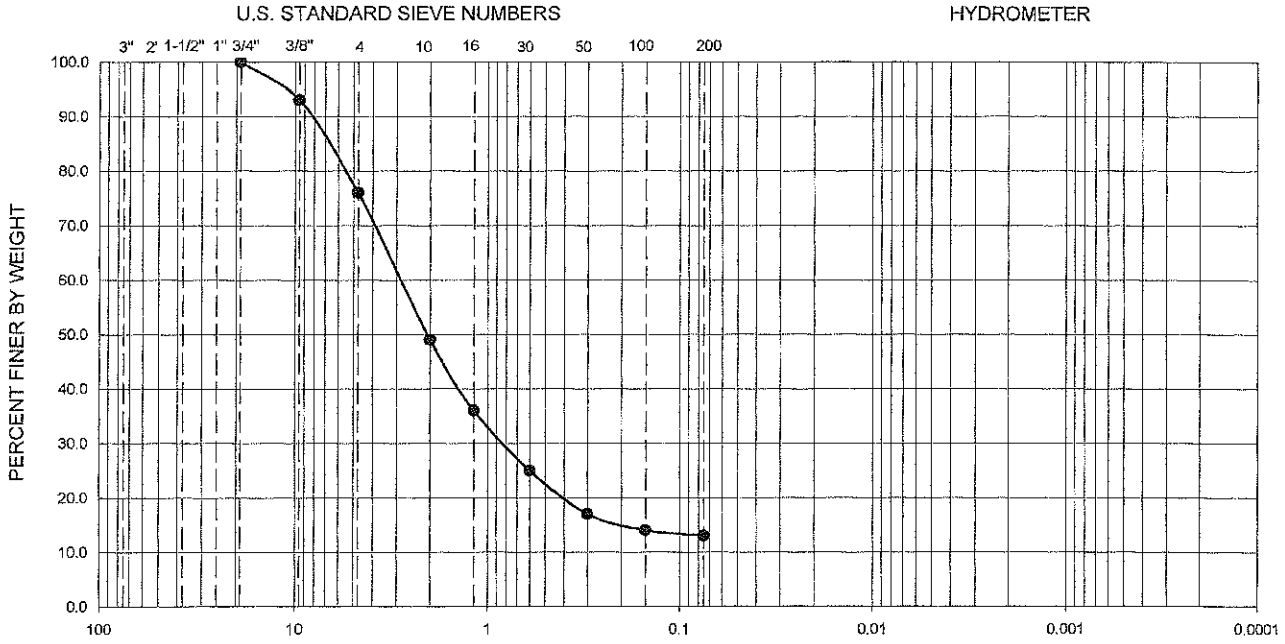
Consolidation Tests

Consolidation tests were performed on selected relatively undisturbed soil samples in general accordance with ASTM D 2435. The samples were inundated during testing to represent adverse field conditions. The percent of consolidation for each load cycle was recorded as a ratio of the amount of vertical compression to the original height of the sample. The results of the tests are summarized on Figures B-6 and B-7.

Soil Corrosivity Tests

Soil pH and minimum resistivity tests were performed on representative samples in general accordance with Arizona Test 236b. The chloride content of selected samples was evaluated in general accordance with Arizona Test 736. The sulfate content of selected samples was evaluated in general accordance with Arizona Test 733. The test results are presented on Figure B-8.

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY

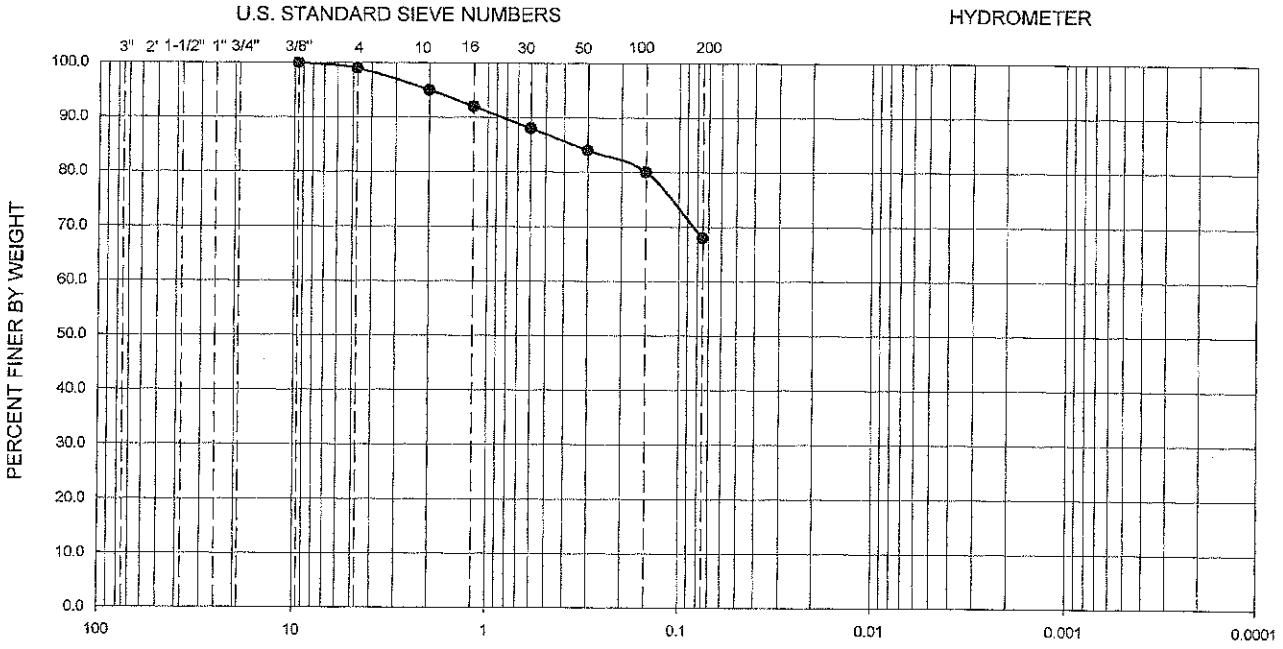


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	B-1	6-7.5	34	16	18	--	--	--	--	--	13	SC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. 603635001 / DATE 4/12	STARFIRE GOLF COURSE WATERLINE IMPROVEMENTS SCOTTSDALE, ARIZONA	B-1

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY

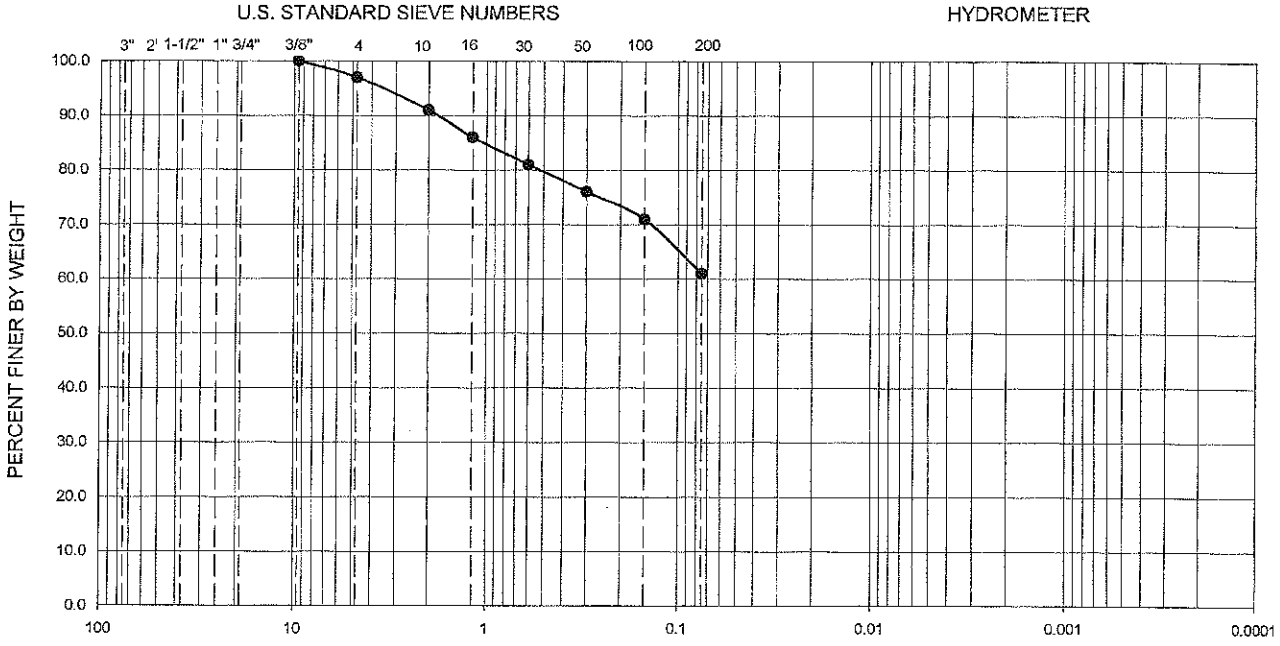


Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	B-3	3.5-5	31	17	14	--	--	--	--	--	68	CL

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. 603635001 / DATE 4/12	STARFIRE GOLF COURSE WATERLINE IMPROVEMENTS SCOTTSDALE, ARIZONA	B-2

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



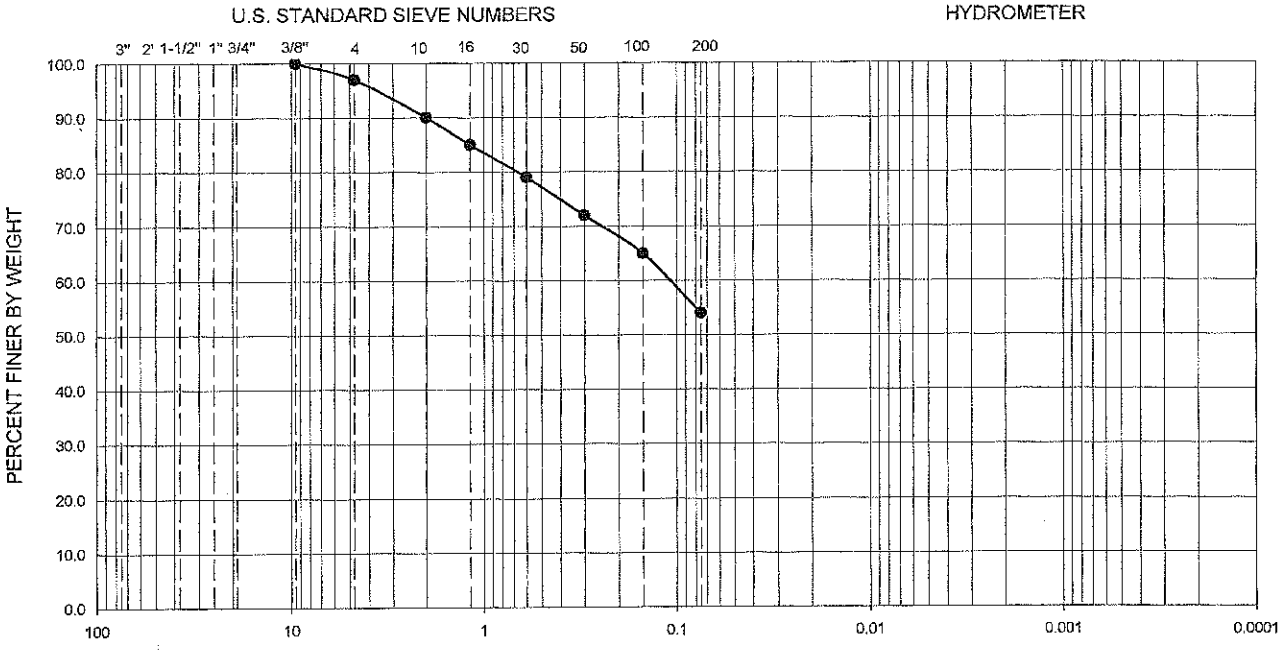
Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	B-5	3.5-5	--	--	NP	--	--	--	--	--	61	ML

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

NP - INDICATES NON-PLASTIC

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. 603635001 / DATE 4/12	STARFIRE GOLF COURSE WATERLINE IMPROVEMENTS SCOTTSDALE, ARIZONA	B-3

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



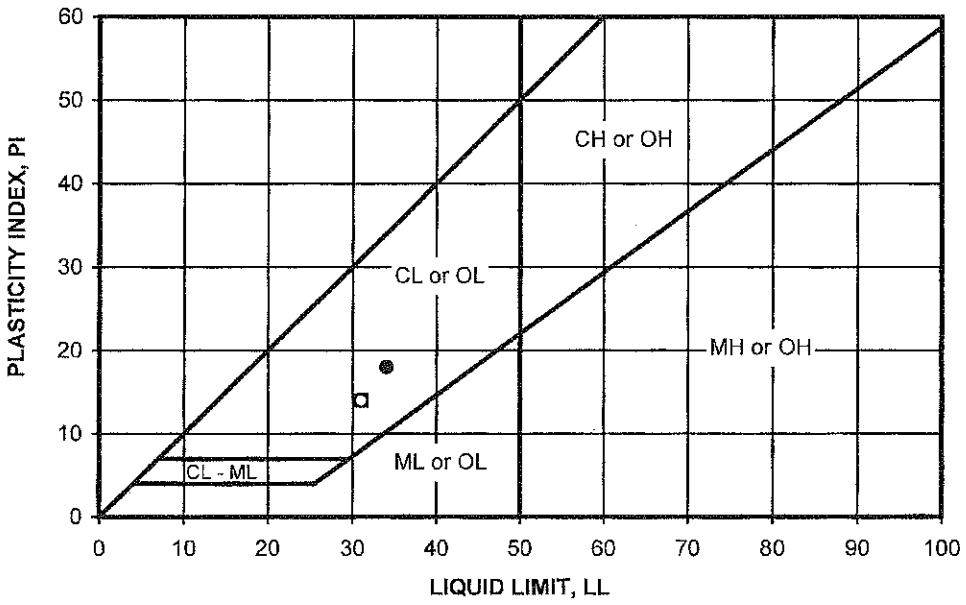
Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	B-6	6-7.5	31	17	14	--	--	--	--	--	54	CL

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 422

Ninyo & Moore	GRADATION TEST RESULTS	FIGURE
PROJECT NO. 603635001 / DATE 4/12	STARFIRE GOLF COURSE WATERLINE IMPROVEMENTS SCOTTSDALE, ARIZONA	B-4

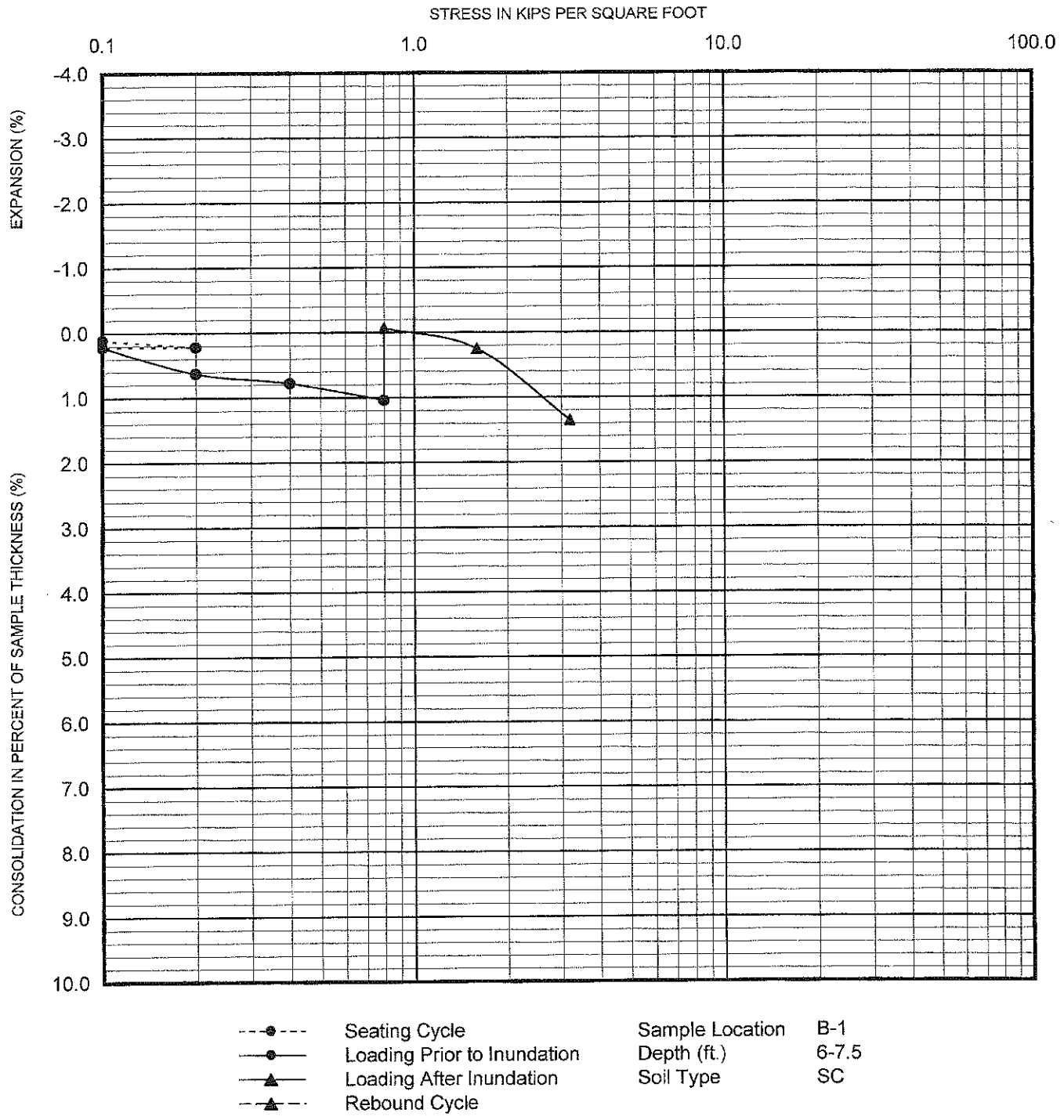
SYMBOL	LOCATION	DEPTH (FT)	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	USCS CLASSIFICATION (Fraction Finer Than No. 40 Sieve)	USCS (Entire Sample)
●	B-1	6-7.5	34	16	18	CL	SC
■	B-3	3.5-5	31	17	14	CL	CL
◆	B-5	3.5-5	--	--	NP	ML	ML
○	B-6	6-7.5	31	17	14	CL	CL

NP - INDICATES NON-PLASTIC



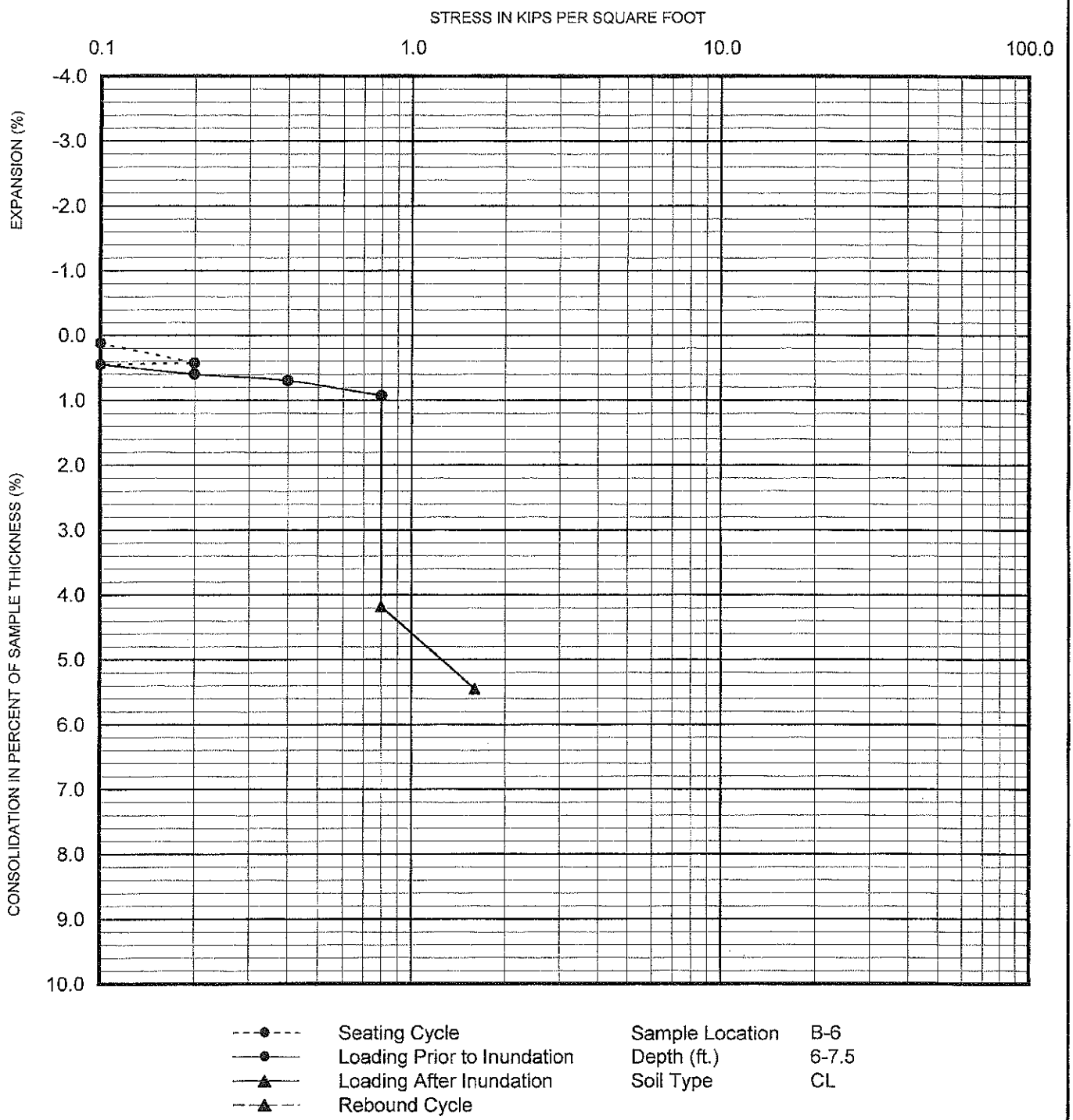
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318

Ninyo & Moore	ATTERBERG LIMITS TEST RESULTS	FIGURE
PROJECT NO. 603635001 / DATE 4/12	STARFIRE GOLF COURSE WATERLINE IMPROVEMENTS SCOTTSDALE, ARIZONA	B-5



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

Ninyo & Moore	CONSOLIDATION TEST RESULTS	FIGURE
PROJECT NO. 603635001 / DATE 4/12	STARFIRE GOLF COURSE WATERLINE IMPROVEMENTS SCOTTSDALE, ARIZONA	B-6



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

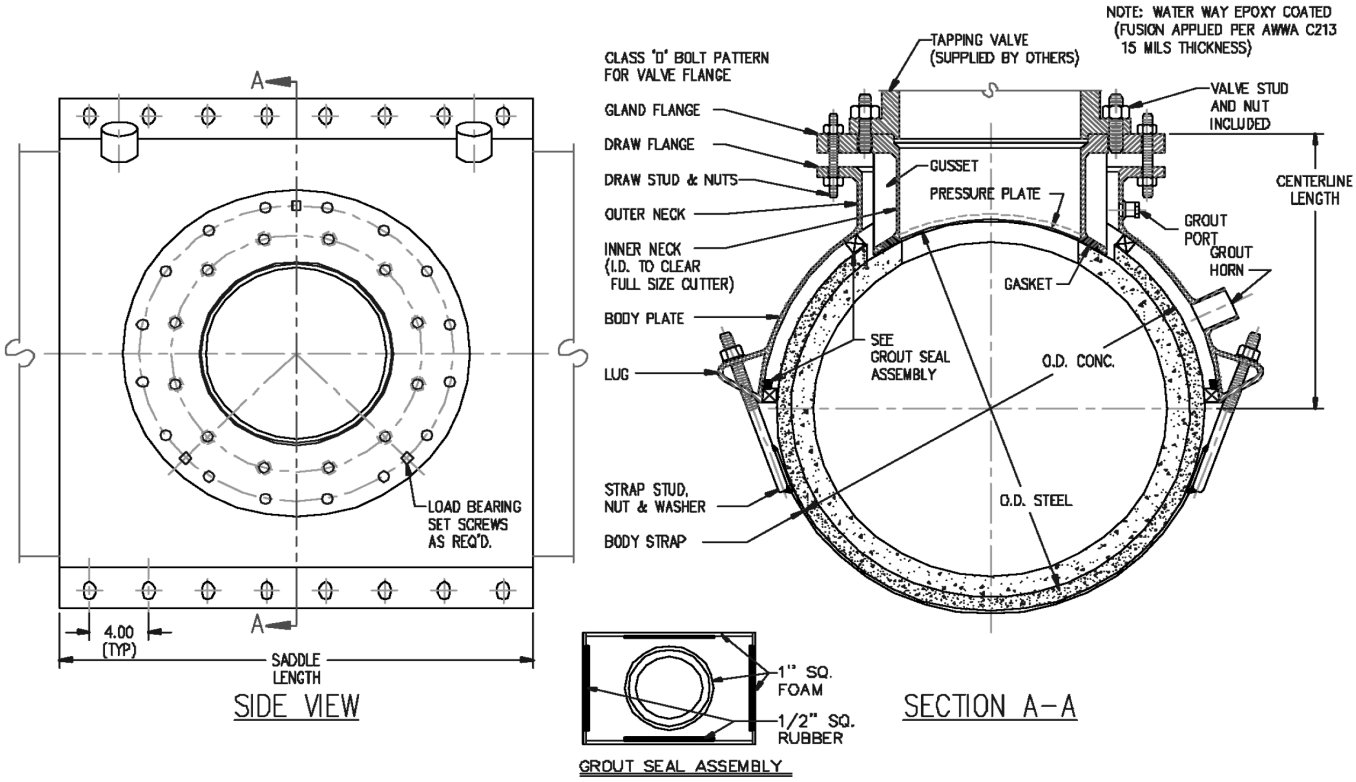
Ninyo & Moore	CONSOLIDATION TEST RESULTS	FIGURE
PROJECT NO. 603635001 / DATE 4/12	STARFIRE GOLF COURSE WATERLINE IMPROVEMENTS SCOTTSDALE, ARIZONA	B-7

SAMPLE LOCATION	SAMPLE DEPTH (FT)	pH [1]	RESISTIVITY [1] (Ohm-cm)	SULFATE CONTENT [2]		CHLORIDE CONTENT [3] (ppm)
				(ppm)	(%)	
B-1	1-5	8.0	1,710	46	0.005	26
B-4	1-5	7.9	2,257	384	0.038	26

[1] PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 236b
[2] PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 733
[3] PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 736

Ninyo & Moore	CORROSIVITY TEST RESULTS	FIGURE
PROJECT NO. 603635001 / DATE 4/12	STARFIRE GOLF COURSE WATERLINE IMPROVEMENTS SCOTTSDALE, ARIZONA	B-8

JCM 415 Tapping Sleeve For Concrete Steel Cylinder Pipe Installation Instructions TYPE I



READ ENTIRE INSTRUCTION SET BEFORE INSTALLING SLEEVE

1. Excavate and clean pipe in area where sleeve is to be installed. Remove any irregularities extending beyond the normal contour of the pipe surface. Check all measurements to be certain sleeve is correct size for the pipe.

2. Position gland on the pipe and mark area where mortar coating is to be removed.

3. Remove gland and set aside. Carefully remove mortar coating from area where tap is to be made - exposing but not damaging the prestress wires and steel cylinder.

4. Check to make certain all grout gaskets are in place around the edge of the sleeve and around the outlet. Place the sleeve on the pipe with the outlet over the opening in the mortar coating (with the grouting horns up) and install the straps. Tighten the straps with only sufficient torque to lightly seal the grout gaskets, alternating from one side of the sleeve to the other - starting at the outside straps and working in toward the center.

INT415-1-0306

JCM 415 Tapping Sleeve For Concrete Steel Cylinder Pipe Installation Instructions TYPE I (Continued)

5. Pour cement grout into the grout horns in the sleeve filling the space between the sleeve and the pipe. Pound the sleeve with a hammer to vibrate grout into place. After the grout has set, tighten bolts on straps to 80 - 90 ft. lbs. of torque.

   (Note: Torque given is based on clean lightly lubricated threads)

6. Carefully cut and remove the exposed prestress wires to provide clearance for the gland to seal against the cylinder. For embedded cylinder pipe, the outer portion of the concrete core must be removed to expose the cylinder. Clean steel cylinder surface of any remaining concrete. (Note: If there is a weld seam on the cylinder of the pipe in the area of the tap, carefully flatten the weld so that the tapping sleeve will seal on it, do not grind the weld). JCM recommends adherence to the AWWA M-44 Manual for proper valve installation, support and trenching.

7. Check the gasket in the gland to make certain it is undamaged and in its retaining groove. Remove any tape used to secure gasket in place during shipment.

8. Install the four (4) threaded studs in the sleeve outlet to assist in properly aligning the gland. Install the gland in the sleeve outlet so that the contour of the gasket seat exactly matches the contour of the steel cylinder. Install the remainder of the draw bolts. Check the gasket seat and all alignments. Tighten the draw bolts evenly to compress the gasket. A feeler gauge can be used to check gasket position during tightening. When completely tightened there should be approximately 1/8” between the gasket seat and pipe cylinder.

9. After installation of the tapping gland, tighten the load bearing set screws located between the draw bolts of the outer bolt circle. This locks the gland in place and transfers any loading from the outlet onto the sleeve and away from the cylinder.

10. Install the tapping valve utilizing the inner circle of studs and nuts. (Furnished on 4” - 12” Outlets.)

11. Use water to pressure test the gland seal (per AWWA C-223), flange gaskets and tapping valve to assure all joints are tight and gaskets properly seated. ***Note: For safety purposes do not test above line pressure. Contact pipe manufacturer for possible need to throttle back pressure on larger taps or for special concerns.***

12. On completion of the pressure test, pour cement mortar (2 parts sand, 1 part cement) into the opening between the gland and the saddle and into the grout port(s) in the sleeve neck, completely filling the space around the gland; allow to set. After the tap is complete, encase the saddle in a protective coating of cement mortar or concrete to a minimum thickness of 1” over the entire assembly including straps to further protect the sleeve.