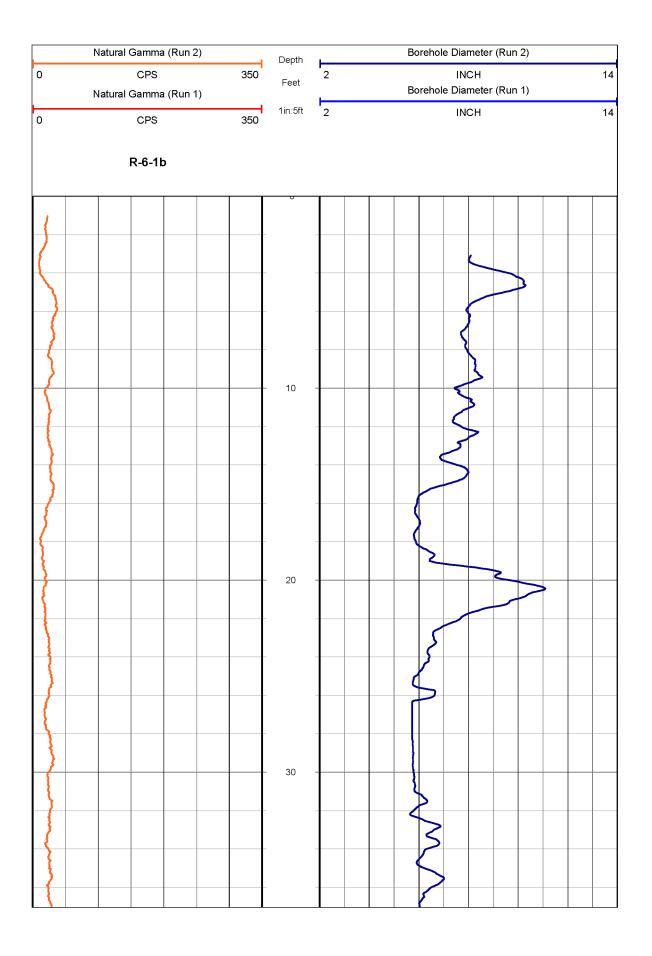
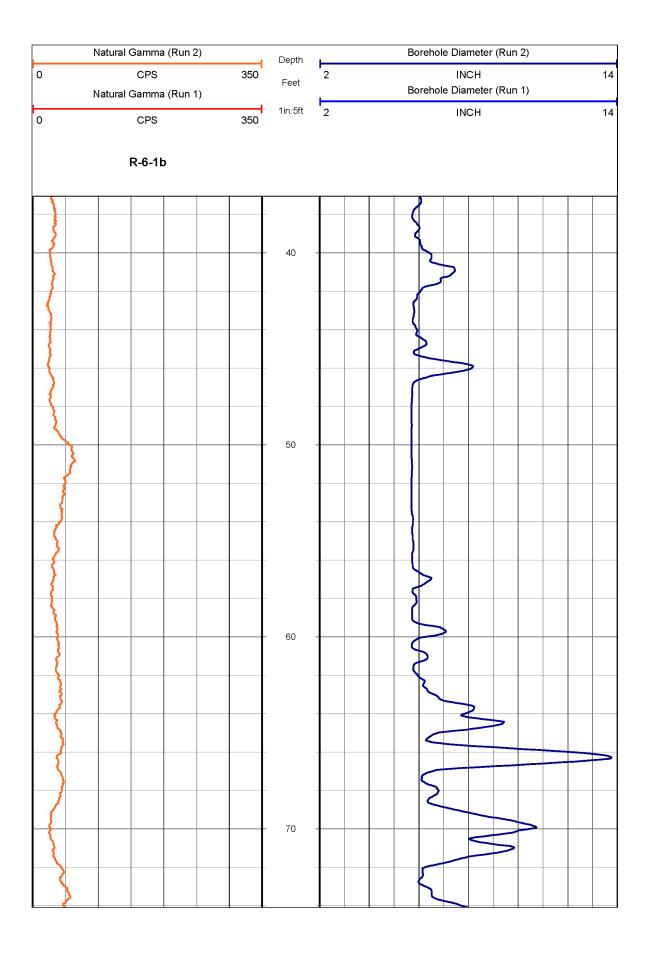
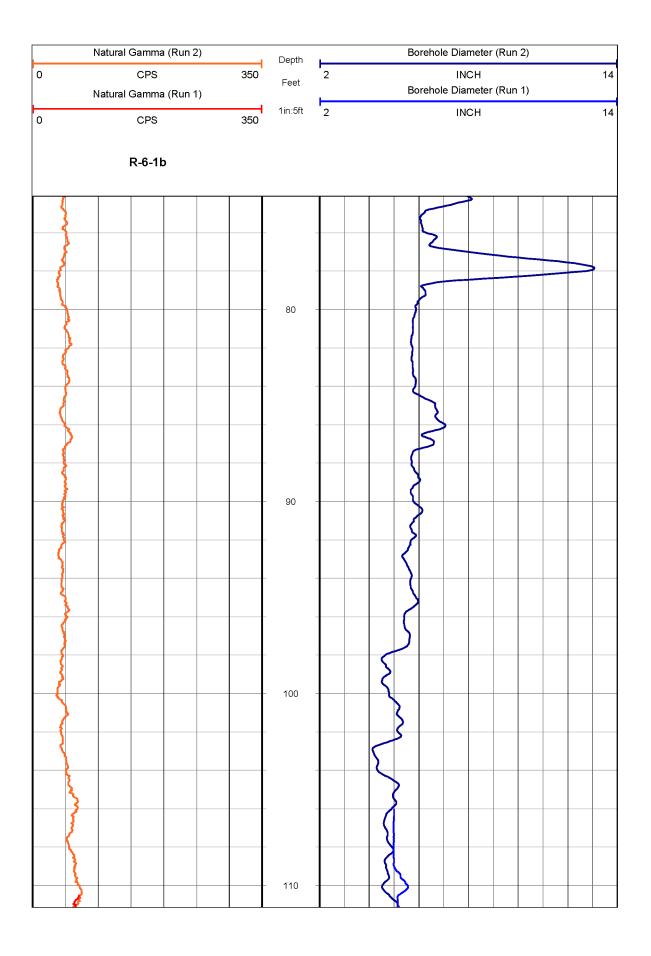
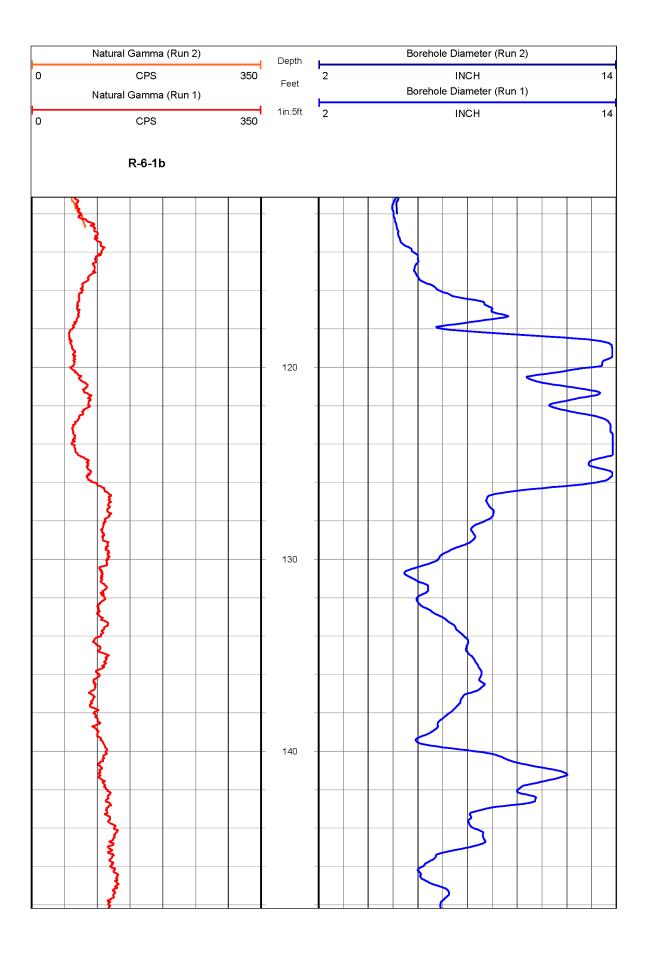
APPENDIX D

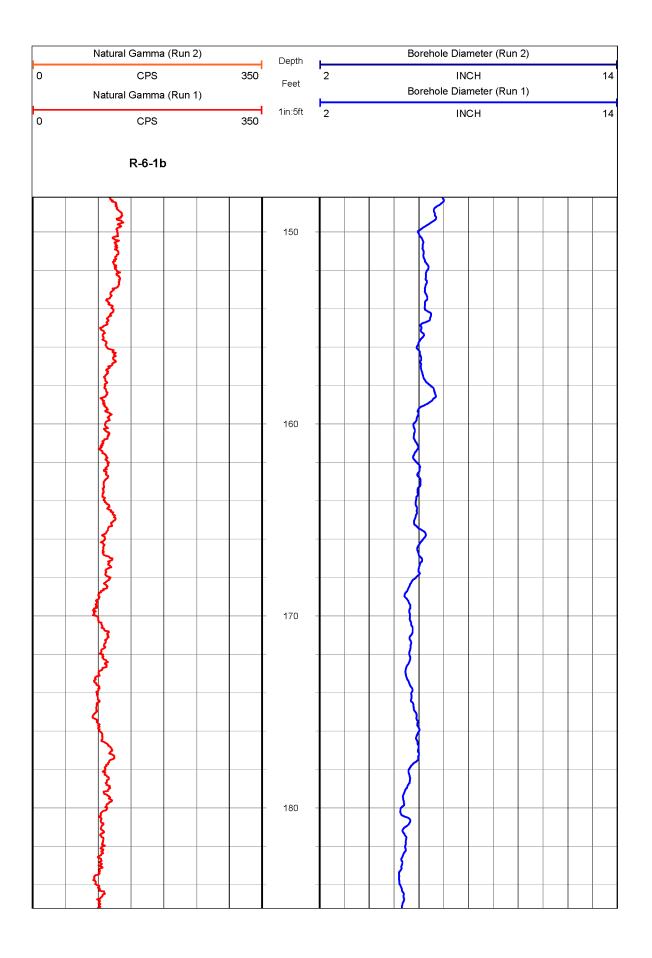
# CALIPER AND NATURAL GAMMA MULTI PAGE LOG SHEETS

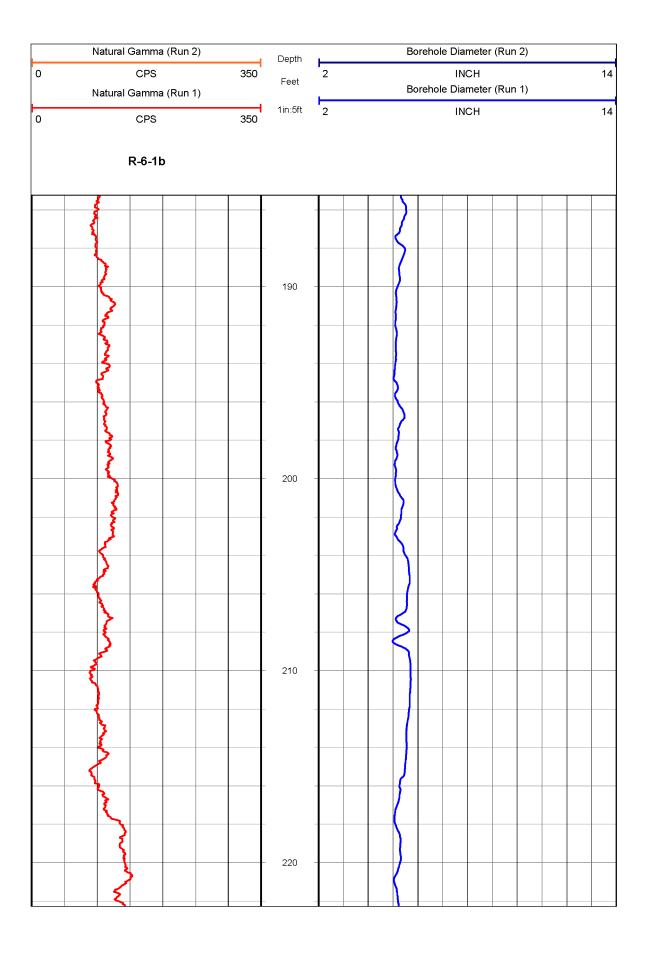


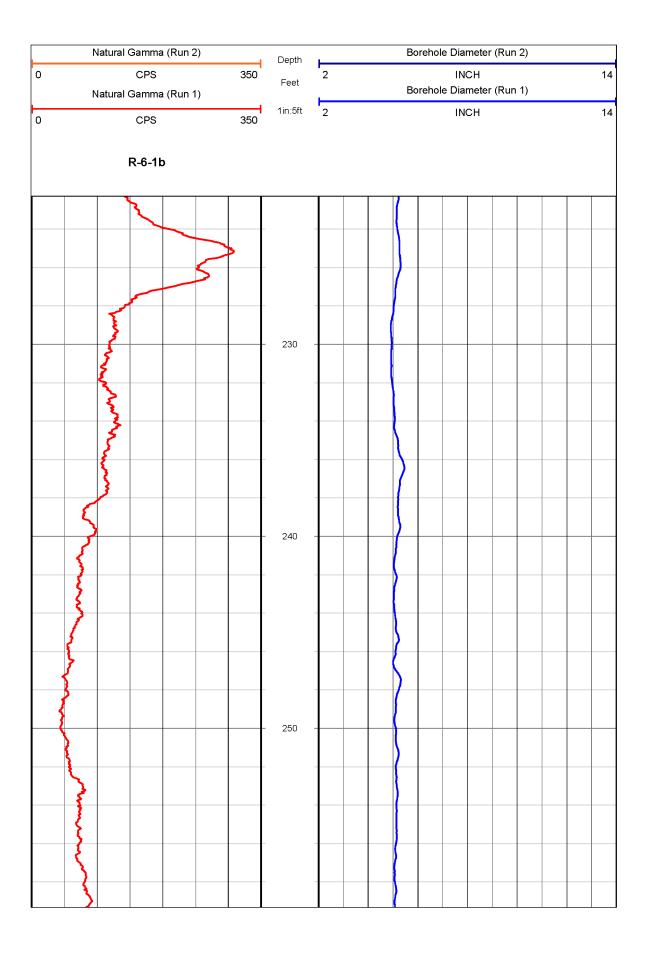


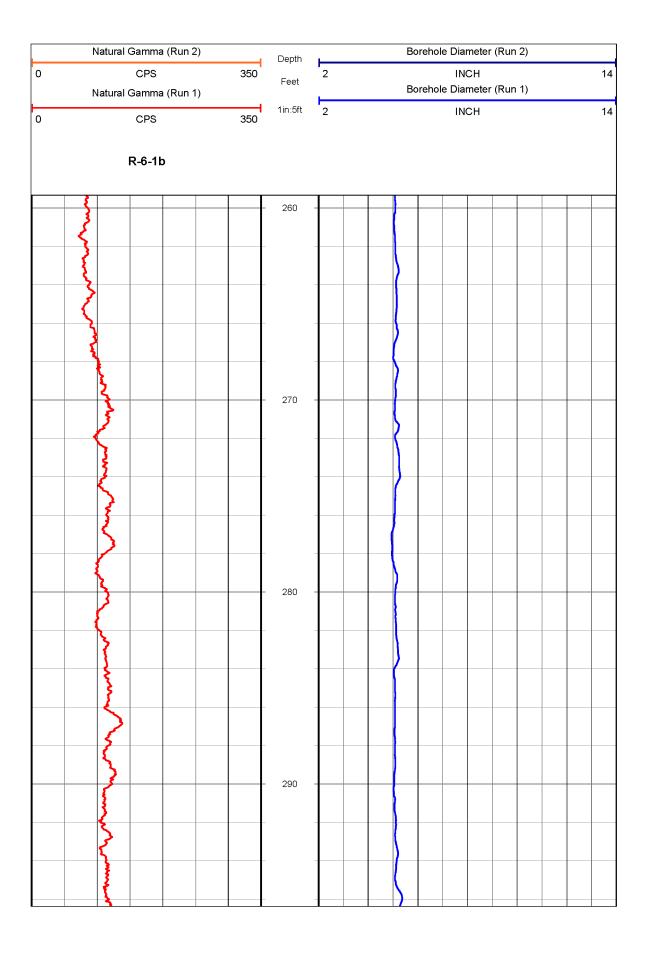


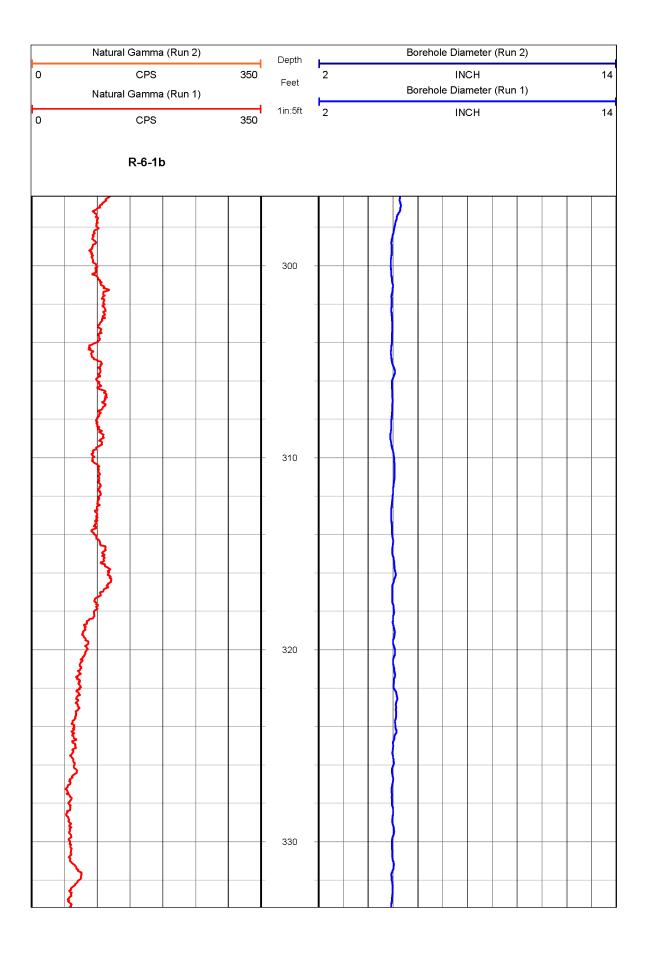


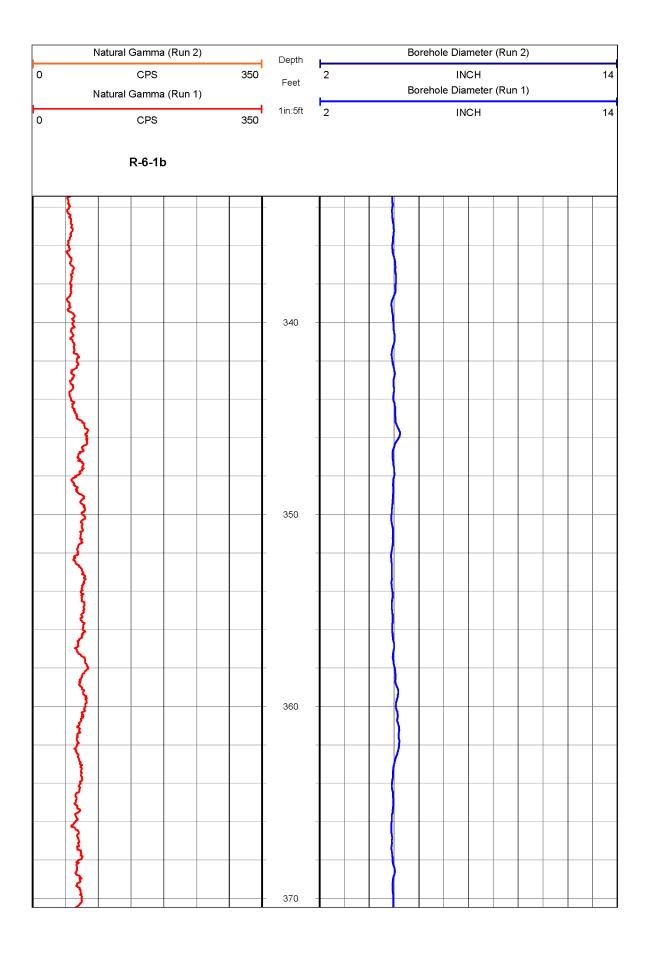


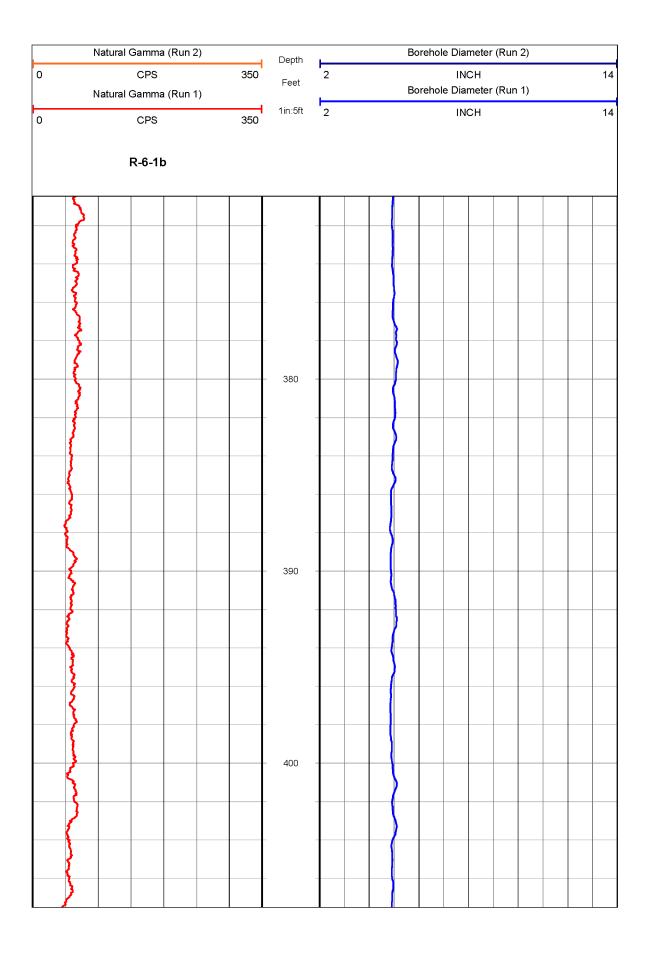


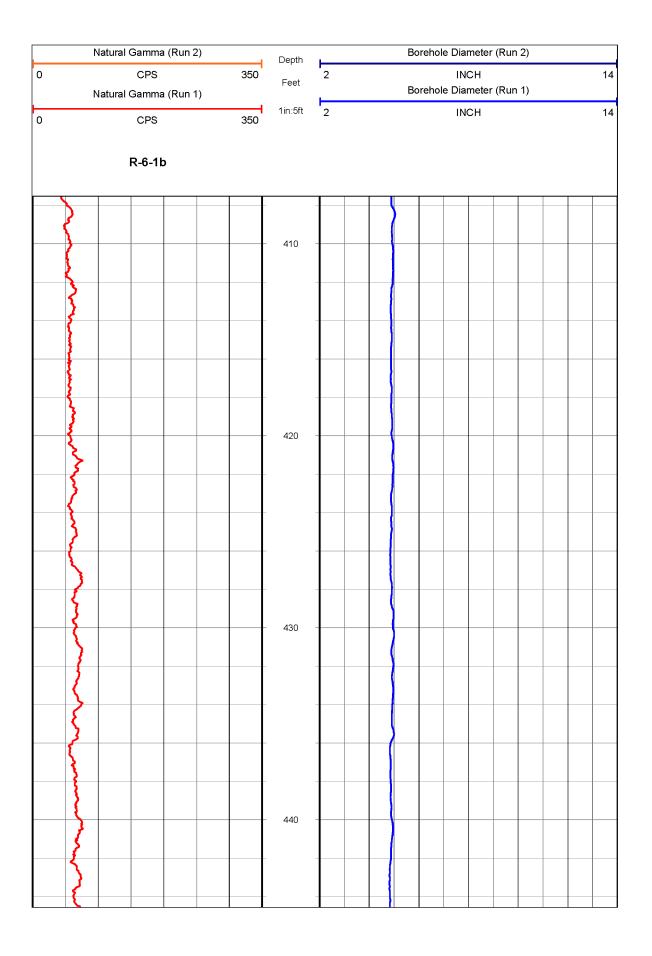




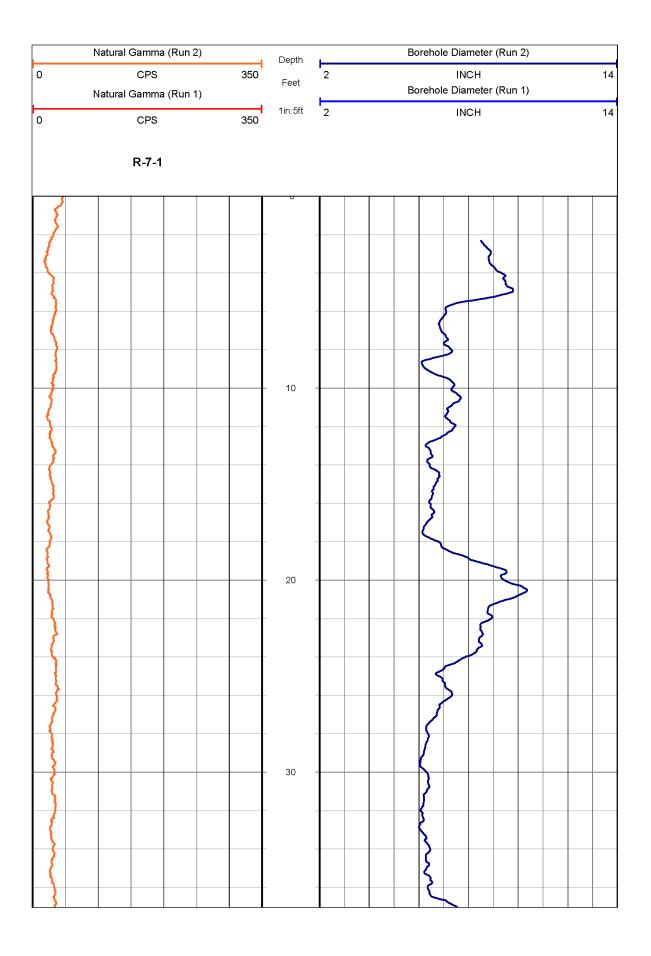


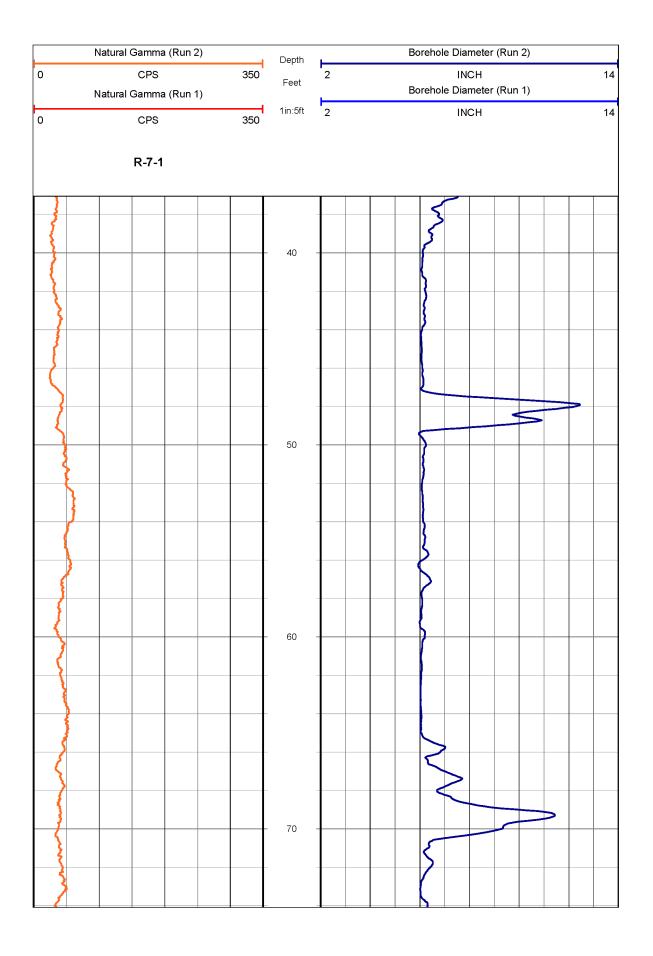


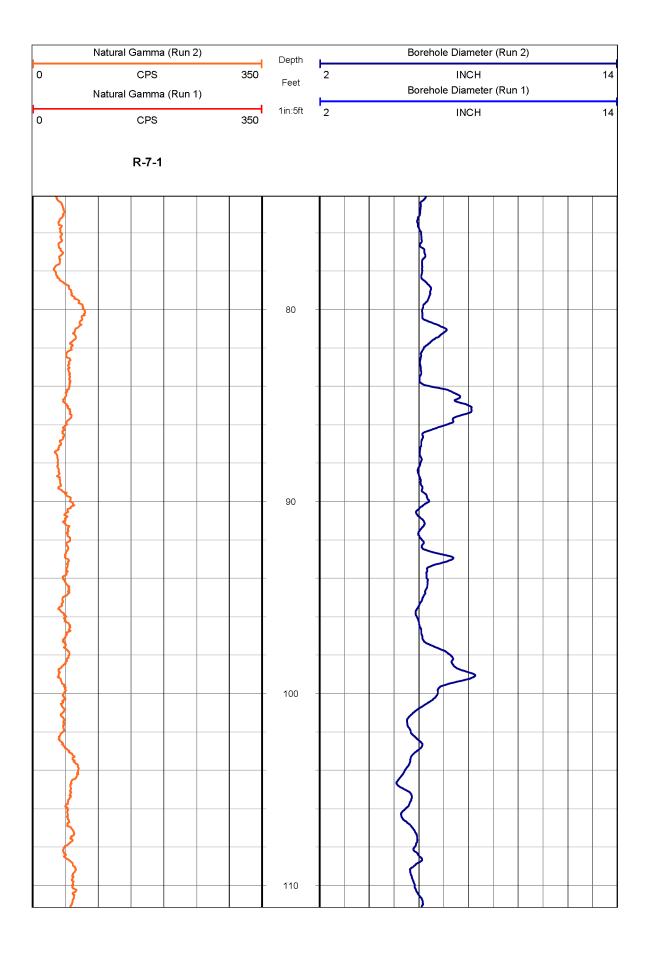


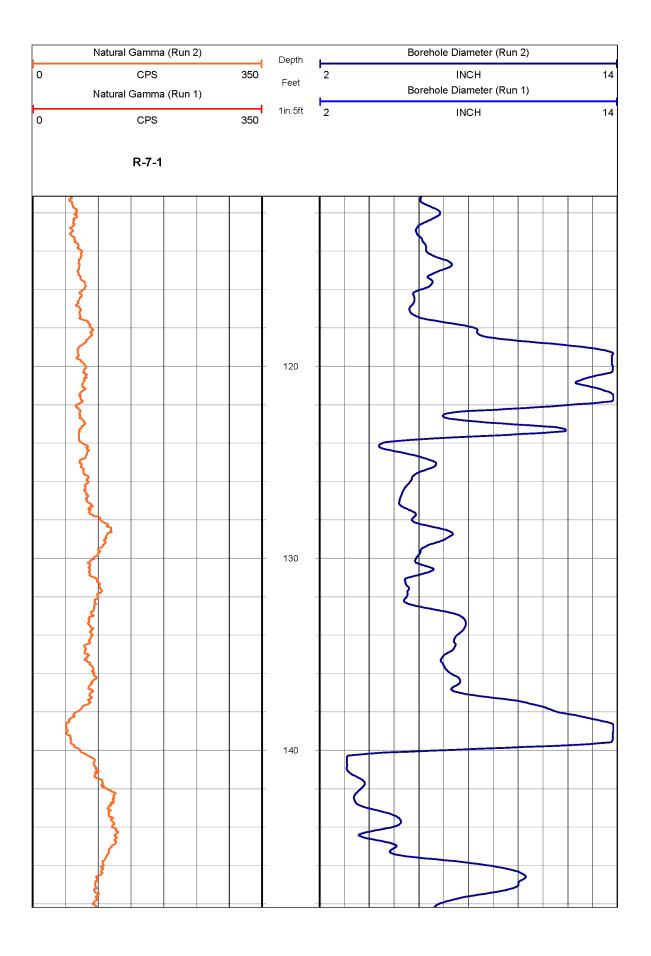


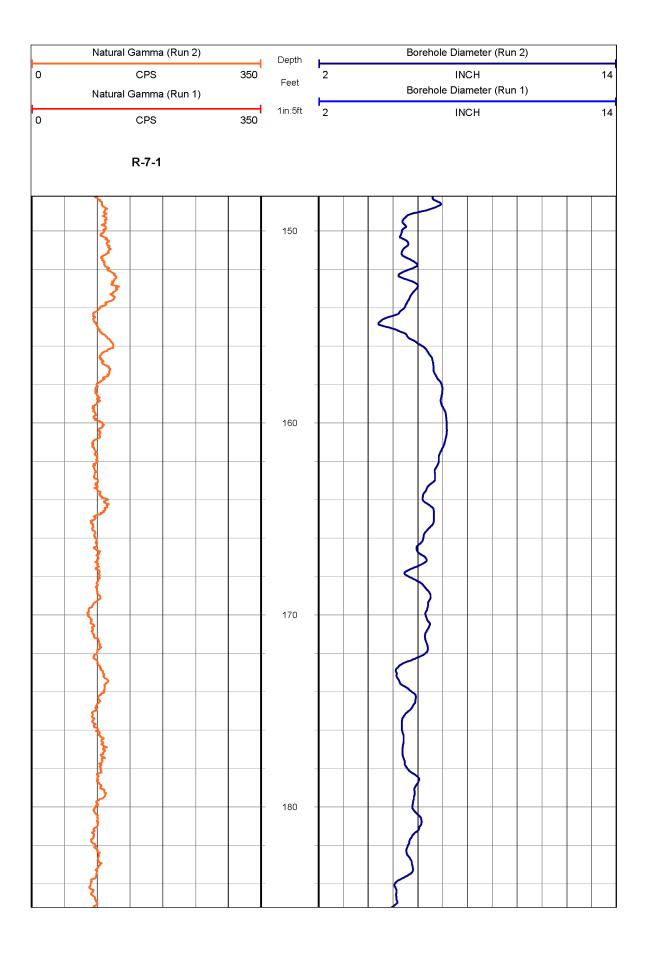
	Natural Gamma (Run 2)					Borehole Diameter (Run 2)										
0	Nat	CPS tural Gamma	a (Run 1	350 )	Depth Feet	2 INCH Borehole Diameter (Run 1)					14					
0	CPS 350			1in:5ft	2 INCH						14					
		R-6-1k	D													
	{															
	<pre>}</pre>				-											
	}				- 450											
	3															
					460											

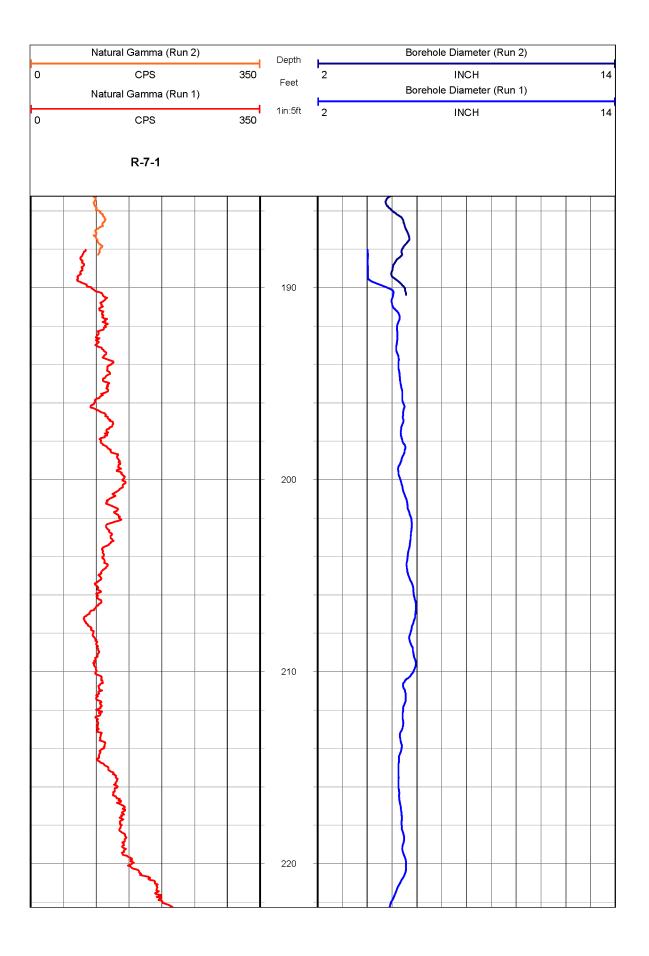


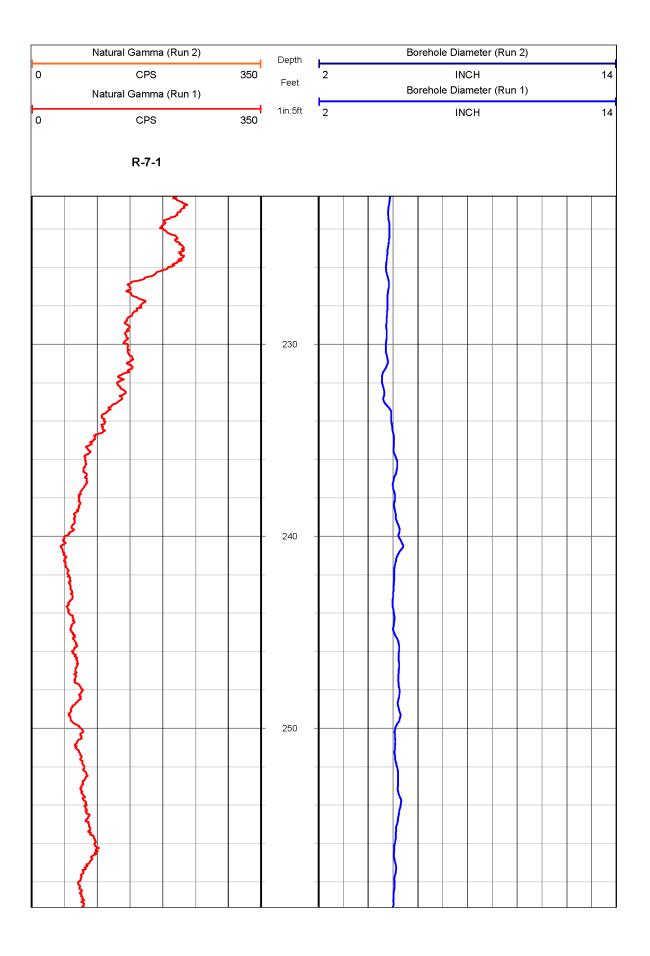


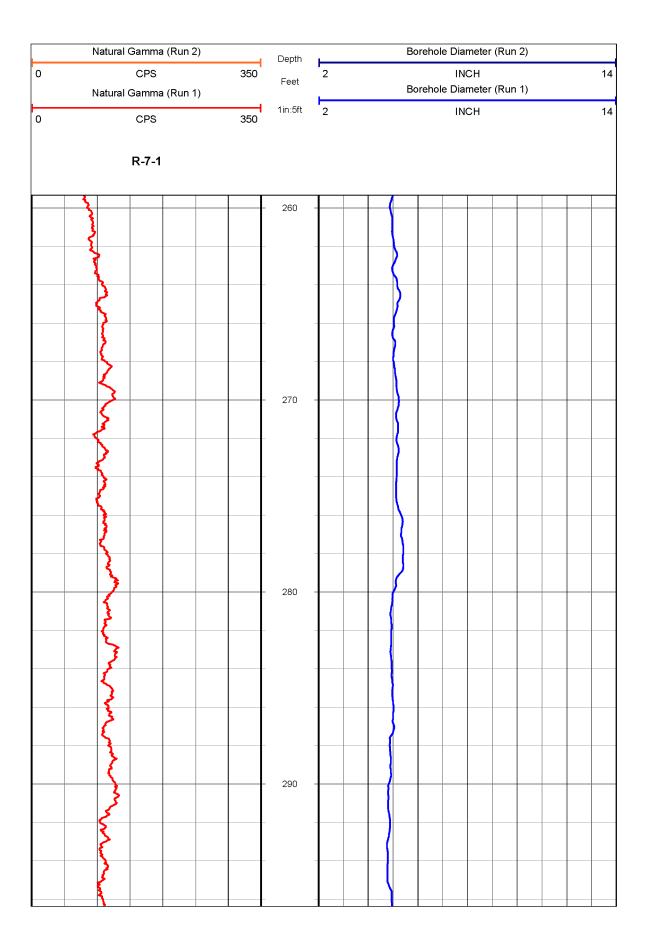


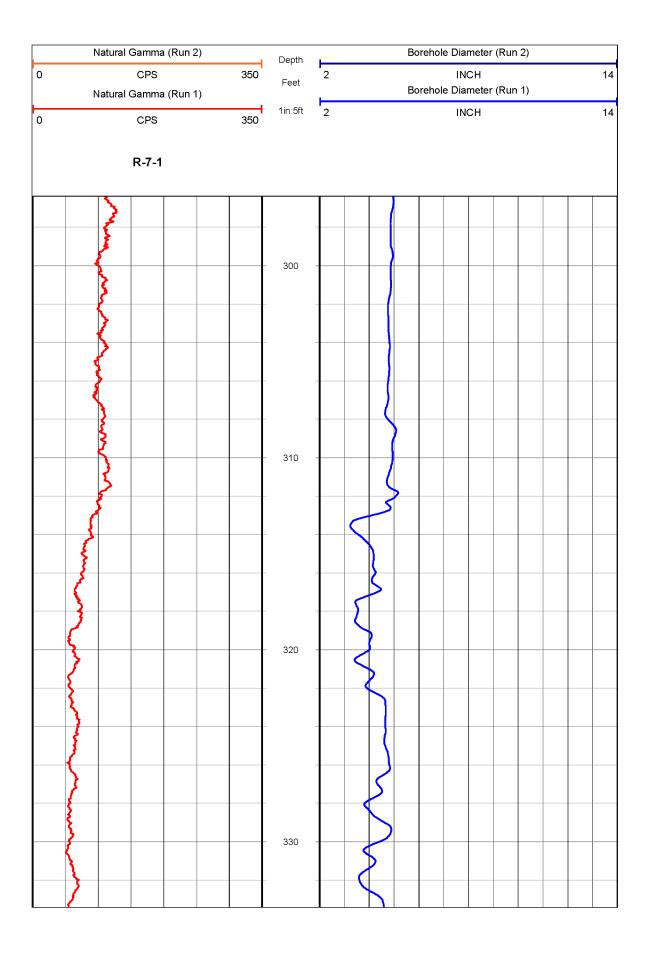


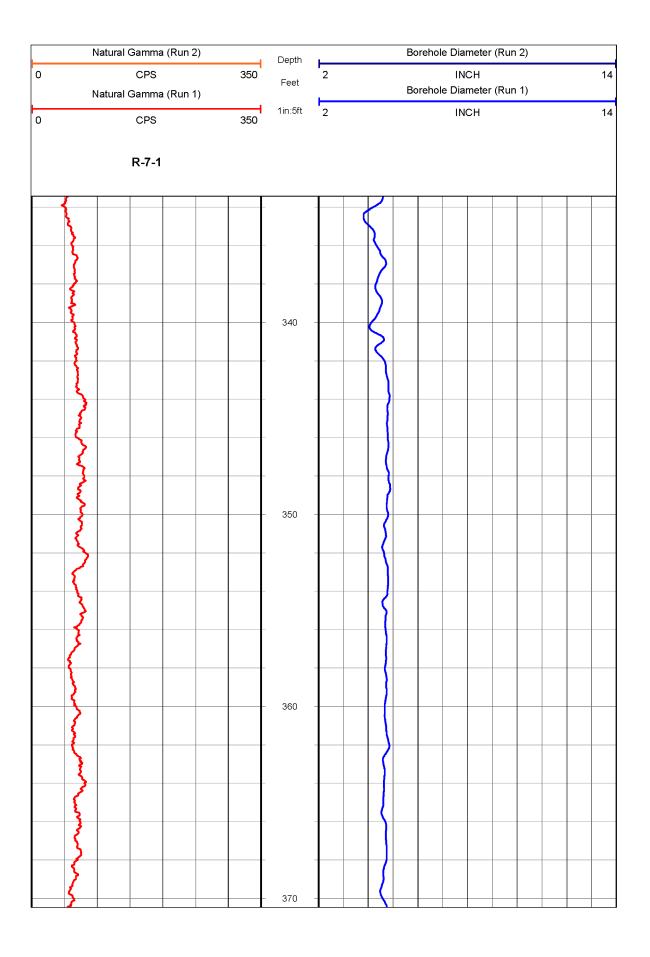


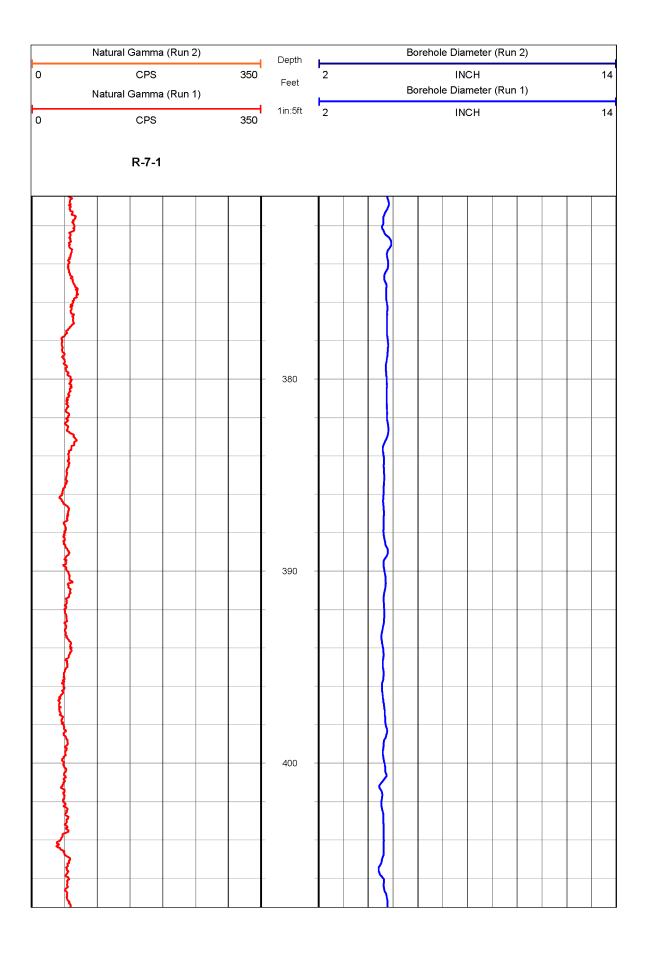


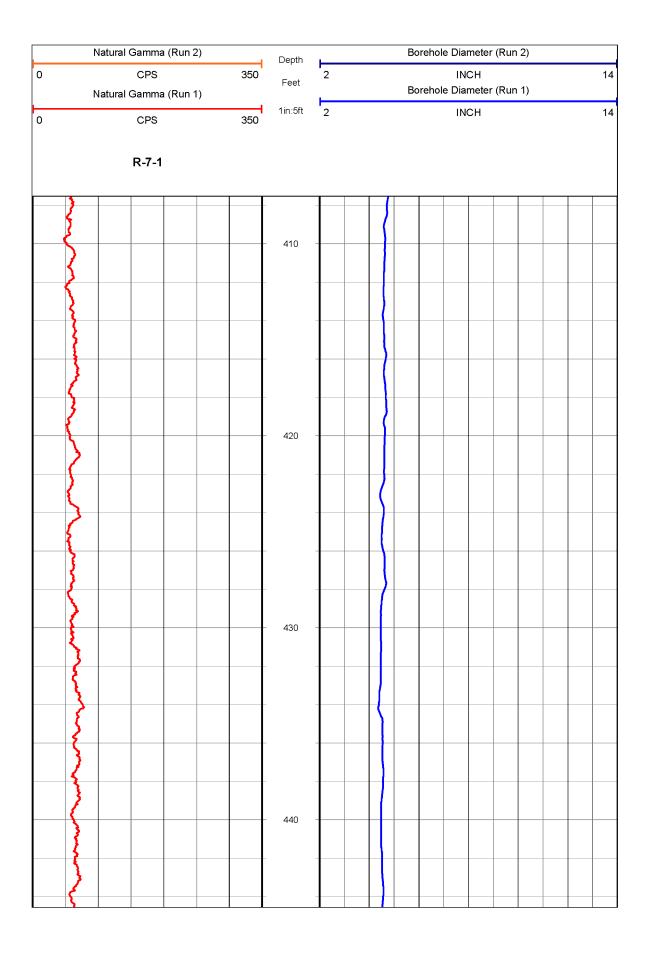












	Natural Gamma (Run 2)					Depth	Borehole Diameter (Run 2)										
0	Natural Gamma (Run 1)			Feet	2 INCH Borehole Diameter (Run 1)						14						
0				1in:5ft	2 INCH							14					
		R-7-1															
						_											
-	<b>`</b>								$\left  \right\rangle$								
						450											

## APPENDIX E

# GEOPHYSICAL LOGGING SYSTEMS – NIST TRACEABLE CALIBRATION PROCEDURES AND CALIBRATION RECORDS



MICRO PRECISION CALIBRATION, INC 12686 HOOVER ST GARDEN GROVE CA 92841 714-901-5659

### **Certificate of Calibration**

Work Order #:

Serial Number:

Department:

Performed By:

Cal. Date:

Cal. Interval: Cal. Due Date:

Purchase Order #:



Cert No. 2200812156209

LA-90010807

160024

N/A

Received Condition: IN TOLERANCE Returned Condition: IN TOLERANCE

13161-130510-01

STEVE BORING

May 30, 2013 12 MONTHS

May 30, 2014

Date: Jun 5, 2013

#### **Customer:**

GEOVISION 1124 OLYMPIC DRIVE CORONA CA 92881

MPC Control #:	AM6768
Asset ID:	160024
Gage Type:	LOGGER
Manufacturer:	OYO
Model Number:	3403
Size:	N/A
Temp/RH:	71°F / 52 %

#### **Calibration Notes:**

See attached data sheet for calculations. Calibrated IAW customer supplied data form Rev 2.1 Frequency measurement uncertainty = 0.0005 Hz Unit calibrated with Laptop Panasonic s/n: 6AKSB97198

Standards	haall	to	Calibrate	Equipment
Stanuarus	oseu	ιu	Calibiate	Lyuipinein

I.D.	Description.	Model	Serial	Manufacturer	Cal. Due Date	Traceability #
BD7715	UNIVERSAL COUNTER	53131A	3416A05377	HEWLETT PACKARD	Jun 8, 2013	2008120206792
BD9000	CALIBRATOR	5500A	7375008	FLUKE	Jun 15, 2013	1808504

#### Procedures Used in this Event

Procedure Name SUSPENSION PS SEISMIC

### Description Logger/Recorder Calibration Procedure rev2.1

Calibrating Technician:

STEVE BORING

QC Approval:

will

Jim Williams

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EA's Publication and NIST Technical Note 1297, 1994 Edition. Services rendered comply with ISO 17025:2005, ISO 9001:2008, ANSI/NCSL Z540-1, MPC Quality Manual, MPC CSD and with customer purchase order instructions.

Calibration cycles and resulting due dates were submitted/approved by the customer. Any number of factors may cause an instrument to drift out of tolerance before the next scheduled calibration. Recalibration cycles should be based on frequency of use, environmental conditions and customer's established systematic accuracy. The information on this report, pertains only to the instrument identified.

All standards are traceable to SI through the National Institute of Standards and Technology (NIST) and/or recognized national or international standards laboratories. Services rendered include proper manufacturer's service instruction and are warranted for no less than thirty (30) days. This report may not be reproduced in part or in a whole without the prior written approval of the issuing MPC lab.

Page 1 of 1

(CERT, Rev 3)



### SUSPENSION PS SEISMIC LOGGER/RECORDER CALIBRATION DATA FORM

INSTRUMENT DATA				
System mfg.:	OYO		Model no.:	3403
Serial no.:	160024		Calibration date:	5/30/2013
By:	Charles Carter		Due date:	5/30/2014
Counter mfg.:	Hewlett Packard		Model no.:	53131A
Serial no.:	3416A05377		Calibration date:	6/8/2012
By:	Micro Precision		Due date:	6/8/2013
Signal generator mfg.:	Fluke		Model no.:	5500A
Serial no.:	7375008		Calibration date:	6/15/2012
By:	Fluke		Due date:	6/15/2013
Laptop controller mfg.:	Panasonic		Model no.:	CF-29
Serial no.:	6AKSB97198		Calibration date:	N/A
SYSTEM SETTINGS:				
Gain:		2		
Filter		10KHz		
Range:		See samp	e period in table bel	ow
Delay:		0		
Stack (1 std)		1		
System date = correct da	te and time	5/30/2013	-12 hours	

#### PROCEDURE:

Set sine wave frequency to target frequency with amplitude of approximately 0.25 volt peak Note actual frequency on data form.

Set sample period and record data file to disk. Note file name on data form.

Pick duration of 9 cycles using PSLOG.EXE program, note duration on data form, and save as

.sps file. Calculate average frequency for each channel pair and note on data form.

Average frequency must be within +/- 1% of actual frequency at all data points.

Maximum erro	or ((AVG-AC	CT)/ACT*1	00)%	As found		0.12%		As left	0.12%
Target	Actual	Sample	File	Time for	Average	Time for	Average	Time for	Average
Frequency	Frequency	Period	Name	9 cycles	Frequency	9 cycles	Frequency	9 cycles	Frequency
(Hz)	(Hz)	(microS)		Hn (msec)	Hn (Hz)	Hr (msec)	Hr (Hz)	V (msec)	V (Hz)
50.00	50.00	200	1	179.8	50.06	179.8	50.06	180.2	49.94
100.0	100.00	100	2	90	100	90.1	99.89	90	100
200.0	200.00	50	3	45.05	199.8	45.05	199.8	45	200
500.0	500.00	20	4	18	500	18	500	18	500
1000	1000.00	10	5	9	1000	9	1000	9	1000
2000	2000.00	5	6	4.5	2000	4.5	2000	A.5	2000
			EVE	BORIN	No.	5/30/2013	/K/	for	
2		Name		2		Date		Sighature /	
Witnessed by: Cha			arles (	les Carter			5/30/2013 Che		h
Name						Date		Signature	-
Su	spension P	S Seismic	Recorder	/Logger Ca	libration Da	ta Form F	Rev 2.1 Fe	bruary 7, 201	12

APPENDIX F

# BORING GEOPHYSICAL LOGGING FIELD DATA LOGS



geophysical services

R-6-1a	-A BORING GEOPHYSICS FIELD LOG SUMMA	₹Y
Borehole*		
SITE*:	Turkey Point NPP DATE*: 15/16/2013	
CLIENT*:	Paul C. Rizzo Associates, Inc. JOB*: 13331	<u></u>
AUTHOR*:	_C. Carter PAGE*: OF _/	
CONTACT:	Rolando J. Benitez PHONE: (412) 607-3560	
	NSTRUCTION: CASED X, UNCASED	,
DIAMETERS AND	D DEPTH RANGES: 2"PVC 0 TO 120 Ft ;, TO	
BOREHOLE TOT/	TAL DEPTH AS DRILLED*: 120 ft	
SURFACE CASIN	NG?: YES DEPTH TO BOTTOM OF CASING; NO 🟒	
DEPTH TO BEDR	ROCK: ~ Sft	
BOREHOLE FLUI	IID: WATER └└ ; FRESH WATER MUD; SALT WATER MUD;	
LOGGING CREW	V: C. Carter	

				· · · · · · · · · · · · · · · · · · ·
LOG TYPE*	FILE NAME*	DEPTH RANGE*	DATE*	TIMES*
Deviation	RELADOUDSWHIL	3.6-106.5.ft	10/16/2013	8:02-8:08am 8:09-8:15am
Deviation	RELAAUUPOL	106.1 - 3.0 ft	10/16/2013	8:09-8:15am
- 				

ITEMS WITH \* MUST BE COMPLETED. OTHER INFORMATION IS OPTIONAL



geophysical services

R-6-la-A Borehole\*

## **ACOUSTIC TELEVIEWER FIELD LOG**

Procedure ASTM D5753-10 Borehole Geophysical GEOVision HI-RAT Field Procedure Rev 2.00a

1

SITE*: Turkey Point NPP	DATE*: 10/16/2013
SITE*: Turkey Point NPP CLIENT*: Paul C. Rizzo Associates, Inc.	JOB*:13331
AUTHOR*: C. Carter REVIEWER: (post field work)	PAGE: 1 OF 2
REVIEWER. (post field work)	
CONTACT:	PHONE: Off Cell
CONTACT:	PHONE: Off Cell
DRILLER	PHONE: Off Cell
COMPANY:	· · · · · · · · · · · · · · · · · · ·
GENERAL SITE CONDITIONS/LOCATION:	
COUNTY:RANGE:TO BOREHOLE CONSTRUCTION: CASED xUN	DWNSHIP:SECTION:
DIAMETERS AND DEPTH RANGES: $2^{\frac{n}{\mu}}PVC 0$ T	0_120 ft;,TO
BOREHOLE TOTAL DEPTH AS DRILLED*: 172	
SURFACE CASING?: YESDEPTH TO BOT DEPTH TO BEDROCK: ~ 5 Ft BOREHOLE FLUID: WATER; FRESH WATE OTHER:	
DEPTH TO BOREHOLE FLUID:	TIME SINCE LAST CIRCULATION: AJ/A
LOGGING CREW: <u>C. Carter</u> VEHICLE(S) USED AND MILEAGE:	
MOBILIZED FROM: Florida City	DEPARTURE TIME: 6'30
ARRIVED ON SITE: 7,00 am	
STANDBY TIME:	CAUSE:

ITEMS WITH \* MUST BE COMPLETED. OTHER INFORMATION IS OPTIONAL

5

**ACOUSTIC TELEVIEWER** 

GE Vision geophysical services

12-6-la-A

	R-6-1	a-A	FIELD LOG				
-		Borehole*	- Procedur	e ASTM D5753-1	0 Borehole Geo	physical	
				sion HI-RAT Field			
SITE*: Turkey Poin			DATE*:	1 1			
CLIENT*: Paul C. Rizz		top Inc I	OB*: 13331				
AUTHOR*: C. Carter	20 7350014	163, 116. J	-	2 OF 2			
	(		- FAGE.	2 UF 2			
REVIEWER:	(post field	work)					
	SILVER		RG 🛄	OTHER			
	8083 🔲	5772 🔀		OTHER			
	5174 🔲	6641 🔽	<u> </u>	OTHER			
SHEAVE* OYO 101	102	] 103 104			RG 🔀		
All GEOVision Te	eleviewer pro	obes are made by F	Robertson Geo	logging, Ltd. of De	ganwy, Conwy, L	ΙK	
PROBE TILT TEST*	90.52	<b>BRUNTON TIL</b>	T* 90		+/-2°		
PROBE TILT TEST*	23.77	- BRUNTON TIL			+/-2°		
PROBE TILT TEST*	56.41		· · · · · · · · · · · · · · · · · · ·		OG* Uls		
	·····	-			.00 <u> </u>		
PROBE AZIMUTH TEST					+/-10°		
PROBE AZIMUTH TEST		BRUNTON AZI			+/-10°		
PROBE AZIMUTH TEST	* 324.30	BRUNTON AZI	MUTH* <u>32</u>	AFTER L	OG*_yls_		
					0		
PROBE OFF	-SET*		1.44M(4.72	FT)			
MINUS CAS	ING STIC	K-UP*	1.17				
DEPTH REF	. OFFSET	AT START*	3.55	REF TO GROU	UND SURFACE		
DEPTH REF	. OFFSET	AT END*	3.54				
1		TH ERROR*	0.01	allow +/-0.4%	of total depth		
				Lu,			
		START	START	END	END		
LOG N/	AMF*	DEPTH*	TIME	DEPTH *	TIME		
RGIAAAUDO		3.6 ft	8:02	106.5 ft	8:08am		
RGIAAAUU	POI	106.1	8:09	3.0 ft	8:15 am		
ILGIARAU		100.1					
			``				
			l	L.,			
		0.75		ila			
MAINTENANCE PERFO	RMED ON	I SHE*:	<i>µ</i>		(^	I/A if none)	
<b>DEVIATION FROM PRO</b>	CEDURE	(IF ANY) OR EC	QUIPMENT F	PROBLEMS OF	と FAILURES (れ	I/A if none)	
			NB				
DATA STORED IN TWO	PLACES	BEFORE DEPA	RTURE	YES. DESCR	IBE: CD (U	SB DRIVE)	
			be-monored	OTHER			
ITEMS WITH	* MUST B	E COMPLETED	. OTHER II	<b>NFORMATION</b>	IS OPTIONAL		



geophysical services

R-6-11	BORING GEOPHYSICS FIELD LOG SUMMARY	
Borehole*		. •
SITE*:	Turkey Point NPP DATE*: 10/14,15/2013, 10/16/20	13
CLIENT*:	Paul C. Rizzo Associates, Inc. JOB*: 13331	
AUTHOR*:	_C. Carter PAGE*; OF _/	
CONTACT:	Rolando J. Benitez PHONE: (412) 607-3560	
BOREHOLE CON	ISTRUCTION: CASED UNCASED X	
DIAMETERS AND	UNCASED X D DEPTH RANGES: $5^{7}4$ 0 TO $10^{10}$ ; $4^{3}74$ 5, $10^{10}$ TO $464$ ft AL DEPTH AS DRILLED*: $46^{4}$ ft CAL DEPTH AS DRILLED*: $46^{4}$ ft	
BOREHOLE TOTA	AL DEPTH AS DRILLED*: 464 ft	
SURFACE CASIN	AL DEPTH AS DRILLED*: 464 ft <u>ec longing</u> NG?: YES <u>X</u> DEPTH TO BOTTOM OF CASING <u>10 ft</u> ; NO <u>X 10/16</u>	
	ROCK: ~5 ft	
BOREHOLE FLUI	ID: WATER; FRESH WATER MUD $\underline{X}_;$ SALT WATER MUD;	
LOGGING CREW	/: C. Carter	

	1	I	I	1		
LOG TYPE*	FILE NAME*	DEPTH RANGE*	DATE*	TIMES*		
Deviation	REIBAUDOWNOI	3.2-464 ft	10/14/2013	2:14-2:27pm		
ATV .	RGIBAUUPOI	463.8 - 109 ft	10/14/2013	2:30-4:09pr	<u></u>	
P-Svelocity	REIBSUSPOOWNOI	34.0 -137.0m	10/14/2013	4:46-6:30pm		
Caliper	R61BCAL TESTOI	NA	10/15/2013	8:39-8:40a		
Cal-NG	RGIBCALUPOI	455.7-99.65.44	10/15/2013	9:15 -9:45	am-	
Caliper	REIBCALTER TOZ	NIA	10/15/2013	10:02-10:02	lam	,
Deviation	REIBAUDOWNOZ	1.9-113.5ft	10/16/2013	9:13-9:24a	m-	10/16
ATV	R61BAUUP02	9:25-10:03 a	16/16/13			
STV	R61BAUUP02	113.5-1.64	10/16/203	9:25-10:03	am	
P-Svelocity	R61BSUSPOWN02	- 2.0-35.0m	10/16/2013	10:27 -11:01 av	~	
Caliper	RGIBCALTESTO3	N/A	10/16/2013	11:24 -11:26	am	
Col-NG	REIBCALUPOZ	116.7-3.35 ft	10/16/2013	11:37-11:48a	in	
Caliper	REIBCALTETTOY	NA	10/16/2013	11:55 - 11:56 a	n	

ITEMS WITH \* MUST BE COMPLETED. OTHER INFORMATION IS OPTIONAL

GE Vision geophysical services <u>R-6-lb</u> Borehole*	ACOUSTIC TELEVIEWER FIELD LOG Procedure ASTM D5753-10 Borehole Geophysical GEOVision HI-RAT Field Procedure Rev 2.00a
SITE*:       Turkey Point NPP         CLIENT*:       Paul C. Rizzo Associates, Inc.         AUTHOR*:       C. Carter         REVIEWER:       (post field work)	DATE*: 10/14/2013 JOB*:13331 PAGE: 1 OF 2
CONTACT:	PHONE: Off Cell
CONTACT:	PHONE: Off Cell
DRILLER COMPANY:	PHONE: Off Cell
GENERAL SITE CONDITIONS/LOCATION:	
COUNTY:RANGE:TO BOREHOLE CONSTRUCTION: CASEDUN DIAMETERS AND DEPTH RANGES: <u>5</u> <sup>3</sup> /4 <sup>77</sup> 0 T	NCASED & 0 <u>110-ft; 5", 110</u> TO <u>464-ft</u>
BOREHOLE TOTAL DEPTH AS DRILLED*: 464	1 +
SURFACE CASING?: YES <u>×</u> DEPTH TO BOT DEPTH TO BEDROCK: <u>S</u> ft BOREHOLE FLUID: WATER ; FRESH WATE OTHER: DEPTH TO BOREHOLE FLUID: <u>&lt; S</u> ft	R MUD <u>X</u> ; SALT WATER MÚD
LOGGING CREW: <u>C. Carter</u> VEHICLE(S) USED AND MILEAGE: MOBILIZED FROM: <u>Florida City</u> ARRIVED ON SITE: <u>J: wa</u> STANDBY TIME: <u>Uld</u>	DEPARTURE TIME: 6; 30 am

ITEMS WITH \* MUST BE COMPLETED. OTHER INFORMATION IS OPTIONAL

GE geophysical	SVision services <u>R-6-</u>	Borehole*		FIELD	ELEVIEW ) LOG 10 Borehole Geop	
		ites, Inc.	<i>GEOV</i> DATE* JOB*: 13331	ision HI-RAT Fiel :16 (14/2.01)	d Procedure Rev	
MICROLOGO TELEVIEWE SHEAVE* ( All PROBE TILT PROBE TILT PROBE AZIM PROBE AZIM	R* 5174 DYO 101 102 <i>GEOVision Televiewer pro</i> TEST* <u>90.22</u> TEST* <u>24.97</u>	5772 X 6641 X 103 10 bes are made by BRUNTON TIL BRUNTON TIL BRUNTON TIL BRUNTON AZ BRUNTON AZ	_T* <u>90</u> _T* <u>25</u> _T* <u>73</u> IMUTH*_/ IMUTH*_2	AFTER L	+/-2° +/-2° -OG* <u>yls</u> +/-10°	ĸ
F N C	PROBE OFFSET* MINUS CASING STIC DEPTH REF. OFFSET DEPTH REF. OFFSET AFTER SURVEY DEP	- K-UP* TAT START* TAT END*	1.44M(4.72 1.61 3.11 2.83 0.28	- )	UND SURFACE	
	LOG NAME* RGIBAUDOWNO? RGIBAUUPDI	START DEPTH* 3.2. 463.8	START TIME 2:14 2:30	END DEPTH * 464 ft 109 ft	END TIME 2:27pm 4:09pm	
MAINTENAN	ICE PERFORMED ON	I N SITE*:	A	 	] (N	/A if none)
DEVIATION	FROM PROCEDURE			PROBLEMS OF	R FAILURES (N	/A if none)
DATA STOR	ED IN TWO PLACES	BEFORE DEPA	ARTURE?	YES. DESCF OTHER	RIBE: CD (US	B DRIVE
IT	EMS WITH * <u>MUST E</u>	<u>BE COMPLETEI</u>	<u>D</u> . OTHER I	INFORMATION	IS OPTIONAL	



R-6-1	P-S SUSPENSION		
Borehole	CORRESPONDING P-S SUSPE	NSION PROCEDUR	RE REV 1.5
SITE*:	Turkey Point NPP	DATE	E*: <u>10/14,1612013</u>
CLIENT*:	Paul C. Rizzo Associates, Inc.	JOB*	13331
AUTHOR*:	Turkey Point NPP Paul C. Rizzo Associates, Inc. C. Carter	PAGI	E 1 OF <u>* 9</u>
CONTACT:		PHONE: Off	Cell
CONTACT:		PHONE: Off	Cell
CONTACT:		PHONE: Off	Cell
DIRECTION	NS TO SITE:		
GENERAL	SITE CONDITIONS/LOCATION:		
COUNTY:	RANGE:	TOWNSHIP:	SECTION:
BOREHOL	E CONSTRUCTION*: CASED	ÚNC	ASED X
DIAMETER	E CONSTRUCTION*: CASED RS AND DEPTH RANGES*: 5 <sup>3</sup> /4"	0 TO 110 ft	; <u>5"</u> , 110 TO46947
BOREHOL	E TOTAL DEPTH AS DRILLED*:	469 ++	
SURFACE	E TOTAL DEPTH AS DRILLED*: CASING?: 44 (10/14) DEPTH TO BEDROCK: ~ 5 ft	BOTTOM OF CA	SING 1/ 04++; NO <u>X /0/1-0</u>
DEPTH TC	BEDROCK: ~ S ft		
	E FLUID: WATER; FRESH WA	IER MUD 7 ;	SALI WATER WUD,
OTHEF DEPTH TC	BOREHOLE FLUID*: Ø	TIME SINCE LAS	ST CIRCULATION: 2pm 10/14, 8an 10/16
	TEMS WITH * <u>MUST BE COMPLETE</u>		

GEOVision Geophysical Services 1124 Olympic Drive, Corona. CA 92881 Ph (951) 549-1234 Fx (951) 549-1236

P-S FIELD LOG REV V1.5



R-6-16 P-S SUSPENSION	VELOC	ITY FIE	LD LOG	<b>REV 1.5</b>	
Borehole CORRESPONDING P-S SUSP	ENSION PROC	EDURE REV	1.5	1	
SITE*: Turkey Point NPP		DATE*:	10/14,161	2013	
CLIENT*: Paul C. Rizzo Associates, Inc.		JOB*: 133	31	and the second	
SITE*:       Turkey Point NPP         CLIENT*:       Paul C. Rizzo Associates, Inc.         AUTHOR*:       C. Carter		PAGE 2 OF	* 1		
LOGGING CREW*: C. Carter					
MOBILIZED FROM:Florida City	DEPARTUF	RE TIME:			
ARRIVED ON SITE:					
STANDBY TIME:	CAUSE:				
LOGGING STARTED:	LOGGING (	COMPLETE	D:		
BATTERIES CHANGED BEFORE LOGGING: Y WINCH COMPROBE	ES; NO GREY	ס <u>י</u> ; sto סירס ר	DRED WITH	NEW OTH	
CALIBRATED RG LOGGER/RECORD					
INSTRUMENT* 160023 160024 🔽		12004	J 15014	19029	
MICROLOGGER* 8083 5772		N <u>O M</u>			
RECEIVER S/N* 12008 20042	26066	11001	23053	30086 K	
ISOLATION TUBE S/N* 300083 24053 X	28068	28072			
SHEAVE* COMPROBE OYO 101	] 102 ] 10	03	RGX		
PROBE OFFSET* OYO 2.0M MINUS CASING STICK-UP*	RG 2.5M	X			
	49				
DEPTH REF. OFFSET AT START* 2.412. DEPTH REF. OFFSET AT FND* 1.96 1.9		REF TO GROU	ND SURFACE		
DEPTH REF. OFFSET AT END*					
AFTER SURVET DEFITTERROR		START	END	END	
LOG NAME*	1			TIME	, ,
RELDSUSPOUNUL	34.0m	4:46 pm	137.0m	6:30pm	10/14
R61BSUSPDOWNOZ	2.0 m	10:27	35.0m	11:01 an	iolie
					}
		guangaga bengen para termeter terministik			
MAINTENANCE PERFORMED ON SITE*:		NLA		(N/A if none)	
EQUIPMENT PROBLEMS OR FAILURES*:		NA		(N/A if none)	
DEVIATIONS FROM TEST PLAN*:		Nhs		(N/A if none)	

ITEMS WITH \* MUST BE COMPLETED. OTHER INFORMATION IS OPTIONAL

1124 Olympic Drive, Corona, CA 92881 Ph (951) 549-1234 Fx (951) 549-1236 GEOVision Geophysical Services

SITE*: T	urkey Poi	nt NPP		DATE*: 10/16/2013		
	-		C			
	*:C. Car			PAGE*OF		
			OMPLETED. OTHER IN	FORMATION IS OPTION		
DEPTH	DEPTH		FILTERED	COMMENTS		
METERS		FILE NO*.	FILE NO*. (if any)	CASING, WATER, RC	OCK ETC	
0.5	1.64					
1.0	3.28			(Min an any		
1.5	4.92		······			
2.0	6.56	208		10:27		
2.5	8.20	209				
3.0	9.84	210				
3.5	11.48	211				
4.0	13.12	212	·			
4.5	14.76	213				
5.0	16.40	214				
5.5	18.04	215				
6.0	19.69	216				
6.5	21.33	217				
7.0	22.97	218	<b></b>	·		
7.5	24.61	219				
8.0	26.25	220				
8.5	27.89	221		n ee ee g		
9.0	29.53	222				
9.5	31.17	223		·		
10.0	32.81	224				
10.5	34.45					
11.0	36.09	226				
11.5	37.73	227	******	NITE IN THE REPORT OF THE PARTY OF T		
12.0	39.37	228			111079-9542024-974-000-00-0	
12.5	41.01	229				
13.0	42.65	230				
13.5	44.29	231				
14.0	45.93	232				
14.5	47.57	233	1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 -			
15.0	49.21	234	1991 - 1991 - 1992 - 1992 - 1993 - 1993 - 1993 - 1994 - 1995 - 1995 - 1995 - 1995 - 1995 - 1995 - 1995 - 1995 - 1995 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 -	1884 - 1895 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -		
15.5	50.85	236				
16.0	52.49					
16.5	54.13	237	1975 (1997)			
17.0	55.77	238				
17.5	57.41	239				
18.0	59.06	240				
18.5	60.70	242		นารกระบบการกระบบการกระบบการกระบบการกระบบการกระบบการกระบบการกระบบการกระบบการกระบบการกระบบการกระบบการกระบบการกระบ		
19.0	62.34					
19.5	63.98	243				

SITE*: 1	urkey Poir	nt NPP		OGGING FIELD NC DATE*: <u>ы/ы/2, 15</u> JOB*:13331	16/201
CLIENT*:	Paul C. I	Rizzo Associates, Inc		JOB*: 13331	
	*: C. Cart	ter	n ng ng king ng n	OF OF <i>FORMATION IS OPTIONAL</i> 	9
	ITEMS V	WITH * MUST BE CC	MPLETED. OTHER IN	FORMATION IS OPTIONAL	······
DEPTH	DEPTH	UNFILTERED	FILTERED	COMMENTS	
	1	FILE NO*.		CASING, WATER, ROCK,	
	·				
20.5	67.26	245			
21.0	68.90	*			
21.5	70.54	247			
22.0	72.18	248			640-50-m-020-10-10-0-1-415-0704
22.5	73.82	249 250			
23.0	75.46				
23.5	77.10	251			<b></b>
24.0	78.74	252			
24.5	80.38	253			
25.0	82.02	254			
25.5	83.66				
26.0	85.30	256			
26.5	86.94	257			
27.0	88.58	258 259			
27.5	90.22	260	anna a mar ann an ann ann ann an raige a chùr, tha Gold a canta a charachar ann an a		s,,,, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
28.0	91.86				
28.5	93.50	261			
29.0	95.14	1			
29.5	96.78	263	<u></u>		
30.0	98.43	264			
30.5	100.07	265			
31.0	101.71	261			
31.5	103.35	268	aan ah oo oo ah oo oo ah oo oo ah oo ah		
32.0	104.99	269	*****		
32.5	106.63	210	ar alar manya yang menantakan menantakan kana kana kana kana kana kana k		
33.0	108.27				
33.5	109.91	271		4:46 10/14	
34.0	111.55	2 273		דיזט וטנוין	
34.5	113.19	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		11:01 10/16	
35.0	114.83			11.01 10116	
35.5	116.47	4			
36.0	118.11	5			
36.5	119.75	6			
37.0	121.39				
37.5	123.03	8			
38.0	124.67	10			
38.5	126.31	11			
39.0	127.95	12			
<u> </u>	129.59 131.23	13			

R-6	-16	GEOVISION			NOTES
SITE*:T	urkey Poin	it NPP		_DATE*: 10/14/2013	•
			с.	JOB*: 13331	
AUTHOR*				PAGE*	OF 9
	ITEMS V	VITH * MUST BE CO	OMPLETED. OTHER INI	ORMATION IS OPTIONA	AL
DEPTH	DEPTH	UNFILTERED		COMMENTS	1
METERS	1	FILE NO*.	FILE NO*. (if any)	CASING, WATER, ROO	
40.5	132.87	14			
41.0	134.51	15			
41.5	136.15	1.6			
42.0	137.80	17		na an a	
42.5	139.44	18			
43.0	141.08	19			
43.5	142.72	20			
44.0	144.36	21			
44.5	146.00	22			
45.0	147.64	23			
45.5	149.28	24			
46.0	150.92	25			
46.5	152.56	26			
47.0	154.20	27			
47.5	155.84	28			
48.0	157.48	29			
48.5	159.12	30			
49.0	160.76	31			
49.5	162.40	32			aproximate the stand of the stand of the stand of the stand
50.0	164.04	33			
50.5	165.68	34			
51.0	167.32	35			
51.5	168.96	36	NATE DESIGNATION OF A DES		
52.0	170.60	37			
52.5	172.24	38	a second and a second	an De la consta de l La consta de la const	
53.0	173.88	39			
53.5	175.52	40			
54.0	177.17	41			
54.5	178.81	43			
55.0	180.45	43			
55.5	182.09	44			
56.0	183.73	45			
56.5	185.37	46			
57.0	187.01	41	2012/01/2012/01/2014/01/01/01/01/01/01/01/01/01/01/01/01/01/		
57.5	188.65	48			
58.0	190.29	49			
58.5	191.93	50			
59.0	193.57	51			
59.5	195.21	52			
60.0	196.85	53			

R-6.	-16 <b>(</b>	GEOVISION	SUSPENSION LO	<b>DGGING FIELD</b>	log rev 1.5 NOTES
SITE*· T		It NPP		DATE*:/U/14/2013	
			IC	JOB*: 13331	
				PAGE* 6	OF 9
AUTHOR	ITFMS V	VITH * MUST BE C	OMPLETED. OTHER INI	FORMATION IS OPTION	AL
DEPTH	DEPTH	UNFILTERED		COMMENTS	1
METERS	1	FILE NO*.	FILE NO*. (if any)		
60.5	198.49	54			
61.0	200.13	55	an far man and a far and a state of the stat		
61.5	201.77	56			
62.0	203.41	57			
62.5	205.05	58			
63.0	206.69	59			
63.5	208.33	60			
64.0	209.97	61			
64.5	211.61	62			
65.0	213.25	63			
65.5	214.90	64			and a second
66.0	216.54	65			
66.5	218.18	66			
67.0	219.82	67	an ya na ana ana ana ana ana ana ana ana		
67.5	221.46	68		<b></b>	
68.0	223.10	69			
68.5	224.74	70 71			
69.0	226.38	11			
69.5	228.02				Notes and the second
70.0	229.66	73			
70.5	231.30	75			
71.5	232.54	76			
72.0	236.22	77			
72.5	237.86	78			
73.0	239.50	19			
73.5	241.14	80			
74.0	242.78	8(			
74.5	244.42	82	any, manyak yana gunananananananana sa kasak di sebi kasi sa kasaka kasa keta kasaka ta sa kasa sa sa sa sa sa	an parting an an a fair an	
75.0	246.06	83	*******		
75.5	247.70	84		999 M 1999 M	
76.0	249.34	85			
76.5	250.98	86			
77.0	252.62	87			
77.5	254.27	88			
78.0	255.91	89			
78.5	257.55	90			
79.0	259.19	91			den en e
79.5	260.83	92			
80.0	262.47	93			

$\mathcal{R}_{-6'}$ $\mathcal{G}$ <b>GEOVISION SUSPENSION LOGGING FIELD NOTES</b> SITE*:	o la	-1h e	SEOVISION		P-S FIELD LOGAR2167
CLIENT*:     Paul C. Rizzo Associates, Inc.     JOB*: 13331       AUTHOR*:     C. Catter     PAGE* 7     OF 9       ITEMS WITH*     MUST BE COMPLETED. OTHER INFORMATION IS OPTIONAL       DEPTH     DEPTH     UNFILTERED     FILENO*.     GAUMENTS       METERS     FEET     FILE NO*.     FILE NO*. (if any)     CASING, WATER, ROCK, ETC       80.0     265.75     9 \$	Contraction of the local division of the loc			JUSI LINDION L	DATE*: 16/14/2013
AUTHOR*:       C. Carter       PAGE*       I       OF       9         TEMS WITH *       MUST BE COMPLETED.       OTHER INFORMATION IS OPTIONAL         DEPTH       DEPTH       UNFILTERED       FILE NO*.       (flany)       COMMENTS         80.5       264.11       9	SIIE":I	urkey Poin			
ADITION         C. Cattolin           HEMS WITH * MUST BE COMPLETED. OTHER INFORMATION IS OPTIONAL           DEPTH         DEPTH           DEPTH         DEPTH           B05         264.11           RETERS         FEET           B10         265.75           R15.         267.39           R15.         267.39           R16.         267.39           R17.         269.03           R18.5         267.067           R8.5         277.057           R8.5         277.231           R9				inc	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	AUTHOR*	C. Cart	er	COMPLETED OTHER IN	
DLT IN         DLT IN <thdlt in<="" th=""> <thdlt in<="" th=""> <thdlt in<="" td="" tr<=""><td>DEDTU</td><td>A STREET STREET STREET</td><td></td><td></td><td></td></thdlt></thdlt></thdlt>	DEDTU	A STREET STREET STREET			
Bit Control (Control (Contre) (Contre)))					
81.0       265.75       9.5         81.5       267.39 $\gamma_{L}$ 82.0       269.03 $\gamma_{T}$ 82.0       273.95 $\gamma_{R}$ 83.0       272.31 $\gamma_{P}$ 83.0       275.59 $\rho_{II}$ 84.0       275.59 $\rho_{II}$ 84.5       277.23 $\rho_{T}$ 85.0       278.87 $\rho_{3}$ 85.0       280.51 $\rho_{5}$ 86.0       282.15 $\rho_{4}$ 87.5       280.51 $\rho_{4}$ 86.0       282.15 $\rho_{4}$ 87.5       287.07 $\ell_{0}$ 88.0       288.71 $\ell_{0}$ 88.0       288.71 $\ell_{0}$ 88.0       288.71 $\ell_{0}$ 90.0       291.99 $\mu_{II}$ 89.0       293.64 $\mu_{2}$ 90.0       296.82 $\mu_{7}$ 91.0       296.66 $\mu_{7}$ 92.5       293.64 $\mu_{2}$ 93.0       305.12 $\mu_{1}$ 92.5       303.48 $\mu_{2}$ <	METERS	IFEE I	FILE NO .		
$81.5$ $267.39$ $97$ $82.0$ $289.03$ $97$ $82.5$ $270.67$ $98$ $83.0$ $272.31$ $99$ $83.5$ $273.95$ $10^{10}$ $84.0$ $275.59$ $10^{10}$ $84.5$ $277.23$ $10^{2}$ $85.0$ $278.87$ $1^{10}3$ $85.5$ $280.51$ $10^{14}$ $86.5$ $283.79$ $10^{16}$ $86.5$ $283.79$ $10^{16}$ $87.0$ $287.07$ $10^{16}$ $87.0$ $287.07$ $10^{16}$ $87.0$ $287.07$ $10^{16}$ $87.0$ $287.07$ $10^{16}$ $88.0$ $288.71$ $10^{16}$ $88.0$ $288.71$ $10^{16}$ $89.0$ $291.99$ $11$ $10^{12}$ $89.0$ $291.92$ $11^{12}$ $10^{12}$ $90.0$ $298.56$ $11^{15}$ $10^{12}$ $90.0$ $298.56$ $11^{12}$ $10^{12}$ $91.0$ $298.56$ $116$	80.5	264.11			
$82.0$ $269.03$ $9^{-7}$ $82.5$ $270.67$ $9^{-7}$ $83.0$ $272.31$ $5^{-9}$ $83.5$ $273.95$ $10^{-1}$ $84.0$ $275.58$ $10^{-1}$ $84.5$ $277.23$ $10^{-2}$ $85.5$ $280.51$ $10^{-1}$ $85.5$ $280.51$ $10^{-1}$ $86.6$ $282.15$ $10^{-5}$ $86.5$ $283.79$ $10^{-6}$ $87.0$ $285.43$ $10^{-7}$ $87.5$ $287.07$ $10^{-8}$ $88.5$ $290.35$ $11^{-1}$ $88.5$ $290.35$ $11^{-7}$ $89.0$ $291.99$ $111$ $89.5$ $293.64$ $11^{-7}$ $90.5$ $296.52$ $11^{-7}$ $91.0$ $298.56$ $11^{-7}$ $92.5$ $303.48$ $11^{-7}$ $92.5$ $303.48$ $11^{-7}$ $92.5$ $303.48$ $11^{-7}$ $92.5$ $303.48$ $11^{-7}$ $92.5$ $311.68$	81.0	265.75			
$82.5$ $270.67$ $9$ $83.0$ $272.31$ $9$ $83.5$ $273.95$ $1b^{5}$ $84.0$ $275.59$ $1b^{1}$ $84.5$ $277.23$ $1b^{2}$ $85.5$ $278.87$ $1b^{2}$ $85.6$ $278.87$ $1b^{2}$ $86.5$ $283.79$ $1b^{4}$ $86.6$ $282.15$ $1b^{4}$ $86.5$ $283.79$ $1b^{4}$ $86.5$ $283.79$ $1b^{4}$ $87.0$ $286.43$ $b^{-1}$ $86.5$ $287.07$ $10^{8}$ $88.0$ $288.71$ $1b^{4}$ $88.5$ $290.35$ $11b$ $88.5$ $290.35$ $11b$ $89.5$ $293.64$ $11^{2}$ $90.0$ $295.28$ $113$ $90.5$ $298.56$ $115$ $91.5$ $300.20$ $116$ $92.0$ $301.84$ $117$ $92.5$ $303.48$ $124$ $93.0$ $305.12$ $119$	81.5	267.39			
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	82.0	269.03			
$83.5$ $273.96$ $10^{10}$ $84.0$ $275.59$ $10^{1}$ $84.5$ $277.23$ $10^{2}$ $85.0$ $277.23$ $10^{2}$ $85.5$ $280.51$ $1b^{14}$ $86.0$ $282.15$ $1b^{5}$ $86.5$ $283.79$ $1b^{1}_{0}$ $87.0$ $285.43$ $1b^{-1}_{1}$ $87.5$ $287.07$ $10^{12}_{0}$ $88.0$ $288.71$ $10^{9}_{1}$ $88.0$ $288.71$ $10^{9}_{1}$ $88.0$ $288.71$ $10^{9}_{1}$ $88.0$ $288.71$ $10^{9}_{1}$ $89.0$ $291.99$ $11$ $89.0$ $291.99$ $11^{1}_{1}$ $90.0$ $295.28$ $11^{2}_{2}$ $90.0$ $298.56$ $115$ $92.0$ $301.84$ $117$ $92.5$ $303.48$ $118^{12}_{2}$ $93.0$ $306.76$ $12^{2}_{2}$ $94.0$ $308.40$ $12^{1}_{2}$ $94.0$ $308.40$ $12^{1}_{2}$ $96.5$ </td <td>82.5</td> <td>270.67</td> <td></td> <td></td> <td></td>	82.5	270.67			
$84.0$ $275.59$ $101$ $84.5$ $277.23$ $10^{2}$ $85.5$ $280.51$ $1b^{4}$ $86.0$ $282.15$ $1b^{5}$ $86.5$ $283.79$ $1b_{0}$ $87.0$ $285.43$ $1b^{1}$ $87.5$ $287.07$ $10g^{8}$ $88.0$ $288.71$ $1b^{0}$ $88.0$ $288.71$ $1b^{0}$ $88.0$ $288.71$ $1b^{0}$ $88.5$ $290.35$ $11D$ $89.0$ $281.99$ $111$ $89.5$ $293.64$ $11^{2}$ $90.0$ $295.28$ $115$ $91.0$ $298.56$ $115$ $91.5$ $296.92$ $11^{4}$ $91.0$ $298.56$ $115$ $91.5$ $303.48$ $116$ $92.5$ $303.48$ $116$ $93.5$ $306.76$ $12^{2}$ $94.0$ $308.40$ $12^{2}$ $94.5$ $313.32$ $12^{2}$ $96.5$ $314.86$ $12.7$	83.0	272.31	<u> </u>		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	83.5	273.95			
$85.0$ $278.87$ $1\nu^3$ $85.5$ $280.51$ $1\nu^4$ $86.0$ $282.15$ $1\nu^5$ $86.5$ $283.79$ $1\nu^6$ $87.0$ $285.43$ $1\nu^ 87.5$ $287.07$ $1\nu^6$ $88.0$ $288.71$ $(\nu^0$ $88.0$ $288.71$ $(\nu^0$ $88.0$ $288.71$ $(\nu^0$ $88.5$ $290.35$ $11.0$ $89.0$ $291.99$ $11$ $89.5$ $293.64$ $17^2$ $90.0$ $295.28$ $11.3$ $90.5$ $296.92$ $11^{14}$ $91.5$ $300.20$ $116^6$ $91.5$ $300.20$ $116^6$ $92.0$ $301.84$ $117$ $92.5$ $303.48$ $118^6$ $93.0$ $305.12$ $11^6$ $94.0$ $308.40$ $12.4$ $94.0$ $308.40$ $12.4$ $96.5$ $313.32$ $12^4$ $96.5$ $314.96$ $12.5$ $97.0$ <td>84.0</td> <td>275.59</td> <td></td> <td>an an a</td> <td></td>	84.0	275.59		an a	
$85.5$ $280.51$ $l\nu\Psi$ $86.0$ $282.15$ $l\nu5$ $86.5$ $283.79$ $l\nu\zeta$ $87.0$ $285.43$ $l\nu$ $87.5$ $287.07$ $l\nu$ S $88.0$ $288.71$ $l\rho$ G $88.5$ $290.35$ $ll\nu$ $89.0$ $291.99$ $ll$ $89.5$ $293.64$ $ll^2$ $90.5$ $295.28$ $ll^3$ $90.5$ $296.92$ $ll'\Psi$ $91.0$ $298.56$ $ll^5$ $91.5$ $300.20$ $ll\phi$ $92.0$ $301.84$ $ll^7$ $92.5$ $303.48$ $ll_8$ $93.5$ $306.76$ $l2 - $ $94.0$ $308.40$ $l2.1$ $94.5$ $310.04$ $l2^{-2}$ $95.5$ $313.32$ $l^24$ $96.5$ $316.60$ $l^2.6$ $97.0$ $318.24$ $l^2.7$ $97.5$ $319.88$ $l^28$ $98.0$ $321.62$ $l^2.9$ $99.0$	84.5	277.23	102		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	85.0	278.87	the second se		
$86.5$ $283.79$ $lb\zeta$ $87.0$ $285.43$ $lb\top$ $87.5$ $287.07$ $lvS$ $88.0$ $288.71$ $loq$ $88.5$ $290.35$ $llD$ $88.5$ $290.35$ $llD$ $89.0$ $291.99$ $ll1$ $89.5$ $293.64$ $llZ^2$ $90.0$ $295.28$ $ll3$ $90.5$ $296.92$ $ll'4$ $91.0$ $298.56$ $llS$ $91.5$ $300.20$ $lld$ $92.5$ $303.48$ $ll\xi$ $92.0$ $301.84$ $llT$ $92.0$ $305.12$ $llq$ $93.0$ $305.12$ $llq$ $94.0$ $308.40$ $lzL$ $94.0$ $308.40$ $lzL$ $94.5$ $310.04$ $lzZ^{-2}$ $95.5$ $313.32$ $lzH$ $96.0$ $314.96$ $lZX$ $97.0$ $318.24$ $lZZ$ $98.0$ $321.52$ $lZM$ $98.0$ $321.5$	85.5	280.51	104		
$87.0$ $285.43$ $lb^{-1}$ $87.5$ $287.07$ $lb^{\circ}$ $88.0$ $288.71$ $lb^{\circ}$ $88.0$ $288.71$ $lb^{\circ}$ $88.5$ $290.35$ $llD$ $89.0$ $291.99$ $lll$ $89.5$ $293.64$ $ll^{\circ}$ $90.0$ $295.28$ $ll^{\circ}$ $90.5$ $296.92$ $ll^{\circ}$ $91.0$ $298.56$ $ll^{\circ}$ $91.5$ $300.20$ $ll^{\circ}$ $91.5$ $300.20$ $ll^{\circ}$ $92.5$ $303.48$ $ll^{\circ}$ $92.5$ $303.48$ $ll^{\circ}$ $93.0$ $305.12$ $ll^{\circ}$ $94.0$ $308.40$ $l2_{\circ}$ $94.5$ $310.04$ $l2_{\sim}$ $95.5$ $313.32$ $l^{24}$ $96.0$ $314.96$ $l^{25}$ $96.5$ $316.60$ $l^{26}$ $97.0$ $318.24$ $l^{27}$ $98.0$ $321.52$ $l^{29}$ $98.0$ $321.52$ $l^{29}$	86.0	282.15	105		
$87.5$ $287.07$ $lvg$ $88.0$ $288.71$ $loq$ $88.5$ $290.35$ $llv$ $89.0$ $291.99$ $lll$ $89.5$ $293.64$ $ll^2$ $90.0$ $295.28$ $ll^3$ $90.5$ $296.92$ $ll'4$ $91.0$ $298.56$ $ll'5$ $91.5$ $300.20$ $ll\ell$ $92.0$ $301.84$ $ll'7$ $92.5$ $303.48$ $llg$ $93.0$ $305.12$ $llq$ $93.5$ $306.76$ $l2\nu$ $94.5$ $310.04$ $l2'$ $94.5$ $310.04$ $l2'$ $95.5$ $313.32$ $l2^{2}$ $96.0$ $314.96$ $l^{2.5}$ $96.5$ $316.60$ $l2^{2}$ $97.0$ $318.24$ $l27$ $98.0$ $321.52$ $l^{2}7$ $98.0$ $321.52$ $l^{2}7$ $98.0$ $321.52$ $l^{2}7$ $98.0$ $324.80$ $l31$ $99.0$	86.5	283.79	106		
$88.0$ $288.71$ $10^{9}$ $88.5$ $290.35$ $11^{1}$ $89.0$ $291.99$ $11^{1}$ $89.5$ $293.64$ $11^{7}$ $90.0$ $295.28$ $11^{3}$ $90.5$ $296.92$ $11^{4}$ $91.0$ $298.56$ $11^{5}$ $91.5$ $300.20$ $11^{6}$ $92.0$ $301.84$ $11^{7}$ $92.5$ $303.48$ $11^{8}$ $93.0$ $305.12$ $11^{9}$ $93.5$ $306.76$ $12^{2}$ $94.5$ $310.04$ $12^{7}$ $94.5$ $310.04$ $12^{7}$ $95.5$ $313.32$ $12^{4}$ $96.0$ $314.96$ $1^{7}5$ $96.5$ $316.60$ $12^{6}$ $97.0$ $318.24$ $12^{7}$ $97.5$ $319.88$ $12^{8}$ $98.0$ $321.52$ $12^{7}$ $98.5$ $323.16$ $13^{5}$ $99.0$ $324.80$ $(31)$ $99.5$ $326.44$ $13^{7}$ <td>87.0</td> <td>285.43</td> <td>107</td> <td></td> <td></td>	87.0	285.43	107		
$88.5$ $290.35$ $11D$ $89.0$ $291.99$ $111$ $89.5$ $293.64$ $11^{2}$ $90.0$ $295.28$ $113$ $90.5$ $296.92$ $114$ $91.0$ $298.56$ $115$ $91.5$ $300.20$ $116$ $91.5$ $300.20$ $116$ $92.0$ $301.84$ $117$ $92.5$ $303.48$ $118$ $93.5$ $306.76$ $120$ $93.5$ $306.76$ $120$ $94.0$ $308.40$ $121$ $94.5$ $310.04$ $127$ $95.5$ $313.32$ $124$ $96.0$ $314.96$ $125$ $97.5$ $319.88$ $126$ $97.5$ $319.88$ $127$ $98.6$ $321.52$ $127$ $98.5$ $323.16$ $130$ $99.0$ $324.80$ $131$ $99.0$ $324.80$ $131$	87.5	287.07	108		
$88.5$ $290.36$ $11D$ $89.0$ $291.99$ $111$ $89.5$ $293.64$ $11Z^2$ $90.0$ $295.28$ $113$ $90.5$ $296.92$ $114$ $91.0$ $298.56$ $115$ $91.0$ $298.56$ $115$ $91.5$ $300.20$ $116$ $92.0$ $301.84$ $117$ $92.5$ $303.48$ $118$ $92.5$ $303.48$ $117$ $92.5$ $303.48$ $117$ $92.5$ $303.48$ $117$ $93.5$ $306.76$ $12D$ $93.5$ $306.76$ $12D$ $94.0$ $308.40$ $121$ $94.5$ $310.04$ $127$ $95.5$ $313.32$ $124$ $96.0$ $314.96$ $175$ $96.5$ $316.60$ $126$ $97.5$ $319.88$ $127$ $98.5$ $323.16$ $13D$ $98.5$ $323.16$ $13D$ $99.0$ $324.80$ <td>And the second s</td> <td>288.71</td> <td>109</td> <td></td> <td></td>	And the second s	288.71	109		
$89.0$ $291.99$ $l_{11}$ $89.5$ $293.64$ $l_{17}$ $90.0$ $295.28$ $l_{13}$ $90.5$ $296.92$ $l_{14}$ $91.0$ $298.56$ $l_{15}$ $91.5$ $300.20$ $l_{16}$ $92.0$ $301.84$ $l_{17}$ $92.5$ $303.48$ $l_{16}$ $93.0$ $305.12$ $l_{19}$ $93.5$ $306.76$ $l_{20}$ $94.0$ $308.40$ $l_{21}$ $94.5$ $310.04$ $l_{27}$ $95.5$ $313.32$ $l_{24}$ $96.0$ $314.96$ $l_{25}$ $96.0$ $314.96$ $l_{25}$ $97.0$ $318.24$ $l_{27}$ $97.5$ $319.88$ $l_{28}$ $98.0$ $321.52$ $l_{29}$ $98.0$ $321.52$ $l_{29}$ $99.0$ $324.80$ $l_{31}$ $99.5$ $326.44$ $l_{37}$	and the second se	290.35	110		
$89.5$ $293.64$ $11^{2}$ $90.0$ $295.28$ $113$ $90.5$ $296.92$ $114$ $91.0$ $298.56$ $115$ $91.5$ $300.20$ $116$ $92.0$ $301.84$ $117$ $92.0$ $301.84$ $117$ $92.5$ $303.48$ $118$ $93.0$ $305.12$ $119$ $93.5$ $306.76$ $120$ $94.0$ $308.40$ $121$ $94.5$ $310.04$ $127$ $94.5$ $310.04$ $127$ $95.5$ $313.32$ $124$ $96.0$ $314.96$ $175$ $96.5$ $316.60$ $176$ $97.0$ $318.24$ $127$ $97.5$ $319.88$ $128$ $98.0$ $321.52$ $127$ $98.5$ $323.16$ $13 b$ $99.0$ $324.80$ $131$ $99.5$ $326.44$ $(32-)$		291.99	111		
90.0       295.28 $l13$ 90.5       296.92 $l14$ 91.0       298.56 $l15$ 91.5       300.20 $l16$ 92.0       301.84 $l17$ 92.5       303.48 $l18$ 93.0       305.12 $l19$ 93.5       306.76 $l20$ 94.0       308.40 $l2l$ 94.0       308.40 $l2l$ 95.5       313.32 $l24$ 96.0       314.96 $l^25$ 96.5       316.60 $l26$ 97.0       318.24 $l27$ 98.0       321.52 $l27$ 98.0       323.16 $l30$ 99.0       324.80 $l31$ 99.5       326.44 $l32$		293.64	112		
$90.5$ $296.92$ $(1^{4})$ $91.0$ $298.56$ $(15$ $91.5$ $300.20$ $116$ $92.0$ $301.84$ $117$ $92.5$ $303.48$ $(18$ $93.0$ $305.12$ $(19^{7})$ $93.5$ $306.76$ $(22^{7})$ $94.0$ $308.40$ $(21^{7})$ $94.5$ $310.04$ $(27^{7})$ $95.5$ $313.32$ $12^{24}$ $96.0$ $314.96$ $12^{7}$ $96.5$ $316.60$ $12^{7}$ $97.0$ $318.24$ $127$ $97.5$ $319.88$ $128$ $98.0$ $321.52$ $12^{7}$ $98.5$ $323.16$ $13^{5}$ $99.0$ $324.80$ $(31)$ $99.5$ $326.44$ $(37^{-1})$		295.28			
91.0       298.56 $i15$ 91.5       300.20 $i16$ 92.0       301.84 $i17$ 92.5       303.48 $i18$ 93.0       305.12 $i19$ 93.5       306.76 $i2o$ 94.0       308.40 $i2i$ 94.5       310.04 $i27$ 95.0       311.68 $i23$ 95.5       313.32 $i24$ 96.0       314.96 $i^{7.5}$ 96.5       316.60 $i26$ 97.0       318.24 $i27$ 97.5       319.88 $i28$ 98.0       321.52 $i27$ 98.5       323.16 $i3o$ 99.0       324.80 $i3i$ 99.5       326.44 $i3^{2}$	Contraction of the local division of the loc	296.92	114		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Construction of the Owner of th	298.56	115		
$92.0$ $301.84$ $117$ $92.5$ $303.48$ $118$ $93.0$ $305.12$ $119$ $93.5$ $306.76$ $120$ $94.0$ $308.40$ $121$ $94.5$ $310.04$ $127$ $95.0$ $311.68$ $123$ $95.5$ $313.32$ $124$ $96.0$ $314.96$ $1^{2.5}$ $96.5$ $316.60$ $176$ $97.0$ $318.24$ $177$ $97.5$ $319.88$ $178$ $98.0$ $321.52$ $127$ $98.5$ $323.16$ $13 b$ $99.0$ $324.80$ $131$ $99.5$ $326.44$ $_{1}32$	and the second se				
$92.5$ $303.48$ $1/8$ $93.0$ $305.12$ $1/9$ $93.5$ $306.76$ $120$ $94.0$ $308.40$ $12/$ $94.5$ $310.04$ $12^{-2}$ $95.0$ $311.68$ $123$ $95.5$ $313.32$ $124$ $96.0$ $314.96$ $1^{-25}$ $96.5$ $316.60$ $126$ $97.0$ $318.24$ $127$ $97.5$ $319.88$ $128$ $98.0$ $321.52$ $127$ $98.5$ $323.16$ $13 b$ $99.0$ $324.80$ $(3)/$ $99.5$ $326.44$ $(3^{-2})$		301.84	117		
93.0 $305.12$ $119$ $93.5$ $306.76$ $120$ $94.0$ $308.40$ $121$ $94.5$ $310.04$ $127$ $95.0$ $311.68$ $123$ $95.5$ $313.32$ $124$ $96.0$ $314.96$ $125$ $96.5$ $316.60$ $126$ $97.0$ $318.24$ $127$ $97.5$ $319.88$ $128$ $98.0$ $321.52$ $129$ $98.5$ $323.16$ $130$ $99.0$ $324.80$ $(31)$ $99.5$ $326.44$ $(32)$	and the second data is a second data and a second data and a second data and a second data and a second data a	303.48	118		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			Contraction of the local division of the loc		
94.0 $308.40$ $[2]$ $94.5$ $310.04$ $[27 95.0$ $311.68$ $123$ $95.5$ $313.32$ $124$ $96.0$ $314.96$ $175$ $96.5$ $316.60$ $126$ $97.0$ $318.24$ $127$ $97.5$ $319.88$ $128$ $98.0$ $321.52$ $127$ $98.5$ $323.16$ $13b$ $99.0$ $324.80$ $(3)$ $99.5$ $326.44$ $(37-)$	Contraction of Station of Contract of Cont				
$94.5$ $310.04$ $12^{2}$ $95.0$ $311.68$ $1^{2}3$ $95.5$ $313.32$ $1^{2}4$ $96.0$ $314.96$ $1^{2}5$ $96.5$ $316.60$ $1^{2}6$ $97.0$ $318.24$ $1^{2}7$ $97.5$ $319.88$ $1^{2}8$ $98.0$ $321.52$ $12^{7}$ $98.5$ $323.16$ $13^{5}$ $99.0$ $324.80$ $(3)1$ $99.5$ $326.44$ $(3^{2}-)$					
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		310.04			
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	······································	311.68	123		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		313.32			
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	A DESCRIPTION OF THE OWNER		125		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	and the second design of the s		126		
97.5       319.88       128         98.0       321.52       129         98.5       323.16       130         99.0       324.80       131         99.5       326.44       132		318.24	127		
98.0         321.52         129           98.5         323.16         136           99.0         324.80         131           99.5         326.44         132	and a second		128		
98.5         323.16         13 b           99.0         324.80         131           99.5         326.44         132			129		
99.0         324.80         13/           99.5         326.44         132	mana and a second s		130		
99.5 326.44 132	and the second s		131		
	ACCOUNTS OF THE OWNER OWNER OF THE OWNER				
	100.0	328.08	133		

DGGING FIELD NOTES		4 6 1 Jawa 1995		
DATE*: 10/14/2013	2.000-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-	t NPP	urkey Poin	SITE*:I
JOB*:13331		Rizzo Associates, Inc.	_Paul C. F	CLIENT*:_
_JOB*:13331 _PAGE*OF FORMATION IS OPTIONAL		er	:C. Carte	AUTHOR*
ORMATION IS OPTIONAL				
	FILTERED	UNFILTERED		
CASING, WATER, ROCK, ETC	FILE NO*. (if any)	FILE NO*.	FEET	METERS
Т		134	329.72	100.5
		(35	331.36	100.0
		136	333.01	101.5
		137,	334.65	101.0
		138	336.29	102.5
		139	337.93	102.0
		140	339.57	103.5
		141	341.21	100.0
	na na mana na mana na manana manana na manana na mana n	142	342.85	104.5
		143	344.49	104.0
	nen angelen en e	144	346.13	105.5
		145	347.77	106.0
		146	349.41	106.5
		147	351.05	107.0
		148	352.69	107.5
		149	354.33	108.0
		150	355.97	108.5
		151	357.61	109.0
		152	359.25	109.5
		153	360.89	110.0
		154	362.53	110.5
		155	364.17	111.0
		156	365.81	111.5
		157	367.45	112.0
		158	369.09	112.5
		159	370.73	113.0
		160	372.38	113.5
		161	374.02	114.0
		162	375.66	114.5
		163	377.30	115.0
		164	378.94	115.5
		165	380.58	116.0
		166	382.22	116.5
		167	383.86	117.0
		768	385.50	117.5
		169	387.14	118.0
		170	388.78	118.5
		[7]	390.42	119.0
		172-	392.06	119.5

R-6	-16	GEOVISION SU	SPENSION LC	P-S FIELD LOG REV 1.	
SITE* 1		It NPP		DATE*: 10/14/2013	
CLIENT*:	Paul C. F	Rizzo Associates, Inc		_JOB*:13331	
AUTHOR'	:C. Cart	er		_PAGE*OF	j
	ITEMS V	VITH * <u>MUST BE COM</u> I	<u>PLETED</u> . OTHER INF	ORMATION`IS OPTIONAL	
DEPTH	DEPTH	UNFILTERED	FILTERED	COMMENTS	
METERS	FEET	FILE NO*.	FILE NO*. (if any)	CASING, WATER, ROCK, ETC	2
100 F	005.04			T	
120.5	395.34	174			
121.0	396.98	175			
121.5	398.62	176			
122.0	400.26	111	an a		
122.5	401.90	178			
123.0	403.54	119			
123.5	405.18	180			
124.0	406.82	181			
124.5	408.46	182		1	
125.0	410.10	183			
125.5	411.75	184			
126.0	413.39	185			
126.5	415.03	186			
127.0	416.67	187			
127.5	418.31	188			
128.0	419.95	189			
128.5	421.59	190			
129.0	423.23	191			
129.5	424.87	192			
130.0	426.51	193	2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 -		LOUIS CONTRACTOR
130.5	428.15	194			042-482070-00210384
131.0	429.79	195			
131.5	431.43	196			
132.0	433.07	197			
132.5	434.71	198			
133.0	436.35	199			
133.5	437.99	200			
134.0	439.63	201			
134.5	441.27	202			
135.0	442.91	203			
135.5	444.55	204	<u></u>		
136.0	446.19	205			
136.5	440.19	206			
130.5	449.48	200	and a second	6:30	
137.0	449.48		ана станция и солони и солони С с с с с с с с с с с с с с с с с с с с	1 3172	
138.0	452.76				
138.5	454.40				
139.0	456.04		9774 + & Farmer un valuer menane manar marce chard & F. Barrar, Said (7574) & Barrar, Said (7574)		
139.5	457.68				
140.0	459.32	l		1	1
		· · · ·			



Borehole\*

## **ACOUSTIC TELEVIEWER FIELD LOG**

Procedure ASTM D5753-10 Borehole Geophysical GEOVision HI-RAT Field Procedure Rev 2.00a

SITE*: Turkey Point NPP CLIENT*: Paul C. Rizzo Associates, Inc. AUTHOR*: C. Carter REVIEWER: (post field work)	DATE*: 15/16/2013 JOB*:13331 PAGE: 1 OF 2
CONTACT:	PHONE: Off Cell
CONTACT:	PHONE: Off Cell
DRILLER COMPANY:	PHONE: Off Cell
GENERAL SITE CONDITIONS/LOCATION:	
SURFACE CASING?: YES DEPTH TO BOT DEPTH TO BEDROCK: <u>5</u> BOREHOLE FLUID: WATER; FRESH WATE OTHER:	DEPTH TO WATER TABLE: Ø
LOGGING CREW: <u>C. Carter</u> VEHICLE(S) USED AND MILEAGE: MOBILIZED FROM: <u>Florida City</u> ARRIVED ON SITE: <u>1.00 an</u> STANDBY TIME:	DEPARTURE TIME: 6:30 CAUSE:

GE Vision		٨٢	OUSTIC T		EP
geophysical services		AU			
R-6	-16		FIELC	) LOG	
	Borehole*		re ASTM D5753- /ision HI-RAT Fiel		
SITE*: Turkey Point NPP		DATE		3	
CLIENT*: Paul C. Rizzo Associa	ates, Inc.	JOB*: 1333			
AUTHOR*: <u>C. Carter</u>		PAGE	: 2 OF 2		
REVIEWER: (post field	work)				
		RG 🗌	OTHER		
MICROLOGGER* 8083	5772		OTHER		
TELEVIEWER* 5174	6641 🖌		OTHER		
SHEAVE* OYO 101 102	103 10	04 🔲 Othe	er	RG 🔀	
All GEOVision Televiewer p			ologging, Ltd. of De		К
PROBE TILT TEST* 56.41	_BRUNTON TI	LT* <u>57</u>		+/-2°	
PROBE TILT TEST* 90.50	_BRUNTON TI		ND-W (1) - F (	+/-2°	
PROBE TILT TEST* 59.46	_ BRUNTON TI	LT* <u>59</u>	AFTER I	_OG*YLS	
PROBE AZIMUTH TEST* 324.30			20	+/-10° d	
PROBE AZIMUTH TEST* 28.34	BRUNTON AZ	ZIMUTH*	3.1	+/-10°	
PROBE AZIMUTH TEST* 205.90	BRUNTON A	ZIMUTH*_2	12_AFTER	LOG*_yes_	
PROBE OFFSET*	••••••••••••••••••••••••••••••••••••••	1.44M(4.7	2FT)		
MINUS CASING STIC		1.61			
DEPTH REF. OFFSE			$\mathbb{F}$	UND SURFACE	
DEPTH REF. OFFSE		1.58		of total dopth	
AFTER SURVEY DEF	THERROR	<u>~.vj</u>	_ allow +/-0.4%	or total depth	
	ISTART	START	END	END	
LOG NAME*	DEPTH*	TIME	DEPTH *	TIME	
RGIBAUDOWNOZ	1.9	9:13	113.5ft	9:24 am	
R61BAUUP02	1.6	9:25	113.54	10:03am	
				<u>.</u>	
MAINTENANCE PERFORMED O	N SITE*:	NA		(N	/A if none)
				<u></u>	
					(A if nono)
DEVIATION FROM PROCEDURE <u>* Offset at start sh</u> "Down" by should be shifted	ald he 211	hut 161	was entere	CALORES (IN	in in none)
"Down" by Should be shifted	d+1.5 St ani	d"up" log	should be (	hifted +1.	53 ft.
		1-2-			~
DATA STORED IN TWO PLACES	BEFORE DEP.	ARTURE?	] YES. DESCF	RIBE: CD (US	SB DRIVE)
			OTHER		
ITENO MUTU * MUOT					
ITEMS WITH * <u>MUST I</u>	<u>SE CUMPLETE</u>	$\underline{\nu}$ . UTHER	INFURMATION	IS OPTIONAL	



A-2172 CALIPER FIELD LOG REV 1.32PDF

R	60	6-		6
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CALIPER FIELD LOG

Borehole\*

Procedure ASTM D6167-11 Borehole Caliper Procedure ASTM D6274-10 Borehole Gamma

SITE*:Turkey Point NPPCLIENT*:Paul C. Rizzo Associates, Inc.AUTHOR*:C. Carter	DATE*: <u>10/15/2013</u> , 10/16/2013 JOB*:13331 PAGE: 1 OF 2
CONTACT:	PHONE: Off Cell
CONTACT:	PHONE: Off Cell
CONTACT:	PHONE: Off Cell
DRILLER COMPANY:	PHONE: Off Cell
GENERAL SITE CONDITIONS/LOCATION:	-
COUNTY:RANGE:TO BOREHOLE CONSTRUCTION: CASEDUN DIAMETERS AND DEPTH RANGES: $5^{34}$ , 0 TC BOREHOLE TOTAL DEPTH AS DRILLED*: $46^{4}$ $10^{1/5}$ SURFACE CASING?: YES $\overset{\checkmark}{}$ DEPTH TO BOTT DEPTH TO BEDROCK: $\overset{\sim}{}$ 5 $ft$ BOREHOLE FLUID: $\overset{\sim}{}$ 5 $ft$ DEPTH TO BOREHOLE FLUID: $< 10$ $ft$	CASED X (10  ff;  s", 10) to 464 ft ft OM OF CASING 110 ft; NO X 10 116 DEPTH TO WATER TABLE: Off R MUD X; SALT WATER MUD.
LOGGING CREW: C. Carter VEHICLE(S) USED AND MILEAGE: MOBILIZED FROM: Florida City ARRIVED ON SITE: 7:00 are	DEPARTURE TIME: 6:30

ITEMS WITH \* MUST BE COMPLETED. OTHER INFORMATION IS OPTIONAL

NIA

STANDBY TIME:

CAUSE:



A-2173 CALIPER FIELD LOG REV 1.32PDF

geophysical services		R-6-16		CALIPER FIELD LOG		
		Boreh		Procedure ASTM D6167-11 Boreh		orehole Caliper
						orehole Gamma
SITE*:	Turkey Point NPP		DATE*:	10/15/2013	, 10/16/2013	
CLIENT*:	Paul C. Rizzo Associate	es, Inc.	_ JOB*:1333 <sup>.</sup>			······································
AUTHOR*:	C. Carter		PAGE:	PAGE 2 OF 2	*****	n an
WINCH		ογο 🗌	RG	OTHER		
MICROLO		5772 🗵	OTHER			
CALIPER F		6621	OTHER			
SHEAVE*	OYO 101 102	103 🔄 104	Other			RG 🖌
	PROBE OFFSET		2.08M(6,82	FT)	12 IN MAX	]
	MINUS CASING STICK	-UP*	1.61 1.6			
	DEPTH REF. OFFSET /	AT START*	5.21 5.2	-) REF TO GROU	JND SURFACE	
	DEPTH REF. OFFSET /	AT END*	3.95 5.2	a		
	AFTER SURVEY DEPT	H ERROR*	1.26 0.0	<u> </u>		
	1999-1999-1999-1999-1999-1999-1999-199		1			
		START	START	END	END	
	LOG NAME*	DEPTH*	TIME*	DEPTH*	TIME*	iolis
	R61BCALTESTUI	NLA	8:39	NA	8:40am	1011>
	RGIBCALUPOI	455.7	9:15	99.65 ft	9:45 am	
	R61BCS4TEST02	NA	10:02	NA	10:040m	10/16
	RGIBCALTESTU3	NA	11:24	NL	11:26 am	10116
	R61BCALUPOZ	116.7	11:37	3.35 ft	11:48 am	<u>}</u>
	R 61BCAL TESTOY	NIA	11:55	NIA	11:56am	
		·····				
	L <u></u>		I			
CALIBRATI	ON PLATE S/N 201		AS BUILT		PVC FITTING	3
		1.97 IN	3.94 IN	7.87 IN	4.50 IN	
	FILE NAME	(50 MM)	(100 MM)	(200.0 MM)	(114. MM)	
	RGIBCALTESTOI	1.94	3.93	7.85	4.47	
AS MEAS.*		1.95	3.91	7.84	4.49	
AS MEAS.	RGIBCALTESTU3	1.95	3.91	7.84	4.48	
AS MEAS.	R61BCALTEST04	1.93	3.91	7.83	4.47	
AS MEAS.						
AS MEAS.			L			
MAINTENA	NCE PERFORMED ON S	SITE*:		uls		(N/A if none)
				1		
EQUIPMEN	T PROBLEMS OR FAILL	JRES*:	A	<u>الم</u>		(N/A if none)
SUGGESTI	ONS, ADDITIONS, CHAN	IGES:				÷
ITEMS	WITH * <u>MUST BE COM</u>	<u>PLETED</u> . OTH	IER INFORM	IATION IS OPT	IONAL	
GEOVision	Geophysical Services	1124 Olympic D	rive Corona, CA	92881 Ph (	951) 549-1234 F.	x (951) 549-1236



geophysical services

R-7-1	BORING GEOPHYSI	CS FIELD L	OG SUMMARY
Borehole*			Le ul a
SITE*:	Turkey Point NPP	DATE*:	10/15,16/2013
CLIENT*:	Paul C. Rizzo Associates, Inc.	_JOB*: 13331	
AUTHOR*:	C. Carter	PAGE*:	OF
CONTACT:	Rolando J. Benitez PHONE:	_(412) 607-3560	xx 43 41 + 5 + 16 + 2 + 16 + 17 + 16 + 16 + 16 + 16 + 16 + 16
	STRUCTION: CASED	UNCASED	-
DIAMETERS AND	DEPTH RANGES: <u>5"</u> 0 TO <u>19</u>	10; <u>3<sup>1</sup>/8"</u> ,	190 TO 455 ft
BOREHOLE TOTA	AL DEPTH AS DRILLED*: 455.	ft	
SURFACE CASIN	IG?: YES V DEPTH TO BOTTOM (	DF CASING 190	ft; NO <u>X 10/16</u>
DEPTH TO BEDR			
BOREHOLE FLUI	D: WATER; FRESH WATER MU	D; SALT W	ATER MUD;
LOGGING CREW	: C. Carter		

		r	l	I
LOG TYPE*	FILE NAME*	DEPTH RANGE*	DATE*	TIMES*
Deviation	RTLAUBSWND	4.3-317.8 \$	10/15/2013	11:25-11:39am
ATV	RTIANPOL	717.2-188.54	۹	11:40-12:09pm
Deviation	R7120 DOWNUZ	252-454 ft		12:46 -12:54pm
Deviation	RTIAUVPOZ	453.8-284.14	V V	12:54 - 1:07pm
P-Svelocity	RTISUSPDOWNOL	58.5-1345m	10/15/2013	1:59-3:19pm
Caliper	RTICALTESTOI	NLA	1.	4102-4104 pm
Cal-NG	RTICALUPOI	450.25-179.9ft	V,	4:26 - 4:48pm
Caliper	RTICALTESTOZ	NLA	10/15/2013	5:03-5:04pm
Deviation	RTIANDOWN03	2.5-70.5A	10/16/2013	12:39-12:45pm
Deviation	R714000004	2.5-196.5 ft	10/16/2013	1:41-1:50 pm
ATV	RTIAUUP03	196.5-2.4.44	10/16/2013	1:52-2:51 pm
P-svelucity	R71SUSPDOWN02	2.0-57.0m	(	3:15-4:22 pm
Caliper	R71C4LTEST03	N/A	)	4:46-4:47 pm
Col-NG	RTICALUPO2	191.75-2.5 ft	l	5:00-5:16pm
Capiper			$\checkmark$	•
and the second	RTICALTESTOY	NA MPLETED OTHER	10/16/2013	5:23-5:24pm

CL 10/16/13

ITEMS WITH \* MUST BE COMPLETED. OTHER INFORMATION IS OPTIONAL

GEOVision Geophysical Services

GE Vision geophysical services <u>R-7-1</u> Borehole*	ACOUSTIC TELEVIEWER FIELD LOG Procedure ASTM D5753-10 Borehole Geophysical GEOVision HI-RAT Field Procedure Rev 2.00a
SITE*:       Turkey Point NPP         CLIENT*:       Paul C. Rizzo Associates, Inc.         AUTHOR*:       C. Carter         REVIEWER:       (post field work)	DATE*: 10/15/2013 JOB*:13331 PAGE: 1 OF 2
CONTACT:	PHONE: Off Cell
CONTACT:	PHONE: Off Cell
DRILLER COMPANY:	PHONE: Off Cell
GENERAL SITE CONDITIONS/LOCATION:	
DIAMETERS AND DEPTH RANGES:0 7	NCASED X
BOREHOLE TOTAL DEPTH AS DRILLED*: 45	s ft
SURFACE CASING?: YES X DEPTH TO BOT DEPTH TO BEDROCK: S SA BOREHOLE FLUID: WATER ; FRESH WATE OTHER: DEPTH TO BOREHOLE FLUID: Ø	TOM OF CASING <u>190 年 ; NO</u> DEPTH TO WATER TABLE: <u>ダ</u>
LOGGING CREW: <u>C. Carter</u> VEHICLE(S) USED AND MILEAGE: MOBILIZED FROM: <u>Florida City</u> ARRIVED ON SITE: <u>7:00</u> STANDBY TIME: <u>N</u> [A	DEPARTURE TIME: 6'.30 CAUSE:

ITEMS WITH \* MUST BE COMPLETED. OTHER INFORMATION IS OPTIONAL

GE <i>Vision</i> geophysical services		AC		ELEVIEW	ER
R-7-	)		FIELD		
K = 1 -	Borehole*	 Procedu	ITE ASTM D5753-1		hysical
	201011010		/ision HI-RAT Fiel	•	•
SITE*: <u>Turkey Point NPP</u>		DATE	*: 10/15/2013		
CLIENT*: Paul C. Rizzo Assoc	iates, Inc.	JOB*: 1333			
AUTHOR*: <u>C. Carter</u> REVIEWER: (post field	d work)	PAGE	: 2 OF 2		
		RG 🗌	OTHER		
MICROLOGGER*	5772		OTHER		
TELEVIEWER* 5174 SHEAVE* OYO 101 102		04 🗍 Othe	OTHER	RG X	
All GEOVision Televiewer p		have a second			<
PROBE TILT TEST* 91.66	BRUNTON T	ILT* 92		+/-2°	
PROBE TILT TEST* 9221	BRUNTON T	ILT* 28		+/-2°	
15 PROBE TILT TEST*	BRUNTON T	ILT* <u> </u>		.0G*_yls	
FRODE AZIMUTITEOT				+/-10 <sup>4)</sup>	
PROBE AZIMUTH TEST* 259.8				+/-10°	
PROBE AZIMUTH TEST*_174,4	PBRUNION A	ZIMUTH* <u>1</u>	15AFTER I	_0G* <u>9/8</u>	
PROBE OFFSET*		1.44M(4.7	2FT)	-	
MINUS CASING STIC		1.33 1.3	33		
DEPTH REF. OFFSE		3.39 7.	$\frac{39}{7}$ REF TO GRO	UND SURFACE	
DEPTH REF. OFFSE AFTER SURVEY DE		2.463.	<u>1</u> 4 J 2 <sup>3</sup> allow +/-0.4%	of total dopth	
AFTERSURVETDE	FILLANON	0.150	2'allow 17-0.478		
	START	START	END	END	
LOG NAME*	DEPTH*	TIME	DEPTH *	TIME	
RTIAUDOWNUT	4.3 ft	11:25	317.8 44	11:39	
RTIAUUPOI RTIAUDOWNOL	313.2	11:40	188.5 fb 454 ft	12:09	
R TIAU UPOZ	453.8	12:54	284.154	11070m	
12.1.42				1	
				λ.	
MAINTENANCE PERFORMED O	N SITE*	NIA		(N/	A if none)
					<u> </u>
					( if nono)
DEVIATION FROM PROCEDURE Removed centralizers	after ge	tong hur	r NOLLENIS OF	ft. Ran ch	Viation
lug instead of ATV.	<u>0</u>		J T C		<u></u>
0					
DATA STORED IN TWO PLACES	S BEFORE DEP	ARTURE?	YES. DESCR OTHER	IRF: CD ( DS	BDRIVE
			VILLI		
ITEMS WITH * <u>MUST</u>	<u>BE COMPLETE</u>	<u>D</u> . OTHER	INFORMATION	IS OPTIONAL	

nsli



R-7-1 P-S SUSPENSION	VELOCITY FIELD LOG REV 1.5
SITE*: Turkey Point NPP	DATE*: 10101201) 1010100
CLIENT*: Paul C. Rizzo Associates, Inc.	JOB*: 13331
AUTHOR*: C. Carter	DATE*: <u>10/15/2013</u> JOB*: 13331 PAGE 1 OF * 9
CONTACT:	
CONTACT:	PHONE: Off Cell
CONTACT:	PHONE: Off Cell
CONTACT:	PHONE: Off Cell
DIRECTIONS TO SITE:	
GENERAL SITE CONDITIONS/LOCATION:	
COUNTY RANGE:	TOWNSHIP: SECTION:
BOREHOLE CONSTRUCTION*: CASED DIAMETERS AND DEPTH RANGES*: <u>S</u> <sup>"</sup> BOREHOLE TOTAL DEPTH AS DRILLED*: SURFACE CASING?: <u>Y</u> <sup>A</sup> DEPTH TO DEPTH TO BEDROCK: <u>S</u> <del>F</del> - BOREHOLE FLUID: WATER; FRESH W/ OTHER:	$\frac{190 }{455 }; \frac{3\%}{8}; \frac{190}{100} }_{\text{TO}} \frac{455 }{1000} }_{\text{TO}} \frac{455 }{1000} }_{\text{TO}} \frac{190 }{1000}; }_{\text{TO}} \frac{190 }{1000}; 190 \text$
DEPTH TO BOREHOLE FLUID*: 6	TIME SINCE LAST CIRCULATION: <u>lian</u> , 1:15pm
ITEMS WITH * MUST BE COMPLET	ED. OTHER INFORMATION IS OPTIONAL

GEOVision Geophysical Services 1124 Olympic Drive, Corona, CA 92881 Ph (951) 549-1234 Fx (951) 549-1236

P-S FIELD LOG REV V1.5



	R-7-1 P-S SUSPENSION				<b>REV 1.5</b>
	Borehole CORRESPONDING P-S SUSP			1.5 whichair	
	SITE*: Turkey Point NPP CLIENT*: Paul C. Rizzo Associates, Inc.		-	And the sub-statement of the	
	AUTHOR*: C. Carter		PAGE 2 OF	* 9	
	AUTHORC. Callel	na kan ana ana ka ƙafa ƙwara na ana ana ana ƙafa ta ta ta			-
	LOGGING CREW*:C. Carter			~12 D	
	MOBILIZED FROM:Florida City	DEPARTUR	RE TIME: <u>6</u>	, , 30	
	ARRIVED ON SITE: 7:00				
	STANDBY TIME:	CAUSE:			
	LOGGING STARTED:	LOGGING	COMPLETE	D:	
	BATTERIES CHANGED BEFORE LOGGING: Y WINCH COMPROBE	ES; N GREY 🖌	0 <u>x</u> ;sto 0Y0		NEW OTH
	CALIBRATED RG LOGGER/RECORD	ER	OYO L	OGGER/RE	CORDER
	INSTRUMENT* 160023 160024 🖌				] 19029
	MICROLOGGER*       8083       5772       ✓         RECEIVER S/N*       12008       20042         ISOLATION TUBE S/N*       300083       24053 ✓	26066	11001	ICROLOGG 23053 2M	
	SHEAVE* COMPROBE OYO 101	102 1	03	RG 🗵	
	PROBE OFFSET* OYO 2.0M MINUS CASING STICK-UP* 0.41 6.41	RG 2.5M	X		
	MINUS CASING STICK-UP* 0.4(6,4) DEPTH REF. OFFSET AT START* 2.69 2.69		REF TO GROU		
$c_{\zeta}$	DEPTH REF. OFFSET AT START 2.01 2.01 DEPTH REF. OFFSET AT END* 21.98 2.03		KEF TO GROU		
10/15/13	AFTER SURVEY DEPTH ERROR* 0.11 0.06	J			
		START	START	END	END
	LOG NAME*	and the second sec	TIME		TIME
	R715USPDOWNO1	58.5m 2.0m	1:59	and the second	3:19pm 4:22pn
	R71SUSPDOWN02	2.000	3:15	\$7.0m	4illpn
				ergenen angentismentation over a bitter	
		· ULA	I		(N/A if none)
	MAINTENANCE PERFORMED ON SITE*:			en de la companya de	
	EQUIPMENT PROBLEMS OR FAILURES*:	NLA			(N/A if none)
	DEVIATIONS FROM TEST PLAN*: On 10/11 could not log to 58.5m	b hole co	wed ju	and	(N/A if none)
	(our not log is so.) m				
·					

ITEMS WITH \* MUST BE COMPLETED. OTHER INFORMATION IS OPTIONAL

GEOVision Geophysical Services 1124 Olympic Drive, Corona, CA 92881 Ph (951) 549-1234 Fx (951) 549-1236

R-7-	ι (	GEOVISION	SUSPENSION LO	DGGING FIELD NOTES
SITE*: T				DATE*: 16/16/2013
		Dizzo Associates Ir	1C	JOB*: 13331
				PAGE*OF
AUTHOR*	ITEMS M	UTH * MUST BE C	OMPLETED. OTHER INF	ORMATION IS OPTIONAL
DEPTH	Contraction of the second s	UNFILTERED		COMMENTS
METERS		FILE NO*.		CASING, WATER, ROCK, ETC
IVIETERS				
0.5	1.64			
1.0	3.28			
1.5	4.92			
2.0	6.56	154		3:13
2.5	8.20	155		
3.0	9.84	156		
3.5	11.48	157		
4.0	13.12	158		
4.5	14.76	159		
5.0	16.40	160	ometra do un ya enalesia da da da antina manana da antina da	
5.5	18.04			
6.0	19.69	162		
6.5	21.33	163		
7.0	22.97	164 165		
7.5	24.61	and the second		
8.0	26.25	166		
8.5	27.89 29.53			
9.0 9.5	31.17	168		
10.0	32.81	01		
10.5	34.45	171		
11.0	36.09	172		
11.5	37.73	173		
12.0	39.37	174		
12.5	41.01	175		
13.0	42.65	176		
13.5	44.29	177		
14.0	45.93	178		
14.5	47.57	119		
15.0	49.21	180		
15.5	50.85	181		
16.0	52.49	182		
16.5	54.13	183		
17.0	55.77	184		
17.5	57.41	185		
18.0	59.06	186		
18.5	60.70	187		
19.0	62.34	188 189		
19.5	63.98	190		
20.0	65.62	191		

				DCEIP	A-2180
D_'	1-1 0		JSPENSION LO		
		SECAISION SU		DATE* 10/16/2013	
SITE*:T	urkey Poin	t NPP		DATE	
		Rizzo Associates, Inc		PAGE*_ <u>_</u> PAGE*_ <u></u>	OF 9
AUTHOR*	:C. Carte		<u> 1916 PLETED. OTHER INF</u>	PAGE	0 NAI
	A REAL PROPERTY AND A REAL				
	-	UNFILTERED	FILTERED		
METERS	FEET	FILE NO*.	FILE NO*. (if any)	CASING, WATER, F	YOCK, ETC
20.5	67.26	192			
21.0	68.90	193			
21.5	70.54	194			
22.0	72.18	195			
22.5	73.82	196			
23.0	75.46	197		and and a second se	
23.5	77.10	198		an a fair an	
24.0	78.74	199			
24.5	80.38	200	and and an an an and an		
25.0	82.02	201	and a state of a state of the	·	
25.5	83.66	202	ana na ana ana ana ana ana ana ana ana		
26.0	85.30	203	an Marine and Marine and a sub-static strategy and a sub-static strategy and a sub-static strategy and a sub-st		
26.5	86.94	204			
27.0	88.58	205			
27.5	90.22	206		an a da a company any alla fan a sala a tanàna amin'ny fanisa amin'ny fanisa dia amin'ny fanisa dia amin'ny fa	
28.0	91.86	207			Ministration and the Descent of the International States and the States
28.5	93.50	208			
29.0	95.14	209			
29.5	96.78	210			
30.0	98.43	211			
30.5	100.07				
31.0	101.71	213			<u></u>
31.5	103.35	214			No. of Concession, State of Co
32.0	104.99	215			
32.5	106.63	216	an a		
33.0	108.27	218	annan an dar an		
33.5	109.91	210			
34.0	113.19	220	9 10 10 10 10 10 10 10 10 10 10 10 10 10		
34.5	114.83	221			
35.0 35.5	114.83	222			
35.5	118.11	223		anteren er en	
36.5	119.75	224			
37.0	121.39	225			
37.5	123.03	226			
38.0	124.67	221			
38.5	126.31	228			
39.0	127.95	229			
39.5	129.59	230			
40.0	131.23	231			

				D 2 EI	A-2181 ELD LOG REV 1.5
6 4		COVICION C	USPENSION LO		
In the second				DATE*: <u></u> DATE*:	11/16/2013
SITE*:T	urkey Point	t NPP		UATEUATEUATEUATEUATEUATE	1101,000
CLIENT*:_	_Paul C. R	Rizzo Associates, Inc	•	JUB"I3331	05 9
AUTHOR*	:C. Carte	er		PAGE">	UF
			MPLETED. OTHER INI		UNAL
DEPTH		UNFILTERED	FILTERED	COMMENTS	
METERS	FEET	FILE NO*.	FILE NO*. (if any)	CASING, WATER,	RUCK, ETC
40.5	132.87	232			
41.0	134.51	233	n an		
41.5	136.15	234			
42.0	137.80	235			
42.5	139.44	236			
43.0	141.08	237		10000 - 10000 - 10000 - 10000 - 10000 - 10000 - 10000 - 10000	an a da a managa a su a
43.5	142.72	238		a contractor and a strategy of the strategy of	Konnederson - Organization (See Contraction of an organization of a second
44.0	144.36	239			
44.5	146.00	240			
45.0	147.64	241			
45.5	149.28	242			
46.0	150.92	243			
46.5	152.56	244			
47.0	154.20	245			
47.5	155.84	246			
48.0	157.48	247			
48.5	159.12	248		Mar 2011	
49.0	160.76	249			
49.5	162.40	25D			
50.0	164.04	251			
50.5	165.68	252			
51.0	167.32	253			
51.5	168.96	254			
52.0	170.60	255	n an		
52.5	172.24	256			
53.0	173.88	257			
53.5	175.52	258			
54.0	177.17	259			
54.5	178.81	260			anders and a state of the
55.0	180.45	261			
55.5	182.09			· · · · · · · · · · · · · · · · · · ·	<u>1999 - The State of </u>
56.0 56.5	183.73 185.37	263			
56.5	185.37	265		4:22	
57.5	188.65		hit	-	10/16
57.5	190.29				
58.5	191.93	001	٢٠٠٠ - ٢٠٠٠ - ٢٠٠٠ - ٢٠٠٠ - ٢٠٠٠ - ٢٠٠٠ - ٢٠٠٠ - ٢٠٠٠ - ٢٠٠٠ - ٢٠٠٠ - ٢٠٠٠ - ٢٠٠٠ - ٢٠٠٠ - ٢٠٠٠ - ٢٠٠٠ - ٢٠٠٠	1:59pm 12	slis
59.0	191.53	2			<u>_</u>
59.5	195.21	3			
60.0	196.85	4			
1 00.0	1 .00100	1 200	1	•	1

				P-S FIE	A-2182
R-7	-1 (	GEOVISION	SUSPENSION LO	DGGING FIEL	<b>D NOTES</b>
SITE*:T	urkey Poin	t NPP		DATE^:	
CLIENT*:	Paul C. F	Rizzo Associates, In	C	JOB.: 13331	
	· · · ·	or		PAGE* 6	OF <u>9</u>
	TTEMS W	/ITH * <u>MUST BE C</u>	OMPLETED. OTHER INF	ORMATION IS OPTIC	ONAL
DEPTH		UNFILTERED		COMMENTS	
METERS		FILE NO*.	FILE NO*. (if any)	CASING, WATER,	ROCK, ETC
60.5	198.49	5			
61.0	200.13	6			
61.5	201.77	1			
62.0	203.41	8		en ander ander en and	
62.5	205.05	9			
63.0	206.69	10			
63.5	208.33	<u>//</u>			
64.0	209.97	12			
64.5	211.61	13		an bar a state of the	
65.0	213.25	14		and a second	
65.5	214.90	15			
66.0	216.54	16		· · · · · · · · · · · · · · · · · · ·	
66.5	218.18	17	an a		
67.0	219.82	18	na tan ngananan manakan nga pada tan kana biya na		
67.5	221.46	19			
68.0	223.10	20			
68.5	224.74	22.	1799 mar		
69.0	226.38				A CONTRACTOR OF CO
69.5	228.02	23			
70.0	229.66	24			
70.5	231.30	2000000			
71.0	232.94	26			<u></u>
71.5	234.58	27			
72.0	236.22				
72.5	237.86	29			
73.0	239.50	30	a fan de ferste fan ferste		All and a second se
73.5	241.14	31	an ann a fa air gu ann an ann an Ann ann an Ann		
74.0	242.78	32			ana Californi ya mana mana kata ya kat
74.5	244.42	3 <u>3</u> 34			
75.0	246.06	-			and the second secon
75.5	247.70	35 36	y dan dalam kan mengembah dapat kenang mengembah dalam dari persentak kenang dalam dari berbah dari berbah dari		
76.0	249.34				
76.5	250.98	37			
77.0	252.62	38			
77.5	254.27	39 40			
78.0	255.91	4)			
78.5	257.55	42	an market en eine is de gebruik voor de gebruik van de gebruik gebruik gebruik gebruik gebruik gebruik voor ee		
79.0	260.83	43			
79.5	260.83	44			
80.0	1 202.41	1 7 1	1	I	1

R-7-	۱ G	SEOVISION SU	SPENSI	on lo	<b>GGING FIEL</b>	A-2183 FIELD LOG REV 1.5
	unkou Doint	NDD			DATE*: 16/15/201	3
CLIENT*	Paul C. R	izzo Associates, Inc			10B°' 1.3.3.31	
	~ ~ '				PAGE	
AUTHOR	ITEMS W	er /ITH * <u>MUST BE COM</u> I	PLETED. O	THER INF	ORMATION IS OPT	TIONAL
DEPTH		UNFILTERED	FILTERED		COMMENTS	
METERS		FILE NO*.	FILE NO*.		CASING, WATER	, ROCK, ETC
IVIETERS						
80.5	264.11	45				
81.0	265.75	46		and a first of the		
81.5	267.39	47				
82.0	269.03	48				
82.5	270.67	49		Na managana kata kata kata kata kata kata kata k		
83.0	272.31	So				
83.5	273.95	51				
84.0	275.59	52	+			
84.5	277.23	53				
85.0	278.87	54				an an a data a shi an
85.5	280.51	55		and a first second state of the second s		
86.0	282.15	56				an an a su an
86.5	283.79	57		and the particular sector and the sector of		an a
87.0	285.43	58				
87.5	287.07	59				
88.0	288.71	60		an a		
88.5	290.35	61				
89.0	291.99	62				
89.5	293.64	63				
90.0	295.28	64				
90.5	296.92	66				
91.0	298.56	67				
91.5	<u>300.20</u> 301.84	68				
92.0		69				
92.5	303.48	70				
93.0	306.76	70				
93.5	306.76	11				
94.0	308.40	73				
94.5	311.68	74				
95.0	313.32	15				
<u>95.5</u> 96.0	313.32	16				
96.0	316.60	17				
97.0	318.24	18		999 - 414 - 42 - 47 - 47 - 47 - 47 - 47 - 47 - 4		
97.5	319.88	79				
98.0	321.52	80				
98.5	323.16	81				
99.0	324.80	8 Z				
99.5	326.44	83				
100.0	328.08	84		*****		
1 100.0	1 020.00	1 9 1				

	- 1			P-S FIELD LOG REV 1.5
<u>R-</u>	<u>]-1</u> 6	GEOVISION SU	JSPENSION LU	GGING FIELD NOTES
SITE*: T	urkey Point	t NPP		_DATE*: 10/15/2013
CLIENT*:	Paul C. R	lizzo Associates, Inc		_JOB*:13331
AUTHOR*	0.0.1	- ta		PAGE" 2
	<b>ITEMS</b> W	/ITH * <u>MUST BE COM</u>	I <u>PLETED</u> . OTHER INF	ORMATION IS OPTIONAL
DEPTH	DEPTH	UNFILTERED	FILTERED	COMMENTS
		FILE NO*.	FILE NO*. (if any)	CASING, WATER, ROCK, ETC
			1	
100.5	329.72	85		
101.0	331.36	86	an the Barbary Constant of Statistic States and States and States and States and States and States and States a	
101.5	333.01	87		
102.0	334.65	88		
102.5	336.29	89	and a second	
103.0	337.93	90		
103.5	339.57	9) 92		
104.0	341.21	93		
104.5	342.85	94		
105.0	344.49			
105.5	346.13	95		
106.0	347.77	97		
106.5	349.41	98		
107.0	351.05	99		
107.5	352.69			
108.0	354.33	100		
108.5	355.97			
109.0	357.61	102		
109.5	359.25	104		
110.0	360.89	105		
110.5	362.53 364.17	106		
111.0	365.81	107	an a	
111.5	367.45	108		
112.0	369.09	109		
112.5	370.73	110		
113.5	372.38	111		
114.0	374.02	1/2		
114.0	375.66	113		
114.5	377.30	114		
115.5	378.94	115		
116.0	380.58	116		
116.5	382.22	117	· · ·	
117.0	383.86	118		-
117.5	385.50	119		
118.0	387.14	120		
118.5	388.78	121		
119.0	390.42	122		
119.5	392.06	123		
120.0	393.70	124		
	1	, ·	•	

SITE*Turkey Point NPPJOR*1333       DATE*_ $LotIsIZe/3$ CLIENT*Paul C. Rizzo Associates, IncJOB*13331       JOB*13331         AUTHOR*_C. C. Carler       PAGE* $q$ _OF         TTEMS WITH * MUST BE COMPLETED. OTHER INFORMATION IS OPTIONAL       COMMENTS         DEPTH       DUFTI UNFILTERED       FILTERED       CASING, WATER, ROCK, ETC         120.5       396.534       12.5       COMMENTS         121.0       396.62       12.7       CASING, WATER, ROCK, ETC         122.5       400.26       12.8       -         122.0       400.26       12.8       -         122.0       400.26       12.9       -         122.5       401.90       12.7       -         123.5       400.518       13.1       -         124.0       406.82       13.2       -         125.0       410.10       13.9       -       -         126.5       411.75       1.35       -       -         126.0       413.39       13.6       -       -         126.0       413.39       13.6       -       -         127.0       416.67       13.8       -       -       -         128.0	R-7		GEOVISION	SUSPENSION LC	GGING FIELD NOTES	
CLIENT:       Paul C. Rizzo Associates, Inc.       JOB:       J331         AUTHOR:       C. Carter       PAGE* $Q$ $Q$ TEMS WITH *       MUST BE COMPLETED. OTHER INFORMATION IS OPTIONAL         DEPTH       DEPTH       UNFILTERED       FILE NO*. (if any)       COMMENTS         121.0       396.34       ( $25$ COMMENTS         121.0       396.34       ( $25$ COMMENTS         121.0       396.98       1 $24$ COMMENTS         122.5       400.80       1 $27$ Comments         122.5       400.90       1 $27$ Comments         123.0       403.54 $75$ Comments         124.5       406.82       1 $32$ Comments         124.6       406.82       1 $33$ Comments         124.0       406.82       1 $32$ Comments         125.5       411.75       1 $35$ Comments         127.0       416.67       1 $35$ Comments         127.0       416.67       1 $35$ Comments         128.0       413.39       1 $36$ Comments         127.5       418.31       1 $37$ Comments         128.0 <td>SITE* T</td> <td>urkev Point</td> <td>INPP</td> <td></td> <td>_DATE*: 10/15/2013</td> <td></td>	SITE* T	urkev Point	INPP		_DATE*: 10/15/2013	
AUTHOR*.       C. Carter       PAGE       Dom         TTEMS WITH *       MUST BE COMPLETED. OTHER INFORMATION IS OPTIONAL         DEPTH       DUFIL TERED       FILTERED       COMMENTS         METERS       FEET       FILE NO*.       FILE NO*.       COMMENTS         120.5       396.34       12.5       COMMENTS       CASING, WATER, ROCK, ETC         120.5       396.62       12.7       CASING, WATER, ROCK, ETC       CASING, WATER, ROCK, ETC         122.0       400.26       12.5       CASING, WATER, ROCK, ETC       CASING, WATER, ROCK, ETC         122.0       400.54       1.50       CASING, WATER, ROCK, ETC       CASING, WATER, ROCK, ETC         123.0       400.54       1.50       CASING, WATER, ROCK, ETC       CASING, WATER, ROCK, ETC         123.0       400.54       1.50       CASING, WATER, ROCK, ETC       CASING, WATER, ROCK, ETC         124.5       401.90       1.2-7       CASING, WATER, ROCK, ETC       CASING, WATER, ROCK, ETC         123.0       400.54       1.50       CASING, WATER, ROCK, ETC       CASING, WATER, ROCK, ETC         125.0       410.10       1.77       CASING, WATER, ROCK, ETC       CASING, WATER, ROCK, ETC         126.0       413.39       1.35       CASING, WATER, ROCK, ETC	CLIENT*	Paul C. R	lizzo Associates, Ir	າດ.	_JOB*:13331	
ITEMS WITH * MUST BE COMPLETED. OTHER INFORMATION IS OPTIONAL           DEPTH         DEPTH <thdepth< th="">         DEPTH         DEPT</thdepth<>		0.0.4			PAGE* 1 OF I	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	AUTHUN	ITEMS W	//TH * MUST BE C	COMPLETED. OTHER INF	ORMATION IS OPTIONAL	
DLT III       DLT IIII       DLT IIII       DLT IIII       DLT IIII       DLT IIII       DLT IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	DEDTU				COMMENTS	of contraction of the
Image: Second secon				1	CASING, WATER, ROCK, ETC	
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121.5       398.62 $12.7$ 122.5       400.26 $12.8$ 122.5       401.90 $12.7$ 123.0       403.54 $13.0$ 123.5       405.18 $13.1$ 124.5       408.46 $13.3$ 125.0       410.10 $13.7$ 126.5       411.75 $13.5$ 126.6       413.39 $13.6$ 126.6       415.03 $13.7$ 126.6       415.03 $13.7$ 127.5       418.31 $13.7$ 128.0       419.95 $14.9$ 128.1       421.59 $141$ 128.2       423.23 $142.5$ 129.5       423.23 $142.5$ 130.0       428.51 $14.9$ 130.0       428.51 $14.9$ 131.0       429.79 $14.6$ 131.0       429.79 $14.6$ 131.0       429.79 $14.6$ 131.0       436.35 $15.5$ 133.0       436.35 $15.5$ 133.0       436.35 $15.5$ <	120.5	395.34	125			-
121.5       398.62 $12.7$ 122.0       400.26 $12.8$ 122.5       401.90 $12.7$ 123.0       403.54 $13.5$ 123.5       405.18 $13.7$ 124.5       406.46 $13.3$ 125.6       410.10 $13.7$ 126.0       410.10 $13.7$ 126.5       411.75 $1.3.5$ 126.6       413.39 $13.4$ 126.6       413.39 $13.4$ 126.6       413.39 $13.4$ 127.5       418.31 $1.37$ 127.6       418.31 $1.37$ 128.0       419.95 $14.0$ 128.5       421.59 $14.1$ 128.5       424.87 $14.3$ 130.0       428.51 $14.4$ 131.0       429.79 $14.6$ 131.0       429.79 $14.6$ 131.0       429.79 $14.6$ 131.0       436.35 $15.5$ 133.0       436.35 $15.5$ 133.0       436.35 $15.5$ <	121.0	396.98	126			-
122.5       401.90 $12.9$ 123.0       403.54 $13.0$ 123.5       405.18 $13.1$ 124.0       406.82 $13.2$ 124.5       408.46 $13.3$ 125.0       410.10 $13.9$ 126.6       413.39 $13.6$ 126.6       415.03 $13.7$ 127.0       416.67 $13.8$ 127.0       416.67 $13.8$ 127.5       418.31 $13.7$ 128.0       419.95 $14.9$ 128.5       421.59 $14.1$ 128.6       419.35 $14.7$ 128.0       419.25 $14.4$ 129.0       422.32 $14.2$ 129.0       428.51 $14.4$ 130.0       426.51 $14.4$ 130.5       428.15 $14.7$ 131.0       429.79 $14.6$ 132.0       433.07 $14.8$ 133.0       436.36 $15.5$ 133.0       436.36 $15.5$ 134.0       439.63 $152$ <		398.62	127			-
123.0       403.54 $J3.0$ 123.5       405.18 $[3]$ 124.6       406.82 $J3.2$ 124.5       408.46 $J3.3$ 125.0       410.10 $I3$ °I         126.6       411.75 $I3.5$ 126.0       413.39 $J3.6$ 126.5       411.75 $I3.5$ 126.6       415.03 $J3.7$ 127.0       416.67 $J3.8$ 127.5       418.31 $I3.7$ 128.0       419.95 $I4.1$ 128.0       421.59 $I4.1$ 129.0       423.23 $I4.2$ 129.5       424.87 $I4.3$ 130.0       426.51 $I4.4$ 130.5       428.15 $I4.5$ 131.5       431.43 $I^17.7$ 132.0       433.07 $I4.8$ 132.5       43.471 $I4.7$ 133.5       431.43 $I^17.7$ 134.0       439.63 $I5.2$ 134.5       441.27 $I5.3$ 135.5       444.291 $I4.6$	122.0	400.26				-
123.5       405.18 $(3)$ 124.0       406.82 $132$ 124.5       408.46 $133$ 125.0       410.10 $13$ 126.5       411.75 $135$ 126.0       413.39 $136$ 126.5       415.03 $13$ 127.0       416.67 $135$ 127.5       418.31 $137$ 128.0       419.95 $14D$ 128.5       421.59 $141$ 129.0       423.23 $142$ 129.5       424.87 $143$ 130.0       426.51 $144$ 130.0       426.51 $144$ 131.0       428.75 $143$ 132.0       433.07 $146$ 132.0       433.07 $146$ 132.0       433.07 $147$ 132.0       433.07 $149$ 133.5 $437.99$ $51$ 134.0       439.63 $152$ 134.0       439.63 $152$ 135.5       444.55       136.6         136.6       44	122.5	401.90	129			_
124.0 $406.82$ $132$ 124.5 $408.46$ $133$ 125.0 $410.10$ $13^{4}$ 125.5 $411.75$ $1^{3}5$ 126.0 $413.39$ $136$ 126.5 $411.75$ $1^{3}5$ 126.0 $413.39$ $136$ 126.5 $415.03$ $13^{7}7$ 127.0 $416.67$ $138$ 127.5 $418.31$ $137^{7}$ 128.0 $419.95$ $14^{10}$ 128.0 $419.95$ $14^{10}$ 129.0 $423.23$ $142$ 129.5 $424.87$ $1443$ 130.0 $426.51$ $144^{4}$ 131.5 $428.15$ $144^{4}$ 132.0 $433.07$ $1^{48}$ 132.0 $433.07$ $1^{48}$ 133.0 $436.35$ $15^{5}$ 133.0 $436.35$ $15^{5}$ 133.0 $436.35$ $15^{5}$ 133.0 $436.35$ $15^{5}$ 135.5 $444.72$ $6^{3:10}$ 13	123.0	403.54				-
124.5       408.46 $133$ 125.0       410.10 $15$ ¶         125.5       411.75 $135$ 126.0       413.39 $136$ 126.5       415.03 $137$ 127.0       416.67 $138$ 127.5       418.31 $137$ 127.5       418.31 $137$ 128.5       421.59 $141$ 129.0       423.23 $142$ 129.5       424.87 $143$ 130.0       426.51 $144$ 130.5       428.51 $147$ 130.5       428.51 $147$ 131.0       429.79 $146$ 131.5       431.43 $147$ 132.0       433.07 $148$ 132.0       436.35 $15^{5}$ 133.0       436.35 $15^{5}$ 133.5       437.99 $51$ 134.0       439.63 $152^{-}$ 134.0       439.63 $152^{-}$ 135.5       444.55          136.0       446.19          137.0       <	123.5	405.18	131			-
124.5       408.46 $133$ 125.0       410.10 $13$ ¶         125.5       411.75 $135$ 126.0       413.39 $346$ 126.5       415.03 $137$ 127.0       416.67 $128$ 127.5       418.31 $137$ 127.5       418.31 $137$ 128.0       419.95 $144$ 128.5       421.59 $144$ 129.0       423.23 $144$ 129.5       424.87 $143$ 130.0       426.51 $144$ 130.5       428.15 $143$ 131.0       429.79 $146$ 131.0       429.79 $146$ 131.5       431.43 $147$ 132.0       433.07 $148$ 133.0       436.35 $152$ 133.0       436.35 $152$ 133.0       436.35 $152$ 134.5       441.27 $153$ 135.5       444.91          136.5       444.85          136.5       447.83 <td>and the second design of the</td> <td>406.82</td> <td>132</td> <td></td> <td></td> <td>4</td>	and the second design of the	406.82	132			4
125.5       411.75       13.5         126.0       413.39       13.6         126.5       415.03       13.7         127.0       416.67       138         127.5       418.31       13.7         128.0       419.95       14D         128.5       421.59       141         129.0       423.23       14Z         129.5       424.87       143         130.0       426.51       14U         130.5       428.15       145         131.0       429.79       146         131.0       429.79       146         132.5       434.71       147         132.0       433.07       148         132.5       434.71       149         133.0       436.35       155         133.5       437.99       151         134.5       441.27       153         135.5       444.55       152         135.5       444.55       144.55         136.5       447.83       149         137.5       451.12       148.4         137.5       451.12       138.0         138.0       452.76       138.0     <	and the second	408.46				4
125.5       411.75       135         126.0       413.39       136         126.5       415.03       137         127.0       416.67       135         127.5       418.31       137         128.0       419.95       14D         128.5       421.59       14I         129.0       423.23       142         129.5       424.87       143         130.0       426.51       144I         130.5       428.15       145         131.0       429.79       146         132.5       434.71       147         132.0       433.07       148         132.5       434.71       149         133.0       436.35       15b         133.0       436.35       15b         133.5       437.99       151         134.5       441.27       153         135.5       444.55       15b         136.5       444.55       146.19         135.5       444.783       149         136.5       444.783       149         137.5       451.12       148.145         138.0       452.76       149.47     <	125.0	410.10	134		and a second	_
126.0       413.39       136         126.5       415.03       137         127.0       416.67       138         127.5       418.31       137         128.0       419.95       140         128.5       421.59       141         129.0       423.23       142         129.5       424.87       143         130.0       426.51       144         130.0       426.51       144         130.0       426.51       144         131.0       429.79       146         131.0       429.79       146         131.5       431.43       147         132.0       433.07       148         132.0       436.35       155         133.0       436.35       155         133.0       436.35       155         134.0       439.63       152-         135.5       434.71       147         135.5       444.55       144.7         135.6       442.91       148.7         135.5       444.55       144.7         136.0       446.19       148.7         137.5       451.12       149.4 <td>And the owner of the owner owner</td> <td>411.75</td> <td>135</td> <td></td> <td></td> <td>_</td>	And the owner of the owner	411.75	135			_
126.5       415.03 $1377$ 127.0       416.67 $138$ 127.5       418.31 $137$ 128.0       419.95 $14D$ 128.5       421.59 $14I$ 129.0       423.23 $142$ 129.5       424.87 $143$ 130.0       426.51 $144$ 130.5       428.15 $1475$ 131.0       429.79 $146$ 131.0       429.79 $146$ 131.0       429.79 $146$ 131.0       429.79 $146$ 132.0       433.07 $1477$ 132.0       433.07 $148$ 132.0       436.35 $15P$ 133.0       436.35 $15P$ 133.5       437.99 $51$ 133.5       437.99 $51$ 134.0       439.63 $152$ 135.5       444.291 $442.91$ 135.5       444.55 $444.55$ 136.0       446.19 $442.91$ 136.5       447.83 $437.6$ 137.0 <td></td> <td>413.39</td> <td>136</td> <td></td> <td></td> <td>4</td>		413.39	136			4
127.0 $416.67$ $1\overline{3}\overline{8}$ 127.5 $418.31$ $1\overline{3}7$ 128.0 $419.95$ $/4D$ 128.5 $421.59$ $141$ 129.0 $423.23$ $142$ 129.5 $424.87$ $143$ 130.0 $426.51$ $144$ 130.5 $428.15$ $147$ 131.0 $429.79$ $146$ 131.5 $431.43$ $147$ 132.0 $433.07$ $14\overline{8}$ 132.0 $433.07$ $14\overline{8}$ 132.0 $436.35$ $15^{5}$ 133.0 $436.35$ $15^{5}$ 133.0 $436.35$ $15^{5}$ 133.5 $437.99$ $51$ 134.0 $439.63$ $15^{2}$ 135.5 $444.55$ 135.5 $444.55$ 136.5 $444.55$ 137.0 $449.48$ 137.6 $451.12$ 138.5 $454.40$ 138.5 $456.04$	Construction of the local data and the local data a	415.03	137			4
127.5 $418.31$ $137$ 128.0 $419.95$ $14D$ 128.5 $421.59$ $141$ 129.0 $423.23$ $142$ 129.5 $424.87$ $143$ 130.0 $426.51$ $144$ 130.0 $426.51$ $144$ 130.0 $426.51$ $144$ 131.0 $429.79$ $146$ 131.5 $431.43$ $147$ 132.0 $433.07$ $148$ 132.0 $433.07$ $148$ 132.5 $434.71$ $149$ 133.0 $436.35$ $15b$ 133.5 $437.99$ $151$ 133.5 $437.99$ $151$ 134.5 $441.27$ $153$ 134.5 $441.27$ $153$ 135.0 $442.91$ $446.19$ 136.5 $444.55$ $444.55$ 136.0 $446.19$ $449.48$ 137.5 $451.42$ $452.76$ 138.0 $452.76$ $453.40$ 139.0 $456.04$ <td< td=""><td></td><td>416.67</td><td>138</td><td></td><td></td><td>4</td></td<>		416.67	138			4
128.0 $419.95$ $14^{1/2}$ 128.5 $421.59$ $141$ 129.0 $423.23$ $142$ 129.5 $424.87$ $143$ 130.0 $426.51$ $144$ 130.0 $426.51$ $144$ 130.0 $426.51$ $144$ 130.0 $428.15$ $1475$ 131.0 $429.79$ $146$ 131.5 $431.43$ $147$ 132.0 $433.07$ $148$ 132.0 $433.07$ $148$ 132.5 $434.71$ $147$ 133.0 $436.35$ $15b$ 133.5 $437.99$ $151$ 133.5 $437.99$ $151$ 134.0 $439.63$ $152$ 134.5 $441.27$ $153$ 135.5 $444.291$ $442.91$ 135.5 $444.55$ $442.91$ 136.0 $446.19$ $449.48$ 137.0 $449.48$ $413.43$ 137.5 $451.42$ $452.76$ 138.5 $454.40$	And the second sec	418.31	139			_
128.5       421.59 $141$ 129.0       423.23 $142$ 129.5       424.87 $143$ 130.0       426.51 $144$ 130.5       428.15 $145$ 131.0       429.79 $146$ 131.5       431.43 $147$ 132.0       438.07 $145$ 132.0       438.07 $147$ 132.5       434.71 $147$ 132.5       434.71 $147$ 133.0       436.35 $155$ 133.5 $437.99$ $51$ 134.5       441.27 $153$ 135.0       442.91 $446.19$ 135.5       444.55 $441.27$ 135.5       444.55 $441.27$ 135.6       444.83 $445.5$ 136.0       446.19 $429.47$ 137.0       449.48 $413.576$ 137.5       451.12 $451.40$ 138.0       452.76 $452.76$ 138.5       454.40 $456.04$ 139.0       456.04 $457.68$ <		419.95	140			4
129.0 $423.23$ $142$ 129.5 $424.87$ $143$ 130.0 $426.51$ $1441$ 130.5 $428.15$ $145$ 131.0 $429.79$ $146$ 131.5 $431.43$ $147$ 132.0 $433.07$ $148$ 132.0 $433.07$ $148$ 132.5 $434.71$ $147$ 133.0 $436.35$ $15b$ 133.0 $436.35$ $15b$ 133.5 $437.99$ $151$ 134.0 $439.63$ $152$ 134.5 $441.27$ $153$ 135.0 $442.91$ $135.5$ 136.0 $446.19$ $136.5$ 136.5 $447.83$ $137.5$ 137.0 $449.48$ $137.5$ 137.5 $451.12$ $138.5$ 138.5 $454.40$ $139.0$ 139.0 $456.04$ $139.5$		421.59	141			_
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$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Cartoria Contractoria Contra	439.63	152			_
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$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	and the second se	442.91				
136.0       446.19         136.5       447.83         137.0       449.48         137.5       451.12         138.0       452.76         138.5       454.40         139.0       456.04         139.5       457.68		444.55				
136.5       447.83         137.0       449.48         137.5       451.12         138.0       452.76         138.5       454.40         139.0       456.04         139.5       457.68	Contraction of the Contraction of the Contraction of the					
137.0       449.48		And Property and in case of the local division of the local divisi				
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138.5       454.40         139.0       456.04         139.5       457.68	CALL STREET, ST	452.76				
139.0     456.04       139.5     457.68	A DESCRIPTION OF A DESC					
139.5 457.68						
	and the second s	459.32				



geophysical services	R-7-1 Borehole*	Procedure ASTM D6167-11 Borehole Caliper
	20101010	Procedure ASTM D6274-10 Borehole Gamma
SITE*: Turkey Point NPP CLIENT*: Paul C. Rizzo Asso AUTHOR*: C. Carter	DATE* ciates, Inc. JOB*:1333 PAGE:	: 10/15,16/2013 1 : 1 OF 2
CONTACT:	PHONE: (	Off Cell
CONTACT:	PHONE: (	Off Cell
CONTACT:	PHONE: (	Off Cell
DRILLER COMPANY:	PHONE: (	Off Cell
GENERAL SITE CONDITIONS/	LOCATION:	
COUNTY:RA	NGE:TOWNSHIP:	SECTION:
DIAMETERS AND DEPTH RAN	IGES: <u>5"</u> 0 TO <u>195</u>	SECTION: ; 3%, 190 TO 455 ft
BOREHOLE TOTAL DEPTH AS	BRILLED*: 455 fl	_
SURFACE CASING?: YES <u>K</u> DEPTH TO BEDROCK: <u>5</u> <del>4</del> BOREHOLE FLUID: WATER OTHER:	DEPTH TO BOTTOM OF CA DEPTH TO ; FRESH WATER MUD <u>V</u>	
DEATH TO ROKEHOLE FLOID		CE LAST CIRCULATION: [lam_, 1:15 10]
LOGGING CREW: C. Carter		

ŕ.

LOGGING CKEW. C		
VEHICLE(S) USED AN	ND MILEAGE:	
MOBILIZED FROM:	Florida City	DEPARTURE TIME: 6:30
ARRIVED ON SITE:	1:00 am	
STANDBY TIME:	NA	CAUSE:



geophysical services		R-7-1		CALIPER FIELD LOG		
		Boreho	ole*	Procedure ASTM D6167-11 Borehole Caliper Procedure ASTM D6274-10 Borehole Gamma		
SITE*: CLIENT*:	Turkey Point NPP Paul C. Rizzo Associate	es, Inc.	DATE*: JOB*:13331	10/15,16/	2013	
AUTHOR*:			PAGE:	PAGE 2 OF 2		
		•••	OTHER			
MICROLOG		5772	OTHER OTHER			
CALIPER P	ROBE* 5368 2	6621 103 104	Other			RG 🔀
SHEAVE						
	PROBE OFFSET		2.08M(6.82		12 IN MAX	
	MINUS CASING STICK	-UP*	1.33 1.33			
	DEPTH REF. OFFSET		5.49 5.49		IND SURFACE	
	DEPTH REF. OFFSET		5.35 5.40			
	AFTER SURVEY DEPT	H ERROR <sup>*</sup>	0.14 0.0	1		
		START	START	END	END	
	LOG NAME*	DEPTH*	TIME*	DEPTH*	TIME*	
	RTICALTESTU	NA	4102	N/A	4:04	
	RTICALUPOI	450,25	454:26	179.9 \$	4:48	
			ce iolisios			
	RTICALTESTOZ	NLa	5:03	NA	5:04	
	RTICALTESTO3	ULA	4:46	NIA 2.5ft		
	RTICALUPO2	191.15	5:00	NLA	5:16pm 5:24pm	
	RTICALTESTOY	NA	5:23	N Val	5.2100	
		L	<u> </u>		JJ	
CALIBRAT	ION PLATE S/N 201		AS BUILT		PVC FITTING	
		1.97 IN	3.94 IN	7.87 IN	4.50 IN	
	FILE NAME	(50 MM)	(100 MM)	(200.0 MM)	(114. MM)	
AS MEAS.*		1.92	3.91	7.84	4.48	
AS MEAS.*		1.93	3.91	7.85	4.49	
AS MEAS.	RTICALTESTO3	1.94	3.91	7.81	4.50	
AS MEAS. AS MEAS.	RAICALTESTON	1.92	3.76	1.00	4.5	
AS MEAS.	·					
	NCE PERFORMED ON	SITE*:	Nla			(N/A if none)
EQUIPMENT PROBLEMS OR FAILURES*:			NLA			(N/A if none)
SUGGEST	IONS, ADDITIONS, CHA	NGES:	an an de la color de fait de la color comme de la color de la c			
ITEMS	S WITH * <u>MUST BE COI</u>	<u>MPLETED</u> . OT	HER INFORI	MATION IS OPT	ΓΙΟΝΑL	



R-7-1

Borehole\*

geophysical services

ACOUSTIC TELEVIEWER FIELD LOG

Procedure ASTM D5753-10 Borehole Geophysical GEOVision HI-RAT Field Procedure Rev 2.00a

SITE*:       Turkey Point NPP         CLIENT*:       Paul C. Rizzo Associates, Inc.         AUTHOR*:       C. Carter         REVIEWER:       (post field work)	DATE*: 10/16/2013 JOB*:13331 PAGE: 1 OF 2		
CONTACT:	PHONE: Off Cell		
CONTACT:	PHONE: Off Cell		
DRILLER COMPANY:	PHONE: Off Cell		
GENERAL SITE CONDITIONS/LOCATION:			
COUNTY:RANGE:TO BOREHOLE CONSTRUCTION: CASEDUN DIAMETERS AND DEPTH RANGES:0 T BOREHOLE TOTAL DEPTH AS DRILLED*:455			
SURFACE CASING?: YESDEPTH TO BOTTOM OF CASING; NO ½ DEPTH TO BEDROCK: ~S &DEPTH TO WATER TABLE: Ø BOREHOLE FLUID: WATER; FRESH WATER MUD ¥; SALT WATER MUD OTHER: DEPTH TO BOREHOLE FLUID: ØTIME SINCE LAST CIRCULATION: 1215 pm			
LOGGING CREW: <u>C. Carter</u> VEHICLE(S) USED AND MILEAGE: MOBILIZED FROM: <u>Florida City</u> ARRIVED ON SITE: <u>7:0°am</u> STANDBY TIME: <u>ula</u>	DEPARTURE TIME: 6:30 CAUSE:		

GE	Vision	9				ED
geophysic			AC			Ben I N
	R-	1-1		FIELD		
		Borehole*		ıre ASTM D5753-∶ /ision HI-RAŢ Fiel		
0175*	Turkov Doint NDD		DATE	1 1		2.000
SITE*: CLIENT*:	Turkey Point NPP Paul C. Rizzo Asso	ciates, Inc.		and the second se		
	C. Carter		PAGE	: 2 OF 2		
REVIEWER	R:(post fi	eld work)				
WINCH			RG 🗌	OTHER		
MICROLO		、 5772   「		OTHER		
TELEVIEW	/ER* 5174	6641 🕅		OTHER		
SHEAVE*	OYO 101 102		04 🚺 Othe		RG 🔀	WZ
	All GEOVision Televiewe	r probes are made by		ologging, Ltd. of De	eganwy, Conwy, C +/-2º	<i>IK</i>
PROBE TI	-		~ ~		+/-2 +/-2°	
PROBE TI						
PROBE TI	ZIMUTH TEST* _65.				+/-10	
	ZIMUTH TEST <u>266</u> ZIMUTH TEST* <u>177</u>	SA BRUNTON A		77	+/-10°	
PROBE AZ	21MUTH TEST 214	90 BRUNTON AZ		AFTER	LOG* yes	
	PROBE OFFSET*		1.44M(4.7			
	MINUS CASING S		1.33 1.3 2.46 2.4		UND SURFACE	
	DEPTH REF. OFF DEPTH REF. OFF		2.45 2.3	S (		
	AFTER SURVEY		.01 .1	1 allow +/-0.4%	of total depth	
					1	
		START	START	END	END	
	LOG NAME*	DEPTH* 2.5 ft	TIME 12:39	DEPTH *	TIME 12:450m	
	RTIAUBOWNO3 RTIAUBOWNO4	2.5	12:31	196. 5 <del>ct</del>	1:50	
	RTIAUUP03	196.5	1:52	2.4.ft	2:51	
MAINTEN	ANCE PERFORMED	ON SITE*:	L	JIS	1)	V/A if none)
	N FROM PROCEDU			PROBLEMS O	R FAII URES竹	N/A if none)
DEVIANO	N MOW MODEDC			6		
DATA OTO					RIBE: CD (L	
DATASTO	RED IN TWO PLAC	E2 RELOKE DEL	ARIURE	OTHER		
				wert i filmel i		



geophysical services

<u>R-7-4</u> BORING GEOPHYSICS FIELD LOG SUMMARY				
Borehole*				
SITE*:	Turkey Point NPP	DATE*:	10/15/2013	
CLIENT*:	Paul C. Rizzo Associates, Inc.	_JOB*: 13331_		
AUTHOR*:	C. Carter	PAGE*:	OF _/	
CONTACT:	Rolando J. Benitez PHONE:	(412) 607-3560		
	STRUCTION: CASED ¥	UNCASED		
DIAMETERS AND	DEPTH RANGES: 2" PK 0 TO 17	wft;,	ТО	
BOREHOLE TOTAL DEPTH AS DRILLED*: 120 ft				
SURFACE CASIN	G?: YES DEPTH TO BOTTOM C	OF CASING	_; NO_K	
DEPTH TO BEDROCK: ~ 5 ft				
BOREHOLE FLUID: WATER_X; FRESH WATER MUD; SALT WATER MUD;				
LOGGING CREW	C. Carter			

[	T		1	
LOG TYPE*	FILE NAME*	DEPTH RANGE*	DATE*	TIMES*
Deviation	R74400000010/	4.0 - 122.0 ft	10/15/2013	5:43-5:48pm
Deriation	R744UUPOZ	122.1-4.0ft	10/15/2013	5:43-5:48pm 5:50-5:56pm
				· · · · · · · · · · · · · · · · · · ·
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		an a		an a
		ne on an an anna an anna anna anna anna		
		en er stan i storen en e		
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				an a fainn gha ann ann an 1979 an ann ann an ann ann ann ann ann ann



R-7-4

Borehole\*

geophysical services

ACOUSTIC TELEVIEWER FIELD LOG

Procedure ASTM D5753-10 Borehole Geophysical GEOVision HI-RAT Field Procedure Rev 2.00a

SITE*: <u>Turkey Point NPP</u> CLIENT*: <u>Paul C. Rizzo Associates, Inc.</u>	DATE*: 10/15/2013
CLIENT*: Paul C. Rizzo Associates, Inc. AUTHOR*: C. Carter	JOB*:13331 PAGE: 1 OF 2
REVIEWER: (post field work)	-
CONTACT:	PHONE: Off Cell
CONTACT:	PHONE: Off Cell
DRILLER	PHONE: Off Cell
GENERAL SITE CONDITIONS/LOCATION:	
COUNTY:RANGE:TO BOREHOLE CONSTRUCTION: CASED_XUI	
DIAMETERS AND DEPTH RANGES: 2" QVC 0 T	0_120 Ft_;,TO
BOREHOLE TOTAL DEPTH AS DRILLED*: 17	LO Ft
SURFACE CASING?: YESDEPTH TO BOT	TOM OF CASING; NO_X
DEPTH TO BEDROCK: ~5 ft BOREHOLE FLUID: WATER; FRESH WATE	R MUD : SALT WATER MUD
OTHER:	
DEPTH TO BOREHOLE FLUID: $p$	TIME SINCE LAST CIRCULATION: NA
LOGGING CREW: C. Carter	
VEHICLE(S) USED AND MILEAGE: MOBILIZED FROM: Florida City	DEPARTURE TIME: 2:30
ARRIVED ON SITE: 7:50 au	DEFARTORE TIME. 6.50
STANDBY TIME: N (A	CAUSE:

GE	Z				
geophysical services	ophysical services ACOUSTIC TELEVIE				
Ī	2-7-4		FIELD	) LOG	
	Borehole*		ure ASTM D5753-		• •
SITE*: <u>Turkey Point NPF</u> CLIENT*: Paul C. Rizzo As		<i>GEO</i> DATE JOB*: 1333		ld Procedure Re 3	ev 2.00a
AUTHOR*: C. Carter			2 OF 2		
REVIEWER: (post	field work)				
WINCH ARIES SILVI MICROLOGGER* 8083	5772 📈	RG 🗌	OTHER OTHER		
			OTHER		
SHEAVE* OYO 101 10 All GEOVision Teleview		04 Oth Robertson Ge	· · · · · · · · · · · · · · · · · · ·	RG X	IK
	.66 BRUNTON TI		bologging, Eta. of D	+/-2°	
PROBE TILT TEST* 29	45 BRUNTON TI	LT* <u>29</u>		+/-2°	
PROBE TILT TEST* <u>61.22</u> BRUNTON TILT* <u>6</u> AFTER LOG* <u>428</u>					
PROBE AZIMUTH TEST* $1^{2}3.4^{\circ}$ BRUNTON AZIMUTH* $1^{\circ}$ +/-10 <sup>d</sup> PROBE AZIMUTH TEST* $3^{2}3.3^{\circ}$ BRUNTON AZIMUTH* $3^{\circ}$ +/-10°					
PROBE AZIMUTH TEST* >4 PROBE AZIMUTH TEST* 1/2			AFTER	+/-10°	
	<u>BRONTON AZ</u>				
PROBE OFFSET		1.44M(4.7	'2FT)		
MINUS CASING STICK-UP* $2.15$ DEPTH REF. OFFSET AT START* $3.97$ REF TO GROUND SURFACE					
DEPTH REF. OFFSET AT END* 3.92					
AFTER SURVEY	DEPTH ERROR*	0.05	állow +/-0.4%	of total depth	
[······	START	ISTART	END		
LOG NAME*	DEPTH*	TIME	DEPTH *	END TIME	
R74AUDOWN01	4.0	5:43	122.0 Ft	5:48pm	
R74AUUPO1	122.1	5:50	4.0 ft	5:56 pm	
MAINTENANCE PERFORME	OON SITE*:		Nla	(	N/A if none)
DEVIATION FROM PROCEDURE (IF ANY) OR EQUIPMENT PROBLEMS OR FAILURES $(N/A)$ if none)					
л					
DATA STORED IN TWO PLAC	ES BEFORE DEP/	ARTURE?	] YES. DESCF OTHER	RIBE: CD L	ISB DRIVE
1777 1 A 1 4 11991 1 4 1 4 1 4 1					
ITEMS WITH * MUST BE COMPLETED. OTHER INFORMATION IS OPTIONAL					

**APPENDIX G** 

# BORING GEOPHYSICAL LOGGING FIELD MEASUREMENT PROCEDURES

### PROCEDURE FOR USING THE ROBERTSON GEOLOGGING HI-RESOLUTION ACOUSTIC TELEVIEWER (HIRAT)

### Revision 2.0 Reviewed 11/18/11

#### Background

The acoustic televiewer is a device for producing a qualitative image of the wall of a borehole. Because it uses ultrasound rather than visible light it is able to work in dirty or opaque borehole fluids, although heavy drilling mud will cause excessive dispersion of the acoustic beam. The picture below shows the probes' cylindrical black plastic acoustic imaging window, and one of the bowspring attachments which are used to centralize the probe in the borehole.



Pulses of ultrasound (0.5 - 1.5MHz) are generated by a piezo-electric resonator. The pulses are transmitted through the oil in which the resonator is immersed, through the imaging window, then propagate through the borehole fluid and are reflected from the wall of the borehole. The reflected energy is picked up by the same transducer, from which is recorded both the *amplitude* of the returned pulse and the *travel-time* which have elapsed. Blanking must be applied to prevent the transducer from registering reflections from the inside surface of the imaging window. The material of the window is chosen so that its acoustic properties are similar to the oil which fills it. The window is not designed to withstand borehole fluid pressures, but has a piston device to allow equalization between inside and outside pressure.

The *amplitude* of the returned pulse is a function of the acoustic reflectivity of the borehole wall. If the beam strikes a hard borehole wall normally to the surface the energy will be returned to the transducer and a strong return will be recorded. If the formation is softer, then less energy will be reflected. Also, if the surface of the borehole is rough, or effectively missing because of the presence of a fracture or other structure, then energy will be dispersed and a low energy return will be recorded.

The *travel-time* is a simple function of the diameter of the borehole and the velocity of sound in the borehole fluid (nominally 1.5Km/sec). An A/D converter monitors the output from the transducer once the blanking period has expired and a comparator is used to detect the peak amplitude during the sampling period.

The coaxially-mounted transducer has a planar radiating surface, but the vibration characteristics are such that the acoustic pulse is emitted as a 'pencil' beam. The emitted beam is deflected by a planar mirror so that it leaves the acoustic imaging window at right angles to the probe axis. The mirror is rotated to scan the borehole wall. The ultrasound pulses are synchronized with rotation of the mirror so that up to 360 pulses are emitted in every revolution. Because of the time which must elapse for the two-way transit of the borehole fluid, there is an upper limit upon the number of radial samples that may be acquired from a borehole of a particular radius. In larger boreholes, therefore, it may be necessary to reduce the number of radial samples. The probe is able to operate at 90, 180 or 360 samples per revolution.

**GE** *Vision* 

Hi-RAT Field Procedure Rev 2.0 11-18-11 Page 1 An image of the borehole wall is produced by moving the probe along the borehole axis while it is scanning radially. By the same logic as shown above, it can be seen that any horizontal point will be imaged by more than one sweep of the acoustic beam so long as the axial movement of the probe during one complete sweep is no greater than the beam diameter. Image resolution is therefore a function of the vertical logging speed, the rotational speed of the transducer, the radial sampling interval and borehole diameter.

#### Objective

The objective of this procedure is to map the orientation and dip angles of fractures, bedding planes and voids in rock boreholes, and provide a pseudo "core" of the borehole for comparison with rock cores obtained during drilling. It may also be used to obtain borehole deviation data without an image in soil or non-magnetic cased borings.

#### Instrumentation

This procedure is written specifically for the Robertson Geologging High-Resolution Acoustic Televiewer (HiRAT). The required equipment includes:

- 1. The Robertson High-Resolution Acoustic Televiewer (HiRAT) probe with centralizers.
- 2. A 4-conductor wire-line winch with cable at least 30m (100 feet) longer than the depth of the borehole.
- 3. A sheave with depth encoder with minimum 500 pulses per meter of cable travel. For example, a 400ppr encoder with a 400mm circumference sheave provides 1000 pulses per meter of cable travel.
- 4. A Robertson Geologging Micrologger II, or equivalent.
- 5. A laptop with Robertson Geologging HiRAT program, Version 11 or above, or equivalent, installed and the following minimum system requirements:
  - Windows XP or above
  - 256MB System memory
  - 800x600x24 SVGA Display with DirectX 8.0
  - 1.2Ghz CPU
  - USB 2.0 connection
- 6. 12 volt DC Battery power supply with cables.



Hi-RAT Field Procedure Rev 2.0 11-18-11 Page 2

#### **Environmental Conditions**

This tool is designed for fluid-filled boreholes between 67 and 150mm (3-6in) in rock. In some instances, highly reflective borehole walls may permit use at large diameters. Since fine fractures are usually not visible in the walls of soil borings, the HiRAT adds little more information from a soil boring than a simple video. If the boring has soil AND rock, HiRAT images in the soil may be useful.

#### **HiRAT Field Procedure**

Because the logging software is a standalone module, there are a number of settings which must be initialized in the HiRAT software. These include the depth measurement subsystem and probe operating modes. Click on 'System' on the menu bar to show the following dialog boxes:

#### 1. Log Mode

The probe can operate in three distinct modes:

System			
Log Mode	Scan Depth Wh	eel Positional Encod	er Winch Probe Graphical
	🗴 Vertical	💓 Horizontal	TEST MODE (NON RECORD)
			CANCEL

- Vertical mode is used for boreholes which are drilled from the surface and are deviated at less than 70 degrees from the vertical. Most exploration boreholes will fall into this class. In this mode the image is orientated according to compass directions (magnetic co-ordinates).
- Horizontal mode is used for boreholes which are sub-horizontal so their inclination will probably
  exceed 70 degrees from the vertical. Boreholes in this class would normally be drilled as part of
  ground investigations for tunneling and mining, drilling ahead of a drive to determine the nature
  and extent of fracturing. In this mode the image is orientated according to gravitational
  coordinates (up/down) since there is no unique point of the image circle which can be orientated
  to North with any precision.
- Test mode is used to exercise all probe functions without creating a log. The image will scroll on the screen in the normal fashion, and orientation readouts will be refreshed continuously.

# 2. Scan Parameters

The scan parameters control the radial sampling of the borehole. The values will be retained between logging sessions, so the probe will be initialized correctly at power-on.



Log Mode Scan Depth Wheel F	ositional Encod	er Winch Probe Graphical
Maxin	num Head Speed (3.41 - 20.6	(rev.s per second). 16 ms)
💭 90 pixels per rev.	20.66	rps.
💭 120 pixels per rev.	20.66	rps
🕥 180 pixels per rev.	20.66	rps
💭 360 pixels per rev.	20.66	rps
	12	

• The radial sampling rate can be set to one of 90, 120, 180, 360 samples per revolution. There is a relationship between the logging speed and the radial sampling rate, since the time taken to send the dataset to the surface depends upon its length. The size of the log file is also determined by the radial sampling rate. The probe will always try to use the maximum head speed entered. If limited by a low Baud rate or a large 'window' setting then the probe will reduce its head speed automatically to compensate - see probe operation section.

# 3. Depth Wheel Configuration

The depth measurement system is dependent upon the combination of depth measurement wheel with its specified circumference, and the shaft encoder which translates rotation into pulses which are counted by the logging system controller. Two parameters are therefore required: depth wheel circumference and encoder pulse rate per wheel revolution. The encoder parameters are covered in a subsequent topic.

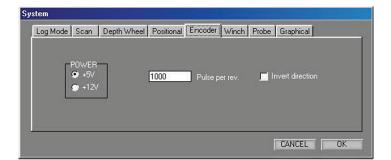
stem	Depth Wheel	Positional   Em	ooder   Wine	h] Proba ]	Graphical	
Log Mode Scan	Depth Wheel	Positional En	coder Winc	h Probe	Graphical	
Metric		Wheel Size	500.00			
💭 Imperia	8	WINEED SIZE	: [00.00	mm		
					CANCEL	OK

- Select Metric or Imperial depth measurement units from the left-hand pane.
- Type the circumference of the depth measurement wheel into the 'wheel size' box. The standard sizes of GEOVision wheels range from 400mm to 1000mm. If measuring in Imperial units (or changing back to metric units), the standard wheel size can be converted automatically by clicking the left mouse button and choosing the appropriate conversion. The size is always specified in units of 1/1000 of the depth unit i.e. millimeters (mm) or millifeet (mft).



## 4. Encoder Configuration

The depth measurement system is dependent upon the combination of depth measurement sheave and the shaft encoder which translates rotation into pulses which are counted by the logging system controller. The depth wheel circumference is covered in a previous topic. In order to accommodate a variety of encoders, their operational characteristics can be configured in the software.



- Select supply voltage from the radio buttons in the left-hand pane. The options are 5 Volt and 12 Volt. GEOVision encoders are always specified for 5 Volt operation.
- Type the number of pulses emitted per revolution into the central box. This can be 400ppr to 5000ppr, depending on the encoder and wheel configuration.
- The logical direction of movement can be reversed if required to accommodate the mounting of the sheave.



#### 5. Winch and Cable Configuration

Smart Winch	r-Baudrate settir	ngs (Cable and Inte	rface dependant)	
🛛 Metric	💮 62.5K	💿 125K	🔵 208.3K	💬 312.5K
🔵 Imperial	Enter commun	ication parameters:	*	
Enable	Cable optio	<u>n</u> Gain	Drive Threshold F	
	Std. 4 Core		10 50	25 SEOPE
	9.			

The Baud settings can be chosen to match the *quality* of the communication channel. The channel will be effected by cable type and length. Typically a Baudrate of 312.5K is used. The remaining controls in the dialog relate to the communications parameters.

- **Cable Option** is used to select the logging cable type which is available on the winch. The options are *Not Connected*, *Std. 4 Core*, *Differential* and *Monocable*. The only cable types used in GEOVision systems is Std. 4 Core. Select the appropriate type from the drop-down menu box. Note this value can only be changed when the probe power is turned off.
- **Gain** is related to cable length and uphole signal attenuation. Gain values range from 0-3 and control the amplification applied to the incoming signal. Use the *Scope* dialog to visualize the incoming signals. Gain should be set so that the signal reaches between 50% and 100% of the height of the *Scope* display, generally obtained with a setting of 0 or 1 for GEOVision winches. If the peak height exceeds this level, clipping will result in artifacts which will be detected erroneously. Click *Apply* to set the parameters before proceeding to the *Scope* dialog.
- **Threshold** is the level at which the incoming signals are detected. Gain and Threshold are related, and can be visualized using the *Scope* dialog. Set the gain so that the signal reaches between 50% and 100% of the height of the display. Then adjust the threshold so that it is between 40% and 80% of the height of the pulses displayed and clear of any region of 'overshoot' of the positive and negative pulses. This will ensure that peaks are detected and noise is ignored. Generally a setting between 45 and 65 is used for GEOVision winches. When the scope dialog is displayed, the position of the mouse is reported as a threshold value to make it simpler to infer the correct setting. The scope option is grayed out when the probe power is turned off.



- Drive sets the strength of the downhole signal. It is not possible to visualize the downhole signal, but the effect of insufficient drive is to disable downhole communication, which will result in the commands being ignored by the probe. Values range from 0 -127, and for GEOVision winches will generally be between 3 and 20. Increase the drive for longer cables.
- **Pulse Width** This is the width of the transmitted communication pulses in 100nS steps. The default is 25 equivalent to 2.5uS. The range is from 8 to 64. The pulse width can be reduced to prevent signal overshoot on short cables. The default value is used in most cases. Note any changes only come into effect during a log. (Note setting too large a pulse width when using the highest Baud rates will automatically be prevented within the probe and the pulse width reduced.)

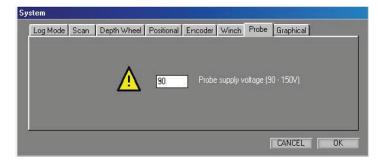
**IMPORTANT** Please note the effects of changing 'Baud' will not appear until the first new log is made. The setting for 'threshold' may be effected by an increase in the 'Baud' rate please recheck 'threshold' if 'Baud' is altered using the 'Scope' function after making a short test log.

The parameters which are entered will be applied automatically if you close the dialog with **OK**. The above parameters once set correctly for a particular winch system will be remembered by the system and should not need to be altered.



## 6. Probe Configuration

The probe is normally energized at 90 Volts from the surface. However, it may be necessary to compensate for voltage drop on longer cables due to the higher power draw of this probe. The voltage at the surface may be increased in order to deliver 90 Volts at the probe. Simply type the value into the text box provided. The voltage should be set at 90V for all GEOVision winches. Values outside the indicated range will be rejected.



# 7. Positional Configuration

The probe includes a 3-axis orientation package, and is capable of producing a borehole image aligned to geographic North. This is achieved by determining and applying two image rotation parameters:

ystem	
Log M	ode Scan Depth Wheel Positional Encoder Winch Probe Graphical
	ign log to North 📕 Setup (default unchecked) 0.00 Magnetic declination (degrees)
	Current Probe Serial Number (Required for calibration purposes)
	789 EDIT
	CANCEL

- *Magnetic Declination* is used to correct for the difference between Magnetic North and True North. The value varies from place to place, so the local value must be inserted here if you wish to perform this correction during data collection. GEOVision collects all data referred to Magnetic North, and makes this correction during processing. If the value is zero, the log will be referred to Magnetic North.
- Align to North is a check-box used to select image rotation to start at Magnetic North. If in addition a value is set for Magnetic Declination (see above) the image will be rotated to start at True North. If the box is not checked, the image will not be oriented to geographic co-ordinates, but will use the local co-ordinate frame of the probe (X, Y, Z axis of the orientation module). This mode may be used to inspect the inside of magnetic casing, where an orientated image would be subjected to random effects caused by the metalwork.



#### 8. Graphical

The palette can be changed between a colored and grey scale setting. The changes affect the log screen palette display and are also applied when replaying a log. Selecting Full range in the 'AGC Palette' will cause the software to spread the palette over the full 16bit signal. 'Mid range' will spread the palette over the first quarter of the 16bit range and 'Low range' will spread the palette over the first eighth of the 16 bit range. In most cases the 'Low range' selection is used. Note these settings do not affect the stored log data in any way. The 'Filter Width' is applied to the Natural Gamma trace data, if active, and is a simply running average filter. The range of the filter width is from 1 to 50 ( x 10 millidepth units ie. mm or mft).

Palette Select	AGC Palette (Display only)	⊣Aux. Data Channel Display
Colourised (Default)	💭 Full range	
	💌 Mid range	Filter Width
💭 Grey scale	🗇 Low range	21

#### 9. Probe Operation

When the operations specified above have been reviewed and the correct settings have been selected, the system is ready for use. The main screen area is divided into 3 horizontal elements. At the top is the depth and orientation readout, together with the scale headings for the scrolling display of unwrapped borehole image.

On the left side of the depth track is the travel time display, with text boxes for probe inclination, azimuth and head temperature.



On the right side is the display of amplitude and indication of current operating mode. Located in the center above the depth track are the text boxes for depth and cable speed (computed at the surface). The ranges for the 'Natural Gamma' channel overlay (optional) are shown above the Amplitude.

DEPTH 13544.01	01 m SPEED 0.0 m/min			TEST LOG MODE - RECORD OFF						
	(TITLE	.0 N	0			GAMMA AMPLITUDE		•		20

The central area is utilized for the scrolling display of unwrapped borehole data. The display is orientated



with the left edge corresponding to North point of the aligned image data (if orientation is selected) according to the outputs of the probe's orientation package.



Depth is initialized by typing the required value into the entry box and pressing Enter. The entry box is not available at times when the system is in logging mode and the depth should not be changed by user entry.

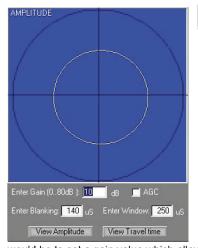
Probe power is applied by clicking on the green-colored 1 button. Power is turned off by clicking on the red-colored 0 button. There is no indicator for the state of the power supply on the desktop, so the external indicators should be observed for this purpose.

To make a log ensure that the Test Mode is disabled - see section 1, Log Mode setting. Click File|New Log and select a filename. Old logs may be overwritten if necessary -TAKE CARE. The header editor will be started automatically. A previous set of header data may be loaded by clicking LOAD and choosing a template.

To start logging, click on the red Record (circle) control. The log data will start to scroll down the screen after a brief pause for synchronization. The messages "DSP2: Detecting data stream" and "Updating probe settings" may be observed at the bottom of the screen during this process. Note that the screen scrolling direction is not affected by the actual direction of movement of the probe. To cease logging, click on the black STOP control (square). The data should be immediately backed up to a USB drive, CD, or other data storage prior to leaving the boring location.

If the data display from a probe which is properly connected appears to occupy only half of the track area, with the remainder filled with random colors such as green which are not part of the regular palette, then it is most likely that the downhole data communication is not functioning properly. This symptom is due to the fact that the probe settings cannot be communicated properly, and it is operating in its default power-up mode. If this is the case, the Drive setting of the System|Winch dialog should be increased or decreased accordingly.





To adjust the probe gain it is necessary to use the Radial Amplitude plot, which is enabled by clicking on the circle with cross-hairs symbol. When the dialog is active a new window will open on top of the unwrapped data display. In this display, the data is presented as a 'polar' plot. Press the 'View Amplitude' button to display the amplitude plot. This plot shows amplitude increasing towards the outside of the circle and the compass direction following the sweep of the transducer. The line indicating the data is drawn in the regular palette, so that high amplitudes are drawn in white and low amplitudes in black/brown. The picture here shows the image of the inside of a cylinder.

If the data is concentrated in a small circle at the center, the gain is too low and should be increased. If the data is obviously clipped at the outside of the circle, then the gain should be reduced. Type the new gain value into the entry box and press Enter. The ideal

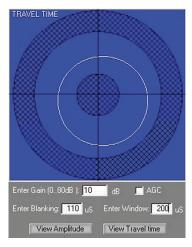
would be to set a gain value which allows the peak values to be displayed without clipping, with the majority of the data around the half-way level. It may also be necessary to adjust the blanking to ensure that internal reflections from the acoustic window are not detected at the new gain value. This will be apparent in the unwrapped data display as pronounced patterning unrelated to the true target. The AGC option causes the probe to set gain automatically thus preventing signal saturation in most cases. (The gain is varied in 6dB steps)

Blanking Period and window length can be set independently. Blanking is set to avoid reflections from the window of the acoustic transducer or random reflections from a rough borehole wall, and window length is set to accommodate the range of borehole radii that might be expected. An error will be indicated if the sum of the blanking period and window length would be greater than 409 microseconds, which is the maximum range of the timer. The default value for the blanking period is 145 microseconds, which is the minimum required for the two-way transit from the transceiver to the outer surface of the acoustic window. It is not advisable to reduce this value beyond the default setting, although it may be increased for larger boreholes at the rate of 1.5mm of one-way travel per microsecond.

Window Length (sample time) defines the period during which the arrival gate remains open to detect the returned acoustic pulse. The acoustic pulse will travel in water at a speed of approximately 1.5mm per microsecond. The default window length is 150 microseconds, which is equivalent to 225 mm of (two-way) travel in the borehole fluid, or approximately 110mm of borehole diameter. If this is added to the default blanking period, which is equivalent to the outside diameter of the acoustic window, it can be seen that the default set-up will be correct for boreholes up to 150mm. An error will be indicated if the sum of the blanking period and window length would be greater than 409 microseconds, which is the maximum range of the timer. Choose the window setting to best match the borehole diameter and conditions.

Pressing the 'View Travel time' button changes the display to that shown below:





The unhatched ring between the two cross hatched zones represents the sample window. The width of this ring will vary with window length value. The profile of a cylinder is represented here appearing as a circle in the sample window. In this example, the circle is not concentric with the cross-hatched zones, indicating the probe is not centralized in the cylinder.



#### 10. Field Standardization Checks

As stated in ASTM D5753, Section 7.1.1, National Institute of Standards and Technology (NIST) calibration and operating procedures do not exist for the borehole geophysical logging industry. However, geophysical logs can be used in a qualitative or quantitative manner, <u>depending on project objectives</u>. Calibration ensures standardization, but since calibration procedures do not exist for the acoustic televiewer, this procedure is written with standardization or validation objectives in mind.

According to ASTM D5753 standardization is the process of checking the log response to reveal evidence of <u>repeatability and consistency</u>. Standardization is needed to establish comparability between logs made with different equipment or at different times and to ensure the accuracy of measurements., Further, standardization checks should include at least two different measurement values approximating the range of interest. Finally, log response needs to be checked using field standards often enough to satisfy the project objectives. Standardization of the log response provides the basis for correcting for changes (for example, changes in output with time due to system drift or changes of equipment). In the specific case of an acoustic televiewer, the ASTM D5753 standard recommends that the oriented image-magnetometer must be checked. To meet these requirements, the following steps are incorporated into the field logging procedure:

- 1. Prior to insertion in the borehole, the probe is tilted at two different angles and the resulting readout is compared to a Brunton pocket transit (Brunton) inclinometer or equivalent and recorded in the field log. This verifies two different measurement values and functionality of the probe accelerometers. This functional test is repeated for one angle after logging. Tilt angle values should agree within +/-2 degrees.
- 2. Prior to insertion in the borehole, the probe is rotated through two different compass orientations and the resulting readout is compared to a Brunton pocket transit or equivalent and recorded in the field log. This verifies two different measurement values and functionality of the probe fluxgate compass. This functional test is repeated for one angle after logging. Azimuth values between the probe and the Brunton should agree within +/-10 degrees. NOTE: It is very difficult to achieve better accuracy than this in the field due to local magnetic field effects of drill rigs, vehicles, etc., and in some locations (near power lines, near pipe lines, near high rise buildings, in cities or at power plants) may be impossible. In these locations these tolerances must be relaxed to permit use of the probe.
- 3. The log is performed with the probe moving downward as well as upward. The downward log is generally performed at a lower vertical resolution and higher speed then the upward log. This allows closure of the deviation log, and repeat measurements as needed. After survey depth error should not exceed 0.4% of the total borehole depth, or 5 inches in 100 feet. Larger errors may be acceptable if the borehole cannot be reoccupied, or the cause of the error is identified as an obstruction during the descent of the probe. In this case depth reference may be corrected to the exit depth reference.



## 11. Required Field Records

- 1) Borehole identification
- 2) Date of test
- 3) Tester or data recorder
- 4) Description of probe reference point; (the "probe offset" on the log form)
- 5) Model and manufacturer of logging tools; (HRAT High Resolution Acoustic Televiewer made by Robertson Geologging, Ltd. of Deganwy, Conwy, UK)
- 6) Tool serial number;
- 7) Top and bottom of logged interval;
- 8) Logging speed (stored in data file header) and direction (in file name);
- 9) Vertical depth error after logging;
- 10) Time constant, time interval or depth interval of digital samples (stored in data file header)
- 11) Data must be stored in at least 2 places, such as the laptop hard disk and CDRom, or hard disk and USB flash drive, or uploaded to FTP, prior to leaving the site.
- 12) Identification of disk containing digitized logs; and all removable digital media, such as CDRoms or USB flash drives with backup copies of data on hard disk, must be "labeled" with job number, borehole designation, date, and tester name. For USB flash drives or hard disks on separate computers, the "label" can be a .txt file with this information, or a file directory which has the job number and borehole name.
- 13) Any deviations from test plan and action taken as a result
- 14) Any equipment problems or maintenance performed are recorded on the log form.

An example Field Log form is attached to this procedure.



#### **Data Analysis and Interpretation**

RG-DIP, the manufacturer's image interpretation package, as well as WellCAD (<u>http://www.alt.lu/wellcad.htm</u>) offer manual and automatic feature recognition options. Feature orientations (dip and azimuth) are automatically calculated. Display options include orthographic projection of borehole deviation, projection and tadpole presentation of identified features, stereonet analysis of feature orientation, feature frequency histograms and 'synthetic cores' for comparison with real core data. The last option is invaluable for orientating and locating core samples, particularly in the case of incomplete core recovery or core damage.

#### Reporting

The final report will include the objective and scope of the survey, location of the boreholes if available, discussion of instrumentation and procedures in the field. For each borehole that is imaged, there will be a plot showing the dip and azimuth of features. A following page shows an example.

Assumptions and limitations of the results will be discussed. Supporting references will be listed as necessary.

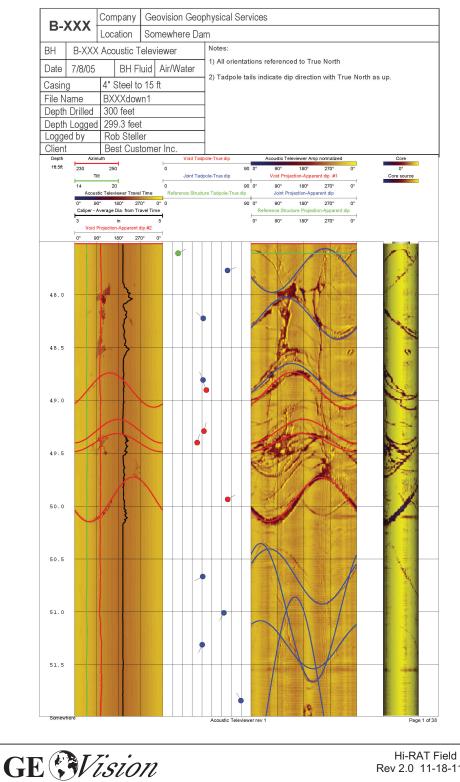
This procedure has been reviewed and approved by the undersigned:

Professional Geophysicist	antory Mart	Date	Nov 18. 2011
QA Review	Man	Date	Nov 18. 2011

References:

- 1. Operating Manual for the HRAT High Resolution Acoustic Televiewer, by Robertson Geologging, Ltd., Deganwy, Conwy, UK
- 2. "Standard Guide for Planning and Conducting Borehole Geophysical Logging", ASTM Standard D5753-05, re-approved 2010.





# **PROCEDURE FOR**

# **OYO P-S SUSPENSION SEISMIC VELOCITY LOGGING**

# Background

This procedure describes a method for measuring shear and compressional wave velocities in soil and rock. The OYO P-S Suspension Method is applied by generating shear and compressional waves in a borehole using the OYO P-S Suspension Logger borehole tool and measuring the travel time between two receiver geophones or hydrophones located in the same tool.

# Objective

The outcome of this procedure is a plot and table of P and  $S_H$  wave velocity versus depth for each borehole. Standard analysis is performed on receiver to receiver data. Processed data is presented in report format, and transmitted in Excel, Word or ASCII format.

# Instrumentation (Figure 1)

- 1. OYO Model 170 Digital Logging Recorder, Robertson Model 3403 Digital Telemetry, or equivalent (top right corner of Figure 1, and Table 1)
- 2. OYO P-S Suspension Logger probe or equivalent, including two sets horizontal and vertical geophones or hydrophones (hereafter referred to simply as "geophones"), seismic source, and power supply for the source and receivers (this is everything down in the borehole in Figure 1)
- 3. Winch and winch controller, with logging cable (Figure 1)
- 4. Batteries to operate P-S Logger and winch (not shown)

The Suspension P-S Logger system, manufactured by OYO Corporation, or the Robertson Digital P-S Suspension Probe with the Robertson Micrologger2 are currently the only two types of commercially available suspension logging systems. As shown in Figure 1, these systems consists of a borehole probe suspended by a cable and a recording/control electronics package on the surface.

The suspension system probe consists of a combined reversible polarity solenoid horizontal shear-wave generator ( $S_H$ ) and compressional-wave generator (P), joined to two biaxial geophones by a flexible isolation cylinder. The separation of the two geophones is one meter, allowing average wave velocity in the region between the geophones to be determined by inversion of the wave travel time between the two geophones. The total length of the probe is



approximately 7 meters; the center point of the geophones is approximately 4 meters above the bottom end of the probe.

The probe receives control signals from, and sends the amplified geophone signals to, the instrumentation package on the surface via an armored 4 or 7 conductor cable. The cable is wound onto the drum of a winch and is used to support the probe. Cable travel is measured by a rotary encoder to provide probe depth data.

The entire probe is suspended by the cable and may be centered in the borehole by nylon "whiskers." Therefore, source motion is not coupled directly to the borehole walls; rather, the source motion creates a horizontally propagating pressure wave in the fluid filling the borehole and surrounding the source. This pressure wave produces a horizontal displacement of the soil forming the wall of the borehole. This displacement propagates up and down the borehole wall, in turn causing a pressure wave to be generated in the fluid surrounding the geophones as the soil displacement wave passes their location.

# **Environmental Conditions**

The OYO P-S Suspension Logging Method can be used in either cased or uncased boreholes. For best results, the uncased borehole must be between 10 and 20 cm in diameter, or 4 to 8 inches. A cased borehole may be as small as 3 inches, if properly grouted (see below). The grout annulus may be up to 2 inches for a 4 inch casing. A smaller annulus is preferred for 3 inch casing.

Uncased boreholes are preferred because the effects of the casing and grouting are removed. It is recommended that the borehole be drilled using the rotary mud method. This method does little damage to the borehole wall, and the drilling fluid coats and seals the borehole wall reducing fluid loss and wall collapse. The borehole fluid is required for the logging, and must be well circulated prior to logging.

If the borehole must be cased, the casing must be PVC and properly installed and grouted. Any voids in the grout will cause problems with the data. Likewise, large grout bulbs used to fill cavities will also cause problems. The grout must be set before testing. This means the grouting must take place at least 48 hours before testing.

For borehole casing, applicable preparation procedures are presented in ASTM Standard D4428/D4428M-91 Section 4.1 (see ASTM website for copy).

# Calibration

Calibration of the digital logger/recorder is required. Calibration is limited to the timing accuracy of the logger/recorder. GEOVision's "Suspension PS Logger/Recorder Calibration Procedure" or equivalent should be used. Calibration must be performed on an annual basis. The following table details the specific instruments calibrated:

	•		
TYPE OF LOGGER/RECORDER	LOCATION OF CALIBRATED DIGITIZER	CALIBRATED MODEL NUMBER	RECORDS ON
OYO (JAPAN)	Seismograph at the surface	PS-170 Model 3331 or 3331A	Laptop via PS-170
Robertson (UK)*	Telemetry Unit at top of probe in the borehole (Figure 1)	Model 3403	Laptop via RG MicroLogger2

Tahle 1	Explanation	of Instrument	Calibration
	LAplanation		Gambradon

\* Robertson GeoLogging (RG) is a subsidiary of OYO International of Japan. The RG probe sections may still say "OYO" even though they are sold by RG from the UK.

# Measurement Procedure

The entire probe is lowered into the borehole to a specific measurement depth by the winch. A measurement sequence is then initiated by the operator from the instrumentation package control panel. No further operator intervention is then needed to complete the measurement sequence described below.

The system electronics activates the SH-wave source in one direction and records the output of the two horizontally oriented geophone axes which are situated parallel to the axis of motion of the source. The source is then activated in the opposite direction, and the horizontal output signals are again recorded, producing a SH-wave record of polarity opposite to the previous record. The source is finally actuated in the first direction again, and the responses of the vertical geophone axes to the resultant P-wave are recorded during this sampling.

The data from each geophone during each source activation is recorded as a different channel on the recording system. The seismograph has at least six channels (two simultaneous recording channels), each with at least a 12 bit 1024 sample record. Newer seismographs may have longer record lengths. The recorded data is displayed on a CRT or LCD display as six channels with a common time scale. Data is stored on digital media for further processing. Up to 8 sampling sequences can be stacked (averaged) to improve the signal to noise ratio of the signals.

Review of the data on the display allows the operator to set the gains, filters, delay time, pulse length (energy), sample rate, and stacking number in order to optimize the quality of the data before recording. Digital media should be verified from time-to-time by opening saved files (at least one) and viewing stored data. This should also be done on transferred or back-up files (see item 2 under required Field Records).

Typical depth spacing for measurements is 1.0 meters, or 3.3 feet. Alternative spacing is 0.5 meter, or 1.6 feet.



# **Required Field Records**

- 1) Field log for each borehole showing
  - a) Borehole identification
  - b) Date of test
  - c) Tester or data recorder
  - d) Description of measurement
  - e) Any deviations from test plan and action taken as a result
- 2) Data must be stored in at least 2 places, such as the laptop hard disk and CDRom, or hard disk and USB flash drive, or uploaded to FTP, prior to leaving the site.
- 3) List of record ID numbers (for data on digital media) and corresponding depth
- 4) All removable digital media, such as CDRoms or USB flash drives with backup copies of data on hard disk, must be "labeled" with job number, borehole designation, record ID number range, date, and tester name. For USB flash drives or hard disks on separate computers, the "label" can be a .txt file with this information, or even a PSLOG .sps file with preliminary information stored. File directories should have job number, project name and borehole name.

An example Field Log is attached to this procedure.

# Analysis

Following completion of field work, the recorded digital records are processed by computer using the OYO Corporation software program PSLOG and interactively analyzed by an experienced geophysicist to produce plots and tables of P and  $S_H$  wave velocity versus depth.

The digital time series records from each depth are transferred to a personal computer for analysis. Figure 2 shows a sample of the data from a single depth. These digital records are analyzed to locate the first minima on the vertical axis records, indicating the arrival of P-wave energy. The difference in travel time between these arrivals is used to calculate the P-wave velocity for that 1-meter interval. When observable, P-wave arrivals on the horizontal axis records are used to verify the velocities determined from the vertical axis data. In addition, the soil velocity calculated from the travel time from source to first receiver is compared to the velocity derived from the travel time between receivers.

The digital records are studied to establish the presence of clear SH-wave pulses, as indicated by the presence of opposite polarity pulses on each pair of horizontal records. Ideally, the SH-wave signals from the 'normal' and 'reverse' source pulses are very nearly inverted images of each other. Digital FFT – IFFT lowpass filtering may be used to remove the higher frequency P-wave signal from the SH-wave signal.



The first maxima are picked for the 'normal' signals and the first minima are picked for the 'reverse' signals. The absolute arrival time of the 'normal' and 'reverse' signals may vary by +/- 0.2 milliseconds, due to differences in actuation time of the solenoid source caused by constant mechanical bias in the source or by borehole inclination. This variation does not affect the velocity determinations, as the differential time is measured between arrivals of waves created by the same source actuation. The final velocity value is the average of the values obtained from the 'normal' and 'reverse' source actuations.

In Figure 2, the time difference over the 1-meter interval of 1.70 millisecond is equivalent to a SH-wave velocity of 588 m/sec. Whenever possible, time differences are determined from several phase points on the  $S_H$  -wave pulse trains to verify the data obtained from the first arrival of the  $S_H$  -wave pulse. In addition, the soil velocity calculated from the travel time from source to first receiver is compared to the velocity derived from the travel time between receivers.

Figure 3 is a sample composite plot of the far normal horizontal geophone records for a range of depths. This plot shows the waveforms at each depth, clearly showing the S-wave arrivals. This display format is used during analysis to observe trends in velocity with changing depth.

Once the proper picks are entered in PSLOG, the picks are transferred to an Excel spreadsheet where Vs and Vp are calculated. The spreadsheet allows output for presentation in charts and tables.

Standard analysis is performed on receiver 1 to receiver 2 data, with separate analysis performed on source to receiver data as a quality assurance procedure.

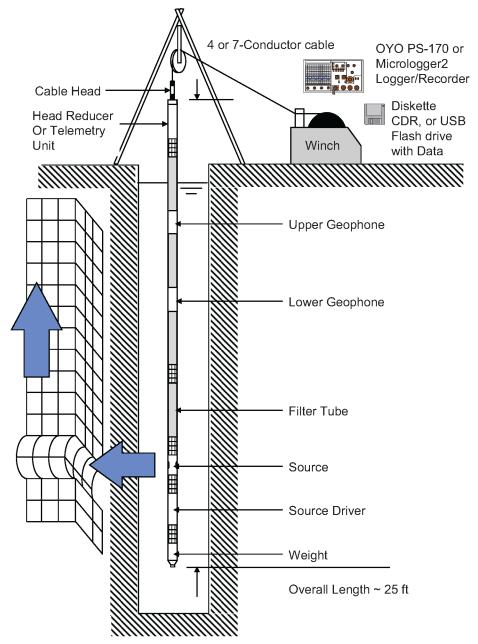
Registered Geophysicist	antry Marta	Date	<u>10/7/10</u>
QA Review	Man	Date	<u>10/7/10</u>

References:

- "In Situ P and S Wave Velocity Measurement", Ohya, S. 1986. Proceedings of In-Situ '86, Use of In-Situ Tests In Geotechnical Engineering, an ASCE Specialty Conference sponsored by the Geotechnical Engineering Division of ASCE and co-sponsored by the Civil Engineering Dept of Virginia Tech.
- 2. Guidelines for Determining Design Basis Ground Motions, Report TR-102293, Electric Power Research Institute, Palo Alto, California, November 1993, Sections 7 and 8.
- 3. "Standard test Methods for Crosshole Seismic Testing", ASTM Standard D4428/D4428M-07, approved July 1, 2007.









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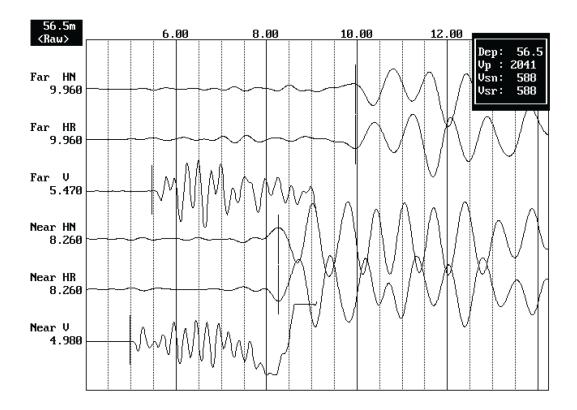


Figure 2. Sample suspension method waveform data showing horizontal normal and reversed (HR and HN), and vertical (V) waveforms received at the near (bottom 3 channels) and far (top 3 channels) geophones. The arrivals in milliseconds for each pick are shown on the left. The box in the upper right corner shows the depth in the borehole and the velocities calculated based on the picks.



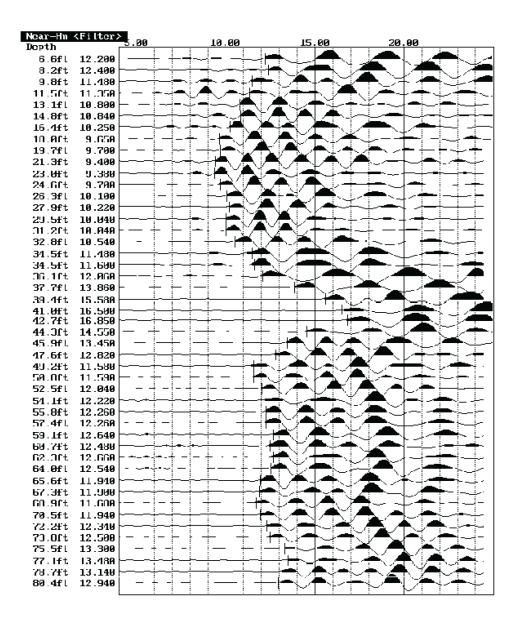


Figure 3. Sample composite waveform plot for normal shear waves received at the near geophone in a single borehole

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**APPENDIX H** 

# **SURVEY FINAL REPORT**



