MUESER RUTLEDGE CONSULTING ENGINEERS

		BORING NO.	B-12
		SHEET	2 **OF** 2
PROJECT	BAY PARK STP - PERIMETER FLOOD PROTECTION	**FILE NO.**	12047
LOCATION	BAY PARK, NEW YORK	**SURFACE ELEV.**	8.2
BORING LOCATION	SEE BORING LOCATION PLAN	**DATUM**	NAVD 88

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG		TYPE OF FEED DURING CORING		CASING USED	[ ] YES [X] NO		
TRUCK	VACUUM	MECHANICAL		DIA., IN.		DEPTH, FT. FROM	TO
SKID		HYDRAULIC		DIA., IN.		DEPTH, FT. FROM	TO
BARGE		OTHER		DIA., IN.		DEPTH, FT. FROM	TO
OTHER							

TYPE AND SIZE OF:

D-SAMPLER		DRILLING MUD USED	[ ] YES [X] NO
U-SAMPLER		DIAMETER OF ROTARY BIT, IN.	
S-SAMPLER		TYPE OF DRILLING MUD	
CORE BARREL		AUGER USED	[X] YES [ ] NO
CORE BIT		TYPE AND DIAMETER, IN.	HAND AUGER
DRILL RODS			

CASING HAMMER, LBS. ______ AVERAGE FALL, IN. ______
SAMPLER HAMMER, LBS. ______ AVERAGE FALL, IN. ______

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATION
					NO WATER LEVEL OBSERVATIONS MADE.

PIEZOMETER INSTALLED [ ] YES [X] NO SKETCH SHOWN ON ______

STANDPIPE:	TYPE		ID, IN.		LENGTH, FT.		TOP ELEV.	
INTAKE ELEMENT:	TYPE		OD, IN.		LENGTH, FT.		TIP ELEV.	
FILTER:	MATERIAL		OD, IN.		LENGTH, FT.		BOT. ELEV.	

PAY QUANTITIES

3.5" DIA. DRY SAMPLE BORING	LIN. FT.		NO. OF 3" SHELBY TUBE SAMPLES	
3.5" DIA. CONTINUOUS SAMPLE BORING	LIN. FT.		NO. OF 3" UNDISTURBED SAMPLES	
CORE DRILLING IN ROCK	LIN. FT.		OTHER: HAND AUGER	4

BORING CONTRACTOR WARREN GEORGE, INC.
DRILLER GILBERT CANELO HELPERS
REMARKS OBSTRUCTION AT 5'; BORING BACKFILLED & MOVED TO BORING B-12A.
RESIDENT ENGINEER PATRICK DONALDSON DATE 10-07-13
CLASSIFICATION CHECK: CHERYL J. MOSS TYPING CHECK: CHERYL J. MOSS

MRCE Form BS-1 **BORING NO.** B-12

MUESER RUTLEDGE CONSULTING ENGINEERS

BORING LOG

BORING NO. B-12A
SHEET 1 OF 2
FILE NO. 12047
SURFACE ELEV. 8.1
RES. ENGR. PATRICK DONALDSON

PROJECT: BAY PARK STP - PERIMETER FLOOD PROTECTION
LOCATION: BAY PARK, NEW YORK

DAILY PROGRESS	SAMPLE NO.	SAMPLE DEPTH	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
11:30				For descriptions from 0' to 4', see boring			DRILLED	Offset from Boring
10-07-13				B-12.			AHEAD	B-12.
Monday							4"	
Partly Cloudy								
70°F	1HA	4.0	HAND	Brown fine to medium sand, some silt, trace		5		
11:40		6.0	AUGER	gravel, organic silty clay pockets (SM)	F			
10:30	2D	6.0	3-3	Light brown fine to medium sand, trace silt,				
10-17-13		8.0	4-4	coarse sand, gravel (SP)				
Thursday	3D	8.0	6-6	Light brown fine to medium sand, trace gravel,				
Sunny		10.0	7-8	silt, coarse sand (SP)		10		
70°F	4D	10.0	8-13	Do 3D (SP-SM)				
		12.0	20-18			12		
	5D	12.0	5-6	Gray fine to coarse sand, some clay, gravel				
		14.0	5-8	(SC)				
	6D	14.0	5-5	Gray & brown fine to medium sand, trace clay,		15		
		16.0	5-8	gravel, coarse sand (SP-SC)				
	7D	16.0	5-6	Gray brown fine to medium sand, trace gravel,				
		18.0	9-11	silt, coarse sand (SP)				
	8D	18.0	12-12	Gray brown fine to medium sand, trace gravel,				
		20.0	11-10	silt, coarse sand (SP)		20		
	9D	20.0	5-8	Tan & brown fine to medium sand, trace silt				
		22.0	10-17	(SP)				
	10D	22.0	16-19	Do 9D (SP-SM)				
		24.0	16-18					
	11D	24.0	8-10	Gray fine to medium sand, trace silt, gravel		25		
		26.0	13-19	(SP-SM)				
	12D	26.0	11-11	Gray fine to medium sand, trace silt (SP-SM)				
		28.0	15-14					
	13D	28.0	10-12	Tan fine to medium sand, trace silt, coarse				
		30.0	16-17	sand, gravel (SP)		30		
	14D	30.0	12-17	Tan fine to medium sand, trace gravel, silt	S			
		32.0	19-26	(SP-SM)				
	15D	32.0	4-7	Tan fine to medium sand, trace silt (SP-SM)				
		34.0	8-15					
	16D	34.0	11-13	Tan fine to medium sand, trace gravel, silt		35		
		36.0	13-18	(SP-SM)				
	17D	36.0	7-7	Tan fine to coarse sand, trace gravel, silt				
		38.0	8-10	(SP)				
	18D	38.0	9-17	Tan & light brown fine to medium sand, trace				
		40.0	17-20	gravel, silt, gray silty clay seams (SP-SM)		40		
	19D	40.0	9-12	Tan fine to medium sand, trace gravel, silt				
		42.0	14-22	(SP-SM)				
	20D	42.0	18-24	Tan fine to medium sand, some gravel, trace				
		44.0	36-45	silt (SP-SM)				
	21D	44.0	21-32	Tan fine to medium sand, trace gravel, silt		45		
		45.9	53-50/5"	(SP-SM)				
	22D	46.0	47-50/4"	Light brown fine to medium sand, trace silt				
		46.8		(SP-SM)				
	23D	48.0	34-66	Light brown fine to medium sand, some gravel,				
13:30		49.3	50/4"	trace silt (SP-SM)		49.3		End of Boring at 49.3'.

MUESER RUTLEDGE CONSULTING ENGINEERS

		BORING NO.	B-12A
		SHEET 2 **OF** 2	
PROJECT	BAY PARK STP - PERIMETER FLOOD PROTECTION	**FILE NO.**	12047
LOCATION	BAY PARK, NEW YORK	**SURFACE ELEV.**	8.1
BORING LOCATION	SEE BORING LOCATION PLAN	**DATUM**	NAVD 88

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG		TYPE OF FEED DURING CORING		CASING USED		X YES		NO		
TRUCK	MOBILE B-58	MECHANICAL		DIA., IN.	4	DEPTH, FT. FROM	0	TO	5	
SKID		HYDRAULIC		DIA., IN.		DEPTH, FT. FROM		TO		
BARGE		OTHER		DIA., IN.		DEPTH, FT. FROM		TO		
OTHER										

TYPE AND SIZE OF:					
D-SAMPLER	2" O. D. SPLIT SPOON	DRILLING MUD USED	X YES	NO	
U-SAMPLER		DIAMETER OF ROTARY BIT, IN.	3-7/8		
S-SAMPLER		TYPE OF DRILLING MUD	EZ-MUD		
CORE BARREL		AUGER USED	X YES	NO	
CORE BIT		TYPE AND DIAMETER, IN.	HAND AUGER		
DRILL RODS	NWJ				

CASING HAMMER, LBS. _____ AVERAGE FALL, IN. _____

*SAMPLER HAMMER, LBS. 140 AVERAGE FALL, IN. 30

*USED SAFETY SAMPLER HAMMER.

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATION
					NO WATER LEVEL OBSERVATIONS MADE.

PIEZOMETER INSTALLED ____ YES X NO SKETCH SHOWN ON _____

STANDPIPE:	TYPE		ID, IN.		LENGTH, FT.		TOP ELEV.
INTAKE ELEMENT:	TYPE		OD, IN.		LENGTH, FT.		TIP ELEV.
FILTER:	MATERIAL		OD, IN.		LENGTH, FT.		BOT. ELEV.

PAY QUANTITIES

3.5" DIA. DRY SAMPLE BORING	LIN. FT.	2	NO. OF 3" SHELBY TUBE SAMPLES	
3.5" DIA. CONTINUOUS SAMPLE BORING	LIN. FT.	39.3	NO. OF 3" UNDISTURBED SAMPLES	
CORE DRILLING IN ROCK	LIN. FT.		OTHER: HAND AUGER	2

BORING CONTRACTOR		WARREN GEORGE, INC.	
DRILLER	LOUIS RAMOS	HELPERS	BENACEO ALBANEZ
REMARKS	BOREHOLE TREMIE GROUTED UPON COMPLETION.		
RESIDENT ENGINEER	PATRICK DONALDSON	DATE	10-17-13
CLASSIFICATION CHECK:	CHERYL J. MOSS	TYPING CHECK:	CHERYL J. MOSS

MUESER RUTLEDGE CONSULTING ENGINEERS

BORING LOG

BORING NO. B-13P
SHEET 1 OF 4
FILE NO. 12047
SURFACE ELEV. 8.8
RES. ENGR. PATRICK DONALDSON

PROJECT: BAY PARK STP - PERIMETER FLOOD PROTECTION
LOCATION: BAY PARK, NEW YORK

DAILY PROGRESS	SAMPLE NO.	SAMPLE DEPTH	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
12:45	1HA	0.0	HAND	Brown fine to medium sand, some silt, trace			DRILLED	
10-07-13		2.0	AUGER	gravel, trace coarse sand, vegetation (SM)			AHEAD	
Monday	2HA	2.0	HAND	Brown fine to medium sand, some gravel, trace			4"	
Partly Cloudy		4.0	AUGER	silt, coarse sand (SP-SM)				
70°F	3HA	4.0	HAND	Brown fine to medium sand, some gravel, silt		5		
13:00		6.0	AUGER	(SM)				
13:00	4D	6.0	13-13	Brown fine to coarse sand, some gravel, trace	F			Filter fabric found in
10-17-13		8.0	14-13	silt (SP-SM)				Sample 4D.
Thursday	5D	8.0	13-14	Black & brown fine to medium sand, some				
Sunny		10.0	17-18	gravel, trace silt (SP-SM)		10		
70°F	6D	10.0	14-13	Brown fine to medium sand, trace gravel, silt,				
		12.0	12-10	coarse sand (SP-SM)				
						13.5		
						15		
	7D	15.0	8-11	Gray fine to medium sand, trace gravel, silt				
		17.0	12-14	coarse sand (SP)				
						20		
	8D	20.0	14-20	Do 7D (SP-SM)				
		22.0	21-24					
						25		
	9D	25.0	16-18	Tan & light brown fine sand, trace silt, medium				
		27.0	19-21	sand (SP-SM)				
						30		
	10D	30.0	28-41	Do 9D (SP-SM)				
14:45		31.8	59-50/4"		S			
07:45								
10-18-13								
Friday						35		
Sunny	11D	35.0	13-28	Tan fine to medium sand, some gravel, trace				
70°F		37.0	33-26	silt, silty clay seams (SP-SM)				
						40		
	12D	40.0	26-33	Light brown medium to fine sand, trace coarse				
		41.8	44-50/4"	sand, silt, gravel (SP)				
						45		
	13D	45.0	18-30	Light brown fine to medium sand, trace silt,				
		47.0	50-49	gravel (SP-SM)				
						50		
10:00	14D	50.0	38-100/6"	Do 13D (SP-SM)		51		End of Boring at 51'.
		51.0						

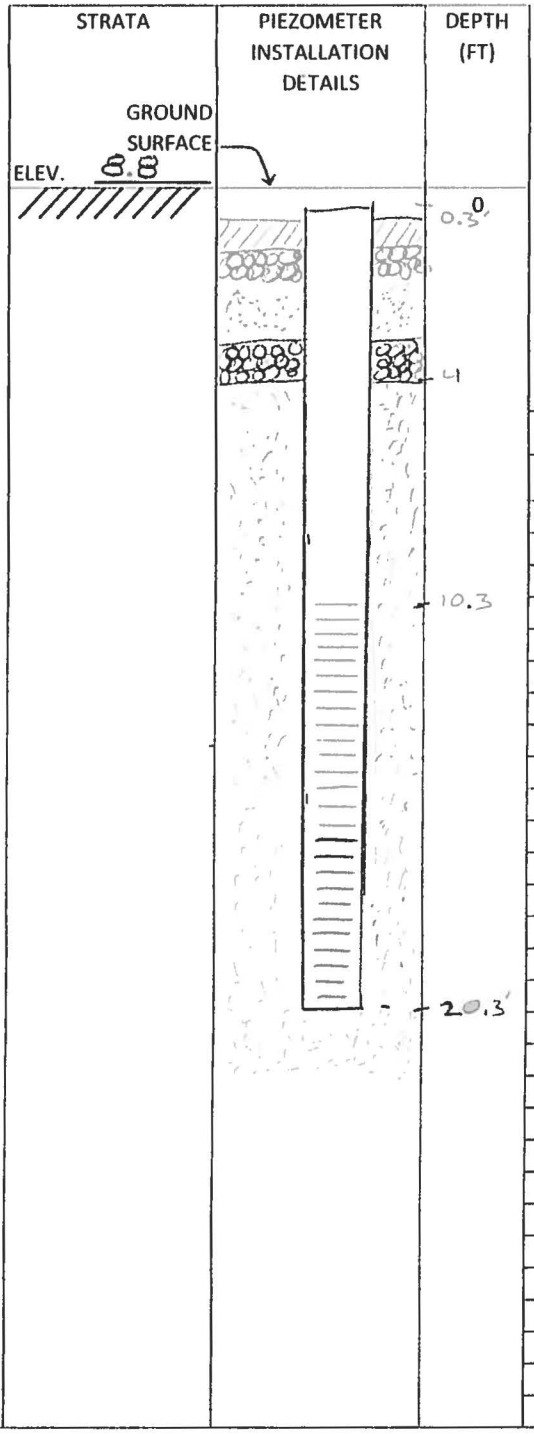
Mueser Rutledge Consulting Engineers
14 Penn Plaza - 225 West 34th Street
New York, NY 10122
T: 917 339-9300 F: 917 339-9400
www.mrce.com

PIEZOMETER RECORD

PIEZOMETER OR BORING NO. B-13P
SHEET 2 OF 4
FILE NO. 12047
INSTALLATION DATE 10/18/13
RES ENGR. PED

PROJECT: Bay Park STP
LOCATION: East Rockaway, NY
PIEZOMETER LOCATION:

☐ SEE SKETCH ON BACK



PIEZOMETER TYPE Screened PVC

INTAKE POINT
depth to bottom, ft = 20.3
depth to top, ft = 10.3
length, ft = 10 = L
diameter, in = 2 , ft = 0.17 = 2R

STANDPIPE/RISER
elevation of rim, ft = 8.5
diameter, in = 2 , ft = 0.17 = 2r

READING TIME		DEPTH – RIM TO WATER	ELEVATION OF WATER	REMARKS
DATE	CLOCK			
10/18	1825	12.2'	-3.7	
10/21	0735	12.2'	-3.7	
10/21	1555	12.0'	-3.5	
10/22	0715	12.0'	-3.5	
10/22	1435	12.2'	-3.7	
10/23	0715	12.35'	-3.9	
10/23	1240	12.2'	-3.7	BEFORE FIT
11/9	1005	12.75'	-4.3	
11/16	1105	14.8	-6.3	
11/22	1438	15.3	-6.8	
11/26	1750	15.6	-7.1	
12/1	1035	13.0	-4.5	
12/7	1020	15.25	-6.8	

SAND
GRAVEL
BENTONITE
GROUT

GROUND SURFACE ELEV. 8.8

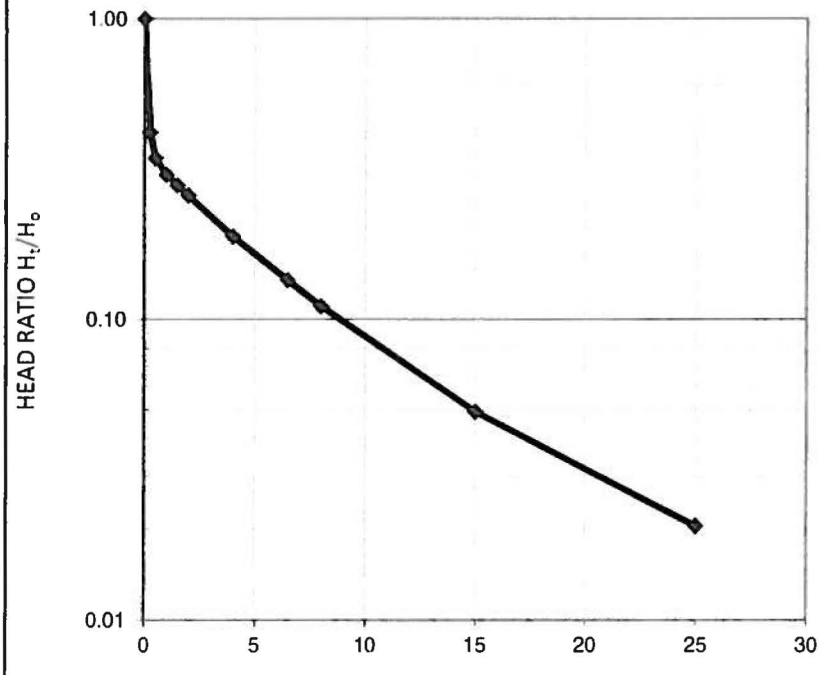
PIEZOMETER NO. B-13P

Mueser Rutledge Consulting Engineers
14 Penn Plaza - West 34th Street
New York, NY 10122

VARIABLE HEAD PERMEABILITY TEST

FILE NO. 12047
PIEZOMETER NO. B-13P
TEST NO. 1

PROJECT: Bay Park STP Flood Protection
LOCATION: East Rockaway, NY
PIEZOMETER LOCATION: SEE BLP
RES. ENG.: Patrick Donaldson
CALC. BY: PED DATE: 10/24/13
CH'KD BY: DATE:



INTAKE POINT	
DEPTH TO BOTTOM, FT=	20.3
DEPTH TO TOP, FT=	10.3
LENGTH, FT=	10
DIAMETER, IN=	2
RADIUS, FT=	0.083
STANDPIPE / RISER	
DIAMETER, IN=	2
RADIUS, FT=	0.083
DEPTH TOP OF CASING, FT=	0.3
BOREHOLE	
DEPTH OF BOREHOLE, FT=	51.0
DIAMETER, IN=	4
RADIUS, FT=	0.167

Average Permeability: 7.77E-04 ft/min
3.95E-04 cm/sec

READING TIME			TEST DEPTH RIM TO WATER ft.	DEPTH RIM TO TIDE OR GWL, ft.	UNBALANCED HEAD, H ft.	HEAD RATIO H_t/H_o	PERMEABILITY	
DATE	CLOCK	Δt MIN.					ft/min	cm/sec
10/23/2013	13:21		12.20	12.20	0.00		STATIC WATER LEVEL	
	TIMER	0	0.00	12.20	12.20	1.00		
		0.25	7.10	12.20	5.10	0.42	4.96E-03	2.52E-03
		0.5	8.00	12.20	4.20	0.34	1.10E-03	5.61E-04
		1	8.50	12.20	3.70	0.30	3.60E-04	1.83E-04
		1.5	8.80	12.20	3.40	0.28	2.40E-04	1.22E-04
		2	9.05	12.20	3.15	0.26	2.17E-04	1.10E-04
		4	9.90	12.20	2.30	0.19	2.24E-04	1.14E-04
		6.5	10.55	12.20	1.65	0.14	1.89E-04	9.59E-05
		8	10.85	12.20	1.35	0.11	1.90E-04	9.66E-05
		15	11.60	12.20	0.60	0.05	1.65E-04	8.37E-05
10/23/2013		25	11.95	12.20	0.25	0.02	1.24E-04	6.32E-05

REMARKS

PIEZOMETER NO. B-13P

MUESER RUTLEDGE CONSULTING ENGINEERS

BORING NO. B-13P
SHEET 4 **OF** 4

PROJECT BAY PARK STP - PERIMETER FLOOD PROTECTION
FILE NO. 12047
LOCATION BAY PARK, NEW YORK
SURFACE ELEV. 8.8
BORING LOCATION SEE BORING LOCATION PLAN
DATUM NAVD 88

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG		TYPE OF FEED DURING CORING		CASING USED		X YES		NO		
TRUCK	DIETRICH 120	MECHANICAL		DIA., IN.	4	DEPTH, FT. FROM	0	TO	11
SKID		HYDRAULIC		DIA., IN.		DEPTH, FT. FROM		TO	
BARGE		OTHER		DIA., IN.		DEPTH, FT. FROM		TO	
OTHER									

TYPE AND SIZE OF:		DRILLING MUD USED	X YES	NO
D-SAMPLER	2" O. D. SPLIT SPOON	DIAMETER OF ROTARY BIT, IN.	3-7/8	
U-SAMPLER		TYPE OF DRILLING MUD	EZ-MUD	
S-SAMPLER				
CORE BARREL		AUGER USED	X YES	NO
CORE BIT		TYPE AND DIAMETER, IN.	HAND AUGER	
DRILL RODS	NWJ			

*CASING HAMMER, LBS. 140 AVERAGE FALL, IN. 30
*SAMPLER HAMMER, LBS. 140 AVERAGE FALL, IN. 30
*USED DONUT HAMMER.

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATION
					NO WATER LEVEL OBSERVATIONS MADE.

PIEZOMETER INSTALLED X YES NO SKETCH SHOWN ON SEE SHEET NO. 2

STANDPIPE:	TYPE	PVC	ID, IN.	2	LENGTH, FT.	10	TOP ELEV.	+8.5
INTAKE ELEMENT:	TYPE	SCREENED PVC	OD, IN.	2-3/8	LENGTH, FT.	10	TIP ELEV.	-11.8
FILTER:	MATERIAL	CLEAN SAND	OD, IN.	4	LENGTH, FT.	16	BOT. ELEV.	-11.8

PAY QUANTITIES

3.5" DIA. DRY SAMPLE BORING	LIN. FT.	45	NO. OF 3" SHELBY TUBE SAMPLES	
3.5" DIA. CONTINUOUS SAMPLE BORING	LIN. FT.		NO. OF 3" UNDISTURBED SAMPLES	
CORE DRILLING IN ROCK	LIN. FT.		OTHER: HAND AUGER	6

BORING CONTRACTOR WARREN GEORGE, INC.
DRILLER DAVE OSUCH HELPERS JR GRANT
REMARKS PIEZOMETER INSTALLED.
RESIDENT ENGINEER PATRICK DONALDSON DATE 10-18-13
CLASSIFICATION CHECK: CHERYL J. MOSS TYPING CHECK: CHERYL J. MOSS

MUESER RUTLEDGE CONSULTING ENGINEERS

BORING LOG

BORING NO. B-14
SHEET 1 OF 2
FILE NO. 12047
SURFACE ELEV. 9.9
RES. ENGR. PATRICK DONALDSON

PROJECT: BAY PARK STP - PERIMETER FLOOD PROTECTION
LOCATION: BAY PARK, NEW YORK

DAILY PROGRESS	SAMPLE NO.	SAMPLE DEPTH	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
13:10	1HA	0.0	HAND	Brown fine to medium sand, trace silt, gravel,			DRILLED	
10-07-13		2.0	AUGER	coarse sand, concrete, vegetation (SP-SM)			AHEAD	
Monday	2HA	2.0	HAND	Tan brown fine to medium sand, trace gravel,			4"	
Partly Cloudy		4.0	AUGER	silt (SP-SM)	F		↓	
70°F	3HA	4.0	HAND	Tan brown gravelly fine to coarse sand, trace		5		
13:35		6.0	AUGER	silt (SP)				
09:00	4D	6.0	15-24	Top 8": Brn f-m sand, sm gravel, silt (SM)		6.7		
10-18-13		8.0	44-49	Bot 10": Blk silty f-m sand, tr c sand, gvl (SM)				
Friday	5D	8.0	42-49	Brown fine to medium sand, trace gravel, silt				
Sunny		10.0	31-21	(SP-SM)		10		
65°F	6D	10.0	5-9	Gray fine to coarse sand, some gravel, silt,				
		12.0	8-7	trace vegetation (SM)				
	7D	12.0	8-14	Brown fine to medium sand, some silt, trace				REC=4"
		14.0	11-14	coarse sand, gravel (SM)				
	8D	14.0	7-8	Tan brown fine to medium sand, trace silt		15		
		16.0	10-9	(SP-SM)				
	9D	16.0	12-20	Brown & light brown fine to medium sand,				
		18.0	18-18	trace gravel, silt (SP-SM)				
	10D	18.0	9-13	Light brown fine to medium sand, trace coarse				
		20.0	12-19	sand, gravel, silt (SP)		20		
	11D	20.0	14-25	Light brown fine to medium sand, trace gravel,	S			
		22.0	27-29	silt (SP-SM)				
	12D	22.0	12-23	Light brown fine to medium sand, trace silt				
		24.0	28-32	(SP-SM)				
	13D	24.0	18-22	Light brown fine to medium sand, trace gravel,		25		
		26.0	24-21	silt (SP-SM)				
	14D	26.0	8-12	Light brown fine sand, trace medium sand,				
		28.0	15-16	silt (SP)				
	15D	28.0	10-15	Light brown fine sand, trace silt, medium sand				
		30.0	12-18	(SP)		30		
	16D	30.0	24-27	Light brown & brown fine to medium sand,				
		32.0	23-48	some gravel, trace silt (SP-SM)				
	17D	32.0	28-26	Brown fine to medium sand, trace gravel, silt				
		34.0	19-20	(SP-SM)		34		**Stratum C from 34'
	18D	34.0	10-14	Top 6": Gray silty clay (CL)	**	34.5		to 34.5'.
		36.0	9-12	Bot 12": Or brn f-m sa, sm si, tr cl pkts, c sa (SM)				18D Top: WC=31
	19D	36.0	17-27	Top 4": Orange brn f-m sand, trace silt (SP-SM)				
		37.9	37-50/5"	Bot 7": Gray m-f sand, trace silt (SP-SM)				
	20D	38.0	20-36	Gray fine to medium sand, trace silt (SP-SM)				
		40.0	21-31			40		
	21D	40.0	26-34	Do 20D (SP-SM)				
		42.0	32-40		S			
	22D	42.0	10-26	Do 20D, trace gravel (SP-SM)				
		43.8	40-50/4"					
	23D	44.0	22-35	Gray & orange brown fine to coarse sand, some		45		
		45.8	53-50/3"	gravel, trace silt (SP-SM)				WC=Water Content
	24D	46.0	10-35	Orange brown fine to coarse sand, some				in percent of dry
		47.3	50/3"	gravel, trace silt (SP-SM)				weight.
	25D	48.0	29-51	Do 24D (SP-SM)				
14:00		49.3	50/4"			49.3		End of Boring at 49.3'.

MUESER RUTLEDGE CONSULTING ENGINEERS

BORING NO. B-14
SHEET 2 **OF** 2

PROJECT BAY PARK STP - PERIMETER FLOOD PROTECTION
FILE NO. 12047
LOCATION BAY PARK, NEW YORK
SURFACE ELEV. 9.9
BORING LOCATION SEE BORING LOCATION PLAN
DATUM NAVD 88

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG		TYPE OF FEED DURING CORING		CASING USED		[X] YES	[ ] NO		
TRUCK	MOBILE B-58	MECHANICAL		DIA., IN.	4	DEPTH, FT. FROM	0	TO	4
SKID		HYDRAULIC		DIA., IN.		DEPTH, FT. FROM		TO	
BARGE		OTHER		DIA., IN.		DEPTH, FT. FROM		TO	
OTHER									

TYPE AND SIZE OF:					
D-SAMPLER	2" O. D. SPLIT SPOON	DRILLING MUD USED	[X] YES	[ ] NO	
U-SAMPLER		DIAMETER OF ROTARY BIT, IN.	3-7/8		
S-SAMPLER		TYPE OF DRILLING MUD	EZ-MUD		
CORE BARREL		AUGER USED	[X] YES	[ ] NO	
CORE BIT		TYPE AND DIAMETER, IN.	HAND AUGER		
DRILL RODS	NWJ				

*CASING HAMMER, LBS. 140 AVERAGE FALL, IN. 30
*SAMPLER HAMMER, LBS. 140 AVERAGE FALL, IN. 30
*USED SAFETY (SAMPLER) & AUTOMATIC (CASING) HAMMERS.

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATION
					NO WATER LEVEL OBSERVATIONS MADE.

PIEZOMETER INSTALLED [ ] YES [X] NO SKETCH SHOWN ON

STANDPIPE:	TYPE		ID, IN.		LENGTH, FT.	TOP ELEV.	
INTAKE ELEMENT:	TYPE		OD, IN.		LENGTH, FT.	TIP ELEV.	
FILTER:	MATERIAL		OD, IN.		LENGTH, FT.	BOT. ELEV.	

PAY QUANTITIES

3.5" DIA. DRY SAMPLE BORING	LIN. FT.	4	NO. OF 3" SHELBY TUBE SAMPLES	
3.5" DIA. CONTINUOUS SAMPLE BORING	LIN. FT.	39.3	NO. OF 3" UNDISTURBED SAMPLES	
CORE DRILLING IN ROCK	LIN. FT.		OTHER: HAND AUGER	6

BORING CONTRACTOR WARREN GEORGE, INC.
DRILLER CAESAR MOREIRA HELPERS SAMMY
REMARKS BOREHOLE TREMIE GROUTED UPON COMPLETION.
RESIDENT ENGINEER PATRICK DONALDSON DATE 10-18-13
CLASSIFICATION CHECK: CHERYL J. MOSS TYPING CHECK: CHERYL J. MOSS

MUESER RUTLEDGE CONSULTING ENGINEERS

BORING LOG

BORING NO. B-15
SHEET 1 OF 2
FILE NO. 12047
SURFACE ELEV. 4.9
RES. ENGR. PATRICK DONALDSON

PROJECT: BAY PARK STP - PERIMETER FLOOD PROTECTION
LOCATION: BAY PARK, NEW YORK

DAILY PROGRESS	SAMPLE NO.	SAMPLE DEPTH	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
14:05	1HA	0.0	HAND	Brown fine to coarse sand, some gravel, trace			DRILLED	
10-07-13		2.0	AUGER	silt (SP)			AHEAD	
Monday	2HA	2.0	HAND	Tan brown gravelly fine to coarse sand, trace			4"	
Partly Cloudy		4.0	AUGER	silt (SP)				
70°F	3HA	4.0	HAND	Dark brown fine sandy organic silt, trace	F	5		
14:20		6.0	AUGER	gravel (OL)				
12:00	4D	6.0	4-2	Gray fine to medium sand, some gravel, silt,				REC=2"
10-18-13		8.0	3-6	trace coarse sand (SM)		8		
Friday	5D	8.0	4-9	Light brown fine to medium sand, trace silt,				
Sunny		10.0	12-18	coarse sand, gravel (SP-SM)		10		
70°F	6D	10.0	5-4	Tan, dark brown & orange brown fine to medium				
		12.0	5-6	sand, trace silt, coarse sand (SP)				
						15		
	7D	15.0	6-10	Orange brown fine to medium sand, trace				
		17.0	11-16	silt (SP)				
						20		
	8D	20.0	12-15	Do 7D (SP-SM)				
		22.0	17-25					
						25		
	9D	25.0	10-22	Orange brown & tan fine to coarse sand, some				
		27.0	18-7	gravel, trace silt, silty clay seams (SP-SM)				
					S	30		
	10D	30.0	7-11	Top 12": Gray fine to medium sand, some silt,				
		32.0	18-24	trace clay, coarse sand (SM)				
				Bot 6": Orange brown fine to medium sand,				
				some silt, trace silty clay seams (SM)		35		
	11D	35.0	18-21	Tan & orange brown fine to medium sand, trace				
		37.0	21-23	silt (SP-SM)				
						40		
	12D	40.0	62-50/4"	Orange brown fine to coarse sand, some				
		40.8		gravel, trace silt (SP-SM)				
						45		
	13D	45.0	53-50/3"	Orange brown fine to medium sand, trace				
		45.8		gravel, silt (SP-SM)				
						50		
14:45	14D	50.0	74-50/2"	Orange brown fine to coarse sand, some		50.7		End of Boring at 50.7'.
		50.7		gravel, trace silt (SP-SM)				

MUESER RUTLEDGE CONSULTING ENGINEERS

BORING NO. B-15
SHEET 2 **OF** 2

PROJECT BAY PARK STP - PERIMETER FLOOD PROTECTION
FILE NO. 12047
LOCATION BAY PARK, NEW YORK
SURFACE ELEV. 4.9
BORING LOCATION SEE BORING LOCATION PLAN
DATUM NAVD 88

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

		TYPE OF FEED DURING CORING		CASING USED					
TYPE OF BORING RIG					X YES		NO		
TRUCK	DIETRICH 120	MECHANICAL		DIA., IN.	4	DEPTH, FT. FROM	0	TO	6
SKID		HYDRAULIC		DIA., IN.		DEPTH, FT. FROM		TO	
BARGE		OTHER		DIA., IN.		DEPTH, FT. FROM		TO	
OTHER									

TYPE AND SIZE OF:

D-SAMPLER	2" O. D. SPLIT SPOON
U-SAMPLER	
S-SAMPLER	
CORE BARREL	
CORE BIT	
DRILL RODS	NWJ

DRILLING MUD USED X YES NO
DIAMETER OF ROTARY BIT, IN. 3-7/8
TYPE OF DRILLING MUD EZ-MUD

AUGER USED X YES NO
TYPE AND DIAMETER, IN. HAND AUGER

*CASING HAMMER, LBS. 140 AVERAGE FALL, IN. 30
*SAMPLER HAMMER, LBS. 140 AVERAGE FALL, IN. 30
*USED DONUT HAMMER.

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATION
					NO WATER LEVEL OBSERVATIONS MADE.

PIEZOMETER INSTALLED ☐ YES ☒ NO SKETCH SHOWN ON

STANDPIPE:	TYPE		ID, IN.		LENGTH, FT.		TOP ELEV.
INTAKE ELEMENT:	TYPE		OD, IN.		LENGTH, FT.		TIP ELEV.
FILTER:	MATERIAL		OD, IN.		LENGTH, FT.		BOT. ELEV.

PAY QUANTITIES

3.5" DIA. DRY SAMPLE BORING	LIN. FT.	56.7	NO. OF 3" SHELBY TUBE SAMPLES	
3.5" DIA. CONTINUOUS SAMPLE BORING	LIN. FT.		NO. OF 3" UNDISTURBED SAMPLES	
CORE DRILLING IN ROCK	LIN. FT.		OTHER: HAND AUGER	6

BORING CONTRACTOR WARREN GEORGE, INC.
DRILLER DAVE OSUCH HELPERS JR GRANT
REMARKS BOREHOLE TREMIE GROUTED UPON COMPLETION.
RESIDENT ENGINEER PATRICK DONALDSON DATE 10-18-13
CLASSIFICATION CHECK: CHERYL J. MOSS TYPING CHECK: CHERYL J. MOSS

MUESER RUTLEDGE CONSULTING ENGINEERS

BORING LOG

BORING NO. B-16
SHEET 1 OF 2
FILE NO. 12047
SURFACE ELEV. 5.4
RES. ENGR. PATRICK DONALDSON

PROJECT: BAY PARK STP - PERIMETER FLOOD PROTECTION
LOCATION: BAY PARK, NEW YORK

DAILY PROGRESS	SAMPLE NO.	SAMPLE DEPTH	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
14:35	1HA	0.0	HAND	Brown fine to medium sand, some gravel, silt,			DRILLED	
10-07-13		2.0	AUGER	trace vegetation (SM)			AHEAD	
Monday	2HA	2.0	HAND	Brown fine to coarse sand, some gravel, trace	F		4"	
Partly Cloudy		4.0	AUGER	silt (SW-SM)				
70°F	3HA	4.0	HAND	Gray & tan fine to coarse sand, some silt,		5		
14:55		6.0	AUGER	gravel (SM)		6		
11:00	4D	6.0	4-6	Brown fine to coarse sand, trace gravel, silt				
10-21-13		8.0	7-8	(SP-SM)				
Monday	5D	8.0	5-9	Brown fine to coarse sand, trace gravel, silt				
Sunny		10.0	11-16	(SP)		10		
70°F	6D	10.0	6-13	Tan brown medium to fine sand, trace gravel,				
		12.0	14-16	coarse sand, silt (SP)				
	7D	12.0	8-13	Tan brown fine to medium sand, trace coarse				
		14.0	12-18	sand, silt, gravel (SP)				
	8D	14.0	8-12	Tan brown fine to medium sand, some silt,		15		
		16.0	13-12	trace gravel (SM)				
	9D	16.0	9-17	Tan brown fine to medium sand, trace silt,				
		18.0	21-22	coarse sand (SP)	S			
	10D	18.0	8-14	Tan brown fine to medium sand, trace silt (SP)				
		20.0	14-19			20		
	11D	20.0	10-20	Do 9D (SP-SM)				
		22.0	18-19					
	12D	22.0	10-15	Tan brown & gray fine to medium sand, trace				
		24.0	13-26	silt (SP-SM)				
	13D	24.0	14-19	Tan brown & gray fine to medium sand, trace		25		
		26.0	8-5	silt (SP-SM)				
	14D	26.0	11-6	Brown fine to coarse sand, trace silt, gravel				
		28.0	2-3	(SP)				
	15D	28.0	3-3	Top 7": Do 14D (SP-SM), Mid 8": Gray si cl (CL)		28.6		
		30.0	5-3	Bot 6": Gray f-m sand, sm silt, tr clay (SM)	C	29.3		15D Bot: WC=39
	16D	30.0	17-27	Light brown fine to medium sand, trace silt				
		32.0	25-53	(SP-SM)				
	17D	32.0	36-45	Do 16D (SP-SM)				
		33.4	50/5"					
	18D	34.0	13-19	Light brown & tan fine to medium sand, trace		35		
		36.0	18-13	silt (SP-SM)				
	19D	36.0	16-41	Orange brown gravelly fine to medium sand,				
		37.8	45-50/4"	trace silt, coarse sand (SP-SM)				
	20D	38.0	28-45	Do 19D (SP-SM)				
		39.8	62-50/3"		S	40		
	21D	40.0	50-50/3"	Do 19D (SP-SM)				
		40.8						
	22D	42.0	46-50/3"	Tan gravelly fine to coarse sand, trace silt				REC=6"
		42.8		(SP-SM)				
	23D	44.0	9-24	Tan fine to coarse sand, some gravel, trace		45		WC=Water Content
		46.0	46-70	silt (SP)				in percent of dry
	24D	46.0	12-20	Do 22D (SP-SM)				weight.
		48.0	23-37					
15:15	25D	48.0	30-60/5"	Do 22D (SP-SM)		48.9		End of Boring at 48.9'.
		48.9				50		

MUESER RUTLEDGE CONSULTING ENGINEERS

BORING NO. B-16
SHEET 2 **OF** 2

PROJECT BAY PARK STP - PERIMETER FLOOD PROTECTION
FILE NO. 12047
LOCATION BAY PARK, NEW YORK
SURFACE ELEV. 5.4
BORING LOCATION SEE BORING LOCATION PLAN
DATUM NAVD 88

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG		TYPE OF FEED DURING CORING		CASING USED		X YES		NO		
TRUCK	MOBILE B-58	MECHANICAL		DIA., IN.	4	DEPTH, FT. FROM	0	TO	6	
SKID		HYDRAULIC		DIA., IN.		DEPTH, FT. FROM		TO		
BARGE		OTHER		DIA., IN.		DEPTH, FT. FROM		TO		
OTHER										

TYPE AND SIZE OF:

D-SAMPLER	2" O. D. SPLIT SPOON
U-SAMPLER	
S-SAMPLER	
CORE BARREL	
CORE BIT	
DRILL RODS	NWJ

DRILLING MUD USED X YES NO
DIAMETER OF ROTARY BIT, IN. 3-7/8, 2-15/16
TYPE OF DRILLING MUD EZ-MUD

AUGER USED X YES NO
TYPE AND DIAMETER, IN. HAND AUGER

*CASING HAMMER, LBS. 140 AVERAGE FALL, IN. 30
SAMPLER HAMMER, LBS. 140 AVERAGE FALL, IN. 30
*USED SAFETY (SAMPLER) & AUTOMATIC (CASING) HAMMERS.

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATION
					NO WATER LEVEL OBSERVATIONS MADE.

PIEZOMETER INSTALLED ☐ YES ☒ NO SKETCH SHOWN ON

STANDPIPE:	TYPE		ID, IN.		LENGTH, FT.		TOP ELEV.
INTAKE ELEMENT:	TYPE		OD, IN.		LENGTH, FT.		TIP ELEV.
FILTER:	MATERIAL		OD, IN.		LENGTH, FT.		BOT. ELEV.

PAY QUANTITIES

3.5" DIA. DRY SAMPLE BORING	LIN. FT.	4	NO. OF 3" SHELBY TUBE SAMPLES	
3.5" DIA. CONTINUOUS SAMPLE BORING	LIN. FT.	38.9	NO. OF 3" UNDISTURBED SAMPLES	
CORE DRILLING IN ROCK	LIN. FT.		OTHER: HAND AUGER	6

BORING CONTRACTOR WARREN GEORGE, INC.
DRILLER CAESAR MOREIRA HELPERS CHUCK DAVIDSON
REMARKS BOREHOLE TREMIE GROUTED UPON COMPLETION.
RESIDENT ENGINEER PATRICK DONALDSON DATE 10-21-13
CLASSIFICATION CHECK: CHERYL J. MOSS TYPING CHECK: CHERYL J. MOSS

MUESER RUTLEDGE CONSULTING ENGINEERS

BORING LOG

BORING NO. B-17
SHEET 1 OF 2
FILE NO. 12047
SURFACE ELEV. 3.6
RES. ENGR. PATRICK DONALDSON

PROJECT: BAY PARK STP - PERIMETER FLOOD PROTECTION
LOCATION: BAY PARK, NEW YORK

DAILY PROGRESS	SAMPLE NO.	SAMPLE DEPTH	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
07:25	1HA	0.0	HAND	Brown gravelly fine to coarse sand, some silt,			DRILLED	
10-08-13		2.0	AUGER	trace vegetation (SM)	F		AHEAD	
Tuesday	2HA	2.0	HAND	Brown fine to medium sand, some silt, trace			4"	
Clear		4.0	AUGER	gravel, concrete (SM)		4		
60°F	3HA	4.0	HAND	Tan brown fine to coarse sand, trace gravel,		5		
07:50		6.0	AUGER	silt (SP)				
09:45	4D	6.0	7-9	Light brown fine to coarse sand, trace gravel,				
10-22-13		8.0	13-13	silt (SP-SM)				
Tuesday	5D	8.0	13-13	Light brown fine to medium sand, trace gravel,				
Sunny		10.0	14-16	silt (SP-SM)		10		
65°F	6D	10.0	2-7	Light brown fine to coarse sand, trace gravel,				
		12.0	11-12	silt (SP)				
						15		
	7D	15.0	8-9	Gray brown fine to medium sand, trace silt				
		17.0	13-14	(SP)				
						20		
	8D	20.0	9-8	Orange brown fine to medium sand, trace silt				
11:30		22.0	14-19	coarse sand (SP)				
09:00								
10-23-13								
Wednesday						25		
Overcast	9D	25.0	19-10	Top 8": Orange brown fine to coarse sand,				
55°F		27.0	12-16	trace gravel, silt, silty clay seams (SP-SM)				
				Bot 8': Gray clayey fine to medium sand (SC)	S			
						30		
	10D	30.0	20-25	Tan fine to medium sand, trace silt (SP-SM)				
		32.0	30-37					
						35		
	11D	35.0	15-16	Orange brown fine to coarse sandy gravel, trace				
		37.0	37-36	silt (GP-GM)				
						40		
	12D	40.0	32-34	Orange brown fine to medium sand, trace				
		41.7	50-50/2"	silt, gravel, coarse sand (SP-SM)				
						45		
	13D	45.0	9-5	Tan fine sand, some silt (SM)				
		47.0	7-8					
						50		
	14D	50.0	7-9	Top 12": Do 13D (SM)				
11:45		52.0	10-10	Bot 12": Tan f-m sand, sm silt, tr gravel (SM)		52		End of Boring at 52'.

MUESER RUTLEDGE CONSULTING ENGINEERS

BORING NO. B-17
SHEET 2 **OF** 2

PROJECT BAY PARK STP - PERIMETER FLOOD PROTECTION
FILE NO. 12047
LOCATION BAY PARK, NEW YORK
SURFACE ELEV. 3.6
BORING LOCATION SEE BORING LOCATION PLAN
DATUM NAVD 88

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG		TYPE OF FEED DURING CORING		CASING USED		X YES		NO		
TRUCK	DIETRICH 120	MECHANICAL		DIA., IN.	4	DEPTH, FT. FROM	0	TO	6	
SKID		HYDRAULIC		DIA., IN.		DEPTH, FT. FROM		TO		
BARGE		OTHER		DIA., IN.		DEPTH, FT. FROM		TO		
OTHER										

TYPE AND SIZE OF:					
D-SAMPLER	2" O. D. SPLIT SPOON	DRILLING MUD USED	X YES	NO	
U-SAMPLER		DIAMETER OF ROTARY BIT, IN.	3-7/8		
S-SAMPLER		TYPE OF DRILLING MUD	EZ-MUD		
CORE BARREL		AUGER USED	X YES	NO	
CORE BIT		TYPE AND DIAMETER, IN.	HAND AUGER		
DRILL RODS	NWJ				

*CASING HAMMER, LBS. 140 AVERAGE FALL, IN. 30
*SAMPLER HAMMER, LBS. 140 AVERAGE FALL, IN. 30
*USED DONUT HAMMER.

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATION
					NO WATER LEVEL OBSERVATIONS MADE.

PIEZOMETER INSTALLED ☐ YES ☒ NO SKETCH SHOWN ON

STANDPIPE:	TYPE		ID, IN.		LENGTH, FT.	TOP ELEV.	
INTAKE ELEMENT:	TYPE		OD, IN.		LENGTH, FT.	TIP ELEV.	
FILTER:	MATERIAL		OD, IN.		LENGTH, FT.	BOT. ELEV.	

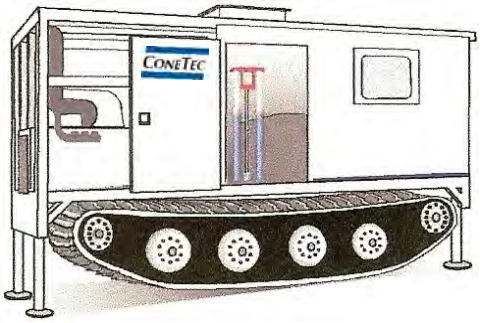
PAY QUANTITIES

3.5" DIA. DRY SAMPLE BORING	LIN. FT.	46	NO. OF 3" SHELBY TUBE SAMPLES	
3.5" DIA. CONTINUOUS SAMPLE BORING	LIN. FT.		NO. OF 3" UNDISTURBED SAMPLES	
CORE DRILLING IN ROCK	LIN. FT.		OTHER: HAND AUGER	6

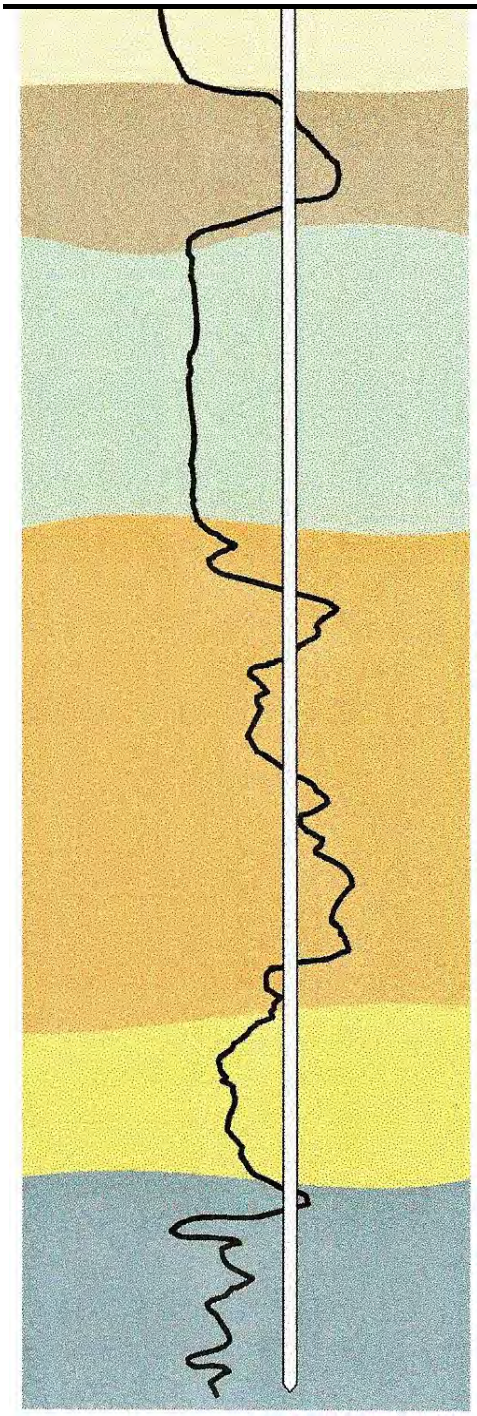
BORING CONTRACTOR WARREN GEORGE, INC.
DRILLER DAVE OSUCH HELPERS JR GRANT
REMARKS BOREHOLE TREMIE GROUTED UPON COMPLETION.
RESIDENT ENGINEER PATRICK DONALDSON DATE 10-23-13
CLASSIFICATION CHECK: CHERYL J. MOSS TYPING CHECK: CHERYL J. MOSS

APPENDIX B

CONETEC FIELD REPORT



Geotechnical and Environmental In Situ Testing Contractors



ConeTec Field Report

Presentation of In Situ Test Results for:

Bay Park Sewage Treatment Plant
Bay Park, New York

Presented to: ARCADIS

Date: October 21st, 2013

Presented by: ConeTec, Inc.
436 Commerce Lane
Unit C
West Berlin, NJ 08091
(856) 767-8600

PRESENTATION OF IN SITU TESTING PROGRAM RESULTS

Bay Park Sewage Treatment Plant
Bay Park, New York

October 7th, 2013 through October 17th, 2013

Prepared for:

ARCADIS
Long Island City, New York

Prepared by:
ConeTec Inc.
West Berlin, NJ

October 21st, 2013

TABLE OF CONTENTS

1.0 INTRODUCTION

This report presents the results of a piezocone penetrometer testing (CPTU) program carried out at the Bay Park Sewage Treatment Plant located Bay Park, New York. The work was performed under subcontract to ARCADIS of Long Island City, New York. The CPTU program took place from October 7th, 2013 through October 17th, 2013.

A total of thirty nine soundings were completed at thirty nine different sounding locations. The CPT testing was performed to evaluate insitu geotechnical criteria of the soils.

CPT sounding locations were selected and numbered under the direction and supervision of Mueser personnel (Mr. Patrick Donaldson).

2.0 FIELD EQUIPMENT AND PROCEDURES

2.1 CONE PENETRATION TESTING

The cone penetrometer tests were carried out using an integrated electronic piezocone manufactured by ConeTec in Vancouver, Canada. The piezocone used was a compression model cone penetrometer with a 15 cm^2 tip and a 225 cm^2 friction sleeve. The cone is designed with an equal end area friction sleeve and a tip end area ratio of 0.80. The piezocone dimensions and the operating procedure were in accordance with ASTM Standard D-5778-12. A diagram of the cone penetrometer used for this project is shown as Figure 1.

Pore pressure filter elements, made of porous plastic, were saturated under a vacuum using silicone as the saturating fluid. The pore pressure element was six millimeters thick and was located immediately behind the tip (the u_2 location) for all soundings.

The cone was advanced using ConeTec's, unitized, 25-ton CPT truck rig. The following data were recorded onto magnetic media every five centimeters (approximately every two inches) as the cone was advanced into the ground:

- Tip Resistance (qc)
- Sleeve Friction (fs)
- Dynamic Pore Pressure (u_t)

Before each sounding a complete set of analog baseline readings are taken with a multi-meter and compared with the digitized value on the computer screen. This provides a check on the analog to digital conversion board.

Evaluation of the analog baselines is key to consistent readings. The baseline data should be stable and should not wander excessively during the course of a sounding. Baseline data can be used to apply corrections to the cone data where necessary. For this project, the baseline shift from sounding to sounding was small, typically less than 0.1% of full scale, and no data corrections were applied.

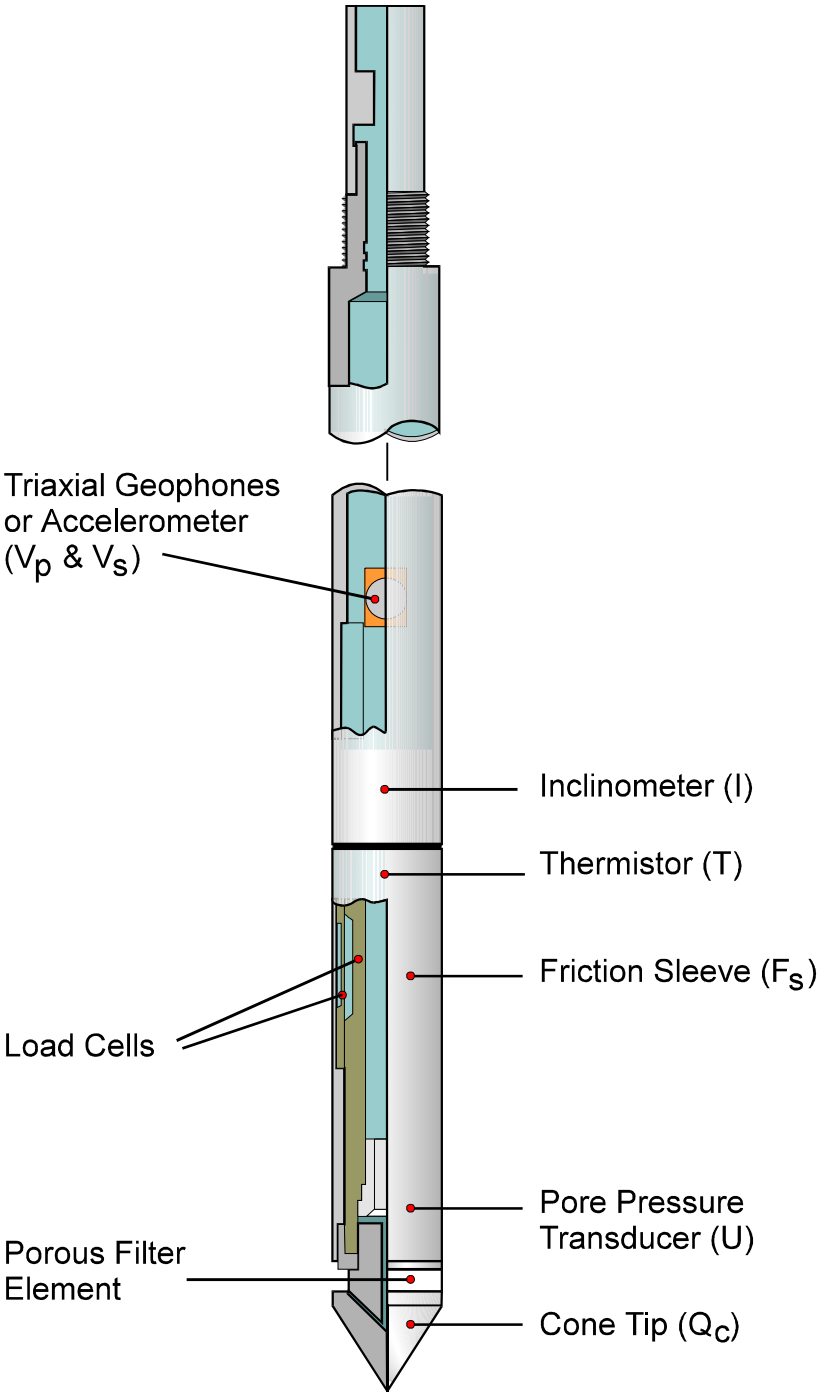


FIGURE 1 - TYPICAL CONE PENETROMETER

2.2 PORE PRESSURE DISSIPATION TESTS

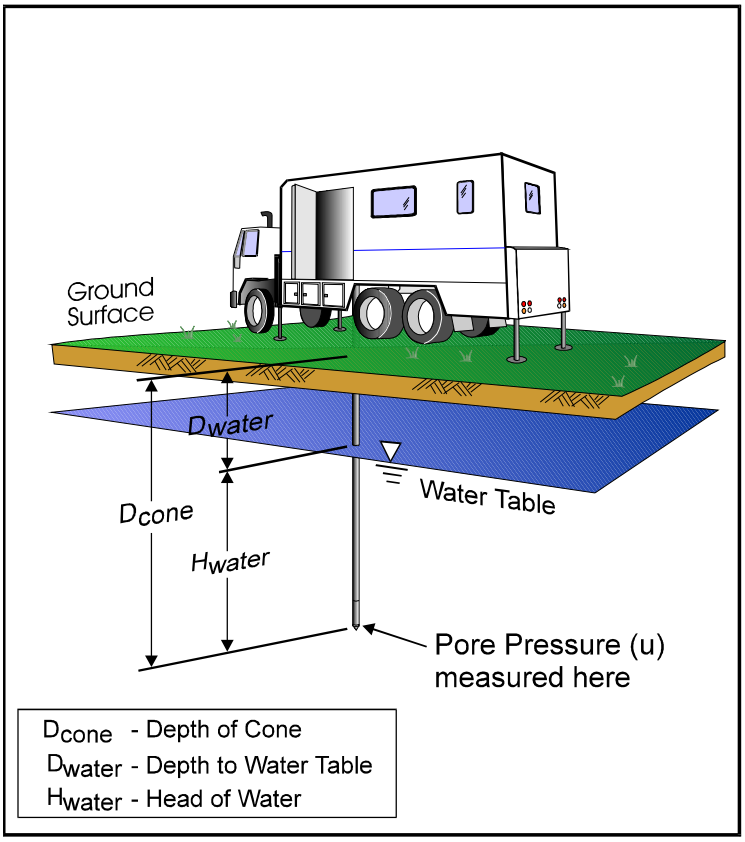
When cone penetration is stopped, the piezocone essentially becomes a piezometer. While stopped, pore water pressures are automatically recorded at five-second intervals and the readings are stored in a dissipation file (.ppd). Dissipation data can then be plotted onto a dissipation curve consisting of pore water pressure (u) verses time (t). The shapes of dissipation curves are very useful in evaluating soil type, drainage and in situ static water level.

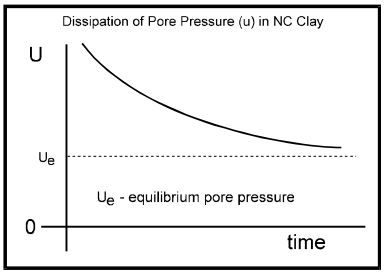
A flat curve that stabilizes quickly (i.e. less than 30 seconds) is typical of a free draining sand. In this case, the final measured pore water pressure is the static in situ water pressure.

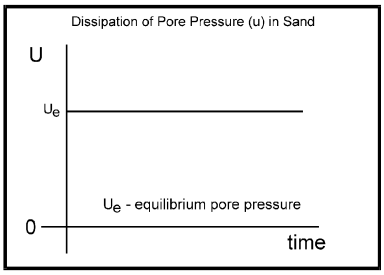
Soils that generate excess dynamic pore water pressure during penetration will dissipate this excess pressure when penetration stops. The shape of the dissipation curve and the time of dissipation can be used to estimate C_h, the coefficient of consolidation that can in turn be used to calculate K_h, the horizontal permeability.

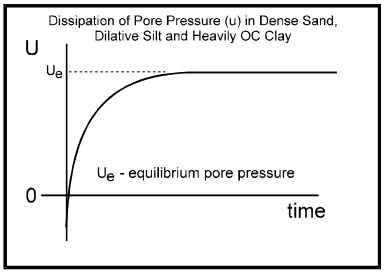
Figure 2 shows some idealized shapes of various pore water pressure dissipation curves. The reader is referred Robertson et. al., 1990 to reference dissipation test data analytical techniques.

Estimation of Ground Water Table from CPT Dissipation Tests









Water Table Calculation

$$D_{water} = D_{cone} - H_{water}$$

where $H_{water} = U_e$ (depth units)

Useful Conversion Factors: 1psi = 0.704m = 2.31 feet (water)
1tsf = 0.958 bar = 13.9 psi
1m = 3.28 feet

FIGURE 2 - TYPICAL DISSIPATION TESTS

3.0 CONE PENETRATION TEST DATA AND INTERPRETATION

3.1 ANALYSIS OF PIEZOCONE DATA - GENERAL

A total of thirty nine CPT soundings, involving 2,155.32 feet of testing, were completed.

The interpretation of cone data is based on the relationship between cone bearing, qc, sleeve friction, fs, and penetration pore water pressure, u. The friction ratio, Rf , (sleeve friction divided by cone bearing) is a calculated parameter which is used to infer soil behavior type. Generally, saturated cohesive soils have low tip resistance, high friction ratios and generate large excess pore water pressures. Cohesionless soils have higher tip resistances, lower friction ratios and do not generate significant excess pore water pressure.

The interpretation of soils encountered on this project was carried out using correlations developed by Robertson, 1989. It should be noted that it is not always possible to clearly identify a soil type based on qc, fs and u. Occasionally soils will fall within different soil categories on the classification charts. In these situations, experience and judgment and an assessment of the pore pressure dissipation data should be used to infer the soil behavior type. Computer tabulations of the interpreted soil types along with certain other geotechnical parameters for each cone hole is presented in Appendix B.

Each of the parameters measured in the sounding is discussed briefly below. A detailed explanation of CPTU testing and interpretation of the results can be found in Robertson, 1989.

TIP RESISTANCE (q_c): The resistance to penetration, measured at the cone tip, provides an accurate profile of subsurface strata. The recorded tip resistance is a composite of the penetration resistance of the soils located five to ten cone diameters (7 to 14 inches) in front of and behind the tip. The actual resistance "sensed" by the tip depends on the soil properties and on the relative stiffness of the layers encountered. Tip resistance is often corrected for pore pressure effects when testing in soft saturated cohesive soils.

For this project the correction was made and the tip resistance shown, q_t is the corrected tip resistance.

The correction used is: $q_t = q_c + (1-a)u$

Where:
- q_t = corrected tip resistance
- q_c = measured tip resistance
- a = net area ratio for cone (0.80 for this project)
- u = dynamic pore water pressure measured behind tip

SLEEVE FRICTION (f_s) The resistance recorded on the friction sleeve, is a measure of the remolded strength of the soil. Values of sleeve friction in very soft soils (such as peat) may fluctuate due to the measured force being small relative to the capacity of the measuring load cell.

FRICTION RATIO (R_f) The ratio of sleeve friction to tip resistance expressed as a percentage, is an indicator of soil type. Cohesive soils generally have friction ratios that are greater than two, while sands and non-plastic silts have friction ratios that are lower than two.

PORE PRESSURE (u*)* Dynamic pore water pressure is measured during penetration. (dynamic pore water pressure data can be found in the .cor, and .xls files. Static pore water pressure is measured when cone penetration is stopped (static pore water pressure data can be found in the .ppd files). The measured dynamic pore water pressure changes with the location of the porous filter and negative readings are possible when the filter is located behind the tip.

It is important to note that the CPT classifies soil by physical behavior, not by grain size; therefore, the CPT classification should be verified against samples obtained from a conventional drilling program. While the CPT soil classification may not always be accurate in terms of the actual label it applies to a particular soil, it is very accurate in grouping soils with similar mechanical properties.

3.2 CONE PLOTS

The data from each sounding was plotted using the computer program SCREENzW. The plots are included in Appendix A. SCREENzW was developed by ConeTec Inc. and it incorporates soil behavior type (SBT) classification as part of the plot. The soil classification is based on the classification chart reproduced chart in Appendix B.

3.3 PORE PRESSURE DISSIPATION TEST RESULTS

Pore water pressure dissipation data are collected and automatically recorded during pauses in penetration. The pore water pressure data is recorded at five second intervals. Numerous pore water pressure dissipation tests were performed on this project. Those plots can be found in Appendix C.

3.4 CPT DATA PROCESSING

The electronic data files were processed using the program SCREENzW. SCREENzW is a program developed by ConeTec to calculate common engineering parameters from CPT data. The processed data file summery sheet is attached in Appendix B. The files (IFI.xls) are included in the electronic data package. The calculations used are summarized in the table at the front of the Appendix. Each calculation is derived according to the referenced article.

For this project, the piezometric surface used was determined from the pore water pressure dissipation tests and the dynamic pore water pressure responses recorded during the CPT. The exact depth used can be found in the headers of the ifi.xls files.

3.5 ELECTRONIC DATA FILES

Along with the report, all of the project data can be downloaded from ConeTec's "ConeTec Data Services" (CDS) website (www.conetecdataservices.com) using a secure, project-specific user name and password. These electronic files contain all important project information including tabular data (.xls and ASCII formats), GPS coordinates of approximate sounding locations, dynamic and static pore water pressure and some basic interpretation files in Microsoft™ Excel format (.xls). Information regarding the digital file formats of the electronic files is included in Appendix D.

5.0 REFERENCES

Robertson, P.K., 1989, “Soil Classification using the Cone Penetration Test”, Canadian Geotechnical Journal, vol. 27, pages 151-158.

Robertson, P.K., Sully, J., Woeller, D.G., Lunne, T., Powell, J.M., and Gillespie, D.J., 1992, “Estimating Coefficient of Consolidation from Piezocone Tests”, Canadian Geotechnical Journal, vol. 29, pages 539-550.

Appendix A

Job No: 13-53065
Client: ARCADIS
Project: Bay Park STP
Date: October 7, 2013 through October 17, 2013

TABLE 1 Summary of CPT Soundings

CPT Sounding	File Name	Date	Cone	Assumed Phreatic Surface (ft)	Final Depth (ft)	Northing UTM Zone 18	Easting UTM Zone 18
CPTu-01	13-53065_CP01	10/14/2013	206:T1500F15U500	4.65	43.96	4498984	613106
CPTu-02	13-53065_CP02	10/16/2013	206:T1500F15U500	5.60	48.56	4498978	613118
CPTu-03	13-53065_CP03	10/16/2013	206:T1500F15U500	9.98	56.76	4498942	613156
CPTu-04	13-53065_CP04	10/14/2013	206:T1500F15U500	6.20	46.42	4498977	613129
CPTu-05	13-53065_CP05	10/7/2013	206:T1500F15U500	6.83	51.02	4498909	613185
CPTu-06	13-53065_CP06	10/7/2013	206:T1500F15U500	7.05	47.41	4498855	613182
CPTu-07	13-53065_CP07	10/15/2013	206:T1500F15U500	4.50	44.29	4498841	613200
CPTu-08	13-53065_CP08	10/8/2013	206:T1500F15U500	5.44	57.25	4498789	613174
CPTu-09	13-53065_CP09	10/8/2013	206:T1500F15U500	5.60	46.92	4498695	613140
CPTu-10	13-53065_CP10	10/8/2013	206:T1500F15U500	5.81	47.74	4498649	613120
CPTu-11	13-53065_CP11	10/15/2013	206:T1500F15U500	7.00	48.72	4498642	613126
CPTu-12	13-53065_CP12	10/8/2013	206:T1500F15U500	5.00	48.23	4498594	613158
CPTu-13	13-53065_CP13	10/8/2013	206:T1500F15U500	6.00	64.47	4498553	613160
CPTu-14	13-53065_CP14	10/9/2013	206:T1500F15U500	6.72	42.65	4498474	613179
CPTu-15	13-53065_CP15	10/9/2013	206:T1500F15U500	5.00	46.42	4498414	613135
CPTu-16	13-53065_CP16	10/17/2013	206:T1500F15U500	3.84	43.31	4498433	613190
CPTu-17	13-53065_CP17	10/14/2013	206:T1500F15U500	5.00	51.67	4498388	613132
CPTu-18	13-53065_CP18	10/9/2013	206:T1500F15U500	4.41	50.69	4498412	613119
CPTu-19	13-53065_CP19	10/9/2013	206:T1500F15U500	5.00	52.82	4498424	613076
CPTu-20	13-53065_CP20	10/15/2013	206:T1500F15U500	7.90	65.12	4498440	612991
CPTu-21	13-53065_CP21	10/9/2013	206:T1500F15U500	4.79	67.58	4498483	612921

CPTu-22	13-53065_CP22	10/17/2013	206:T1500F15U500	7.30	66.11	4498466	612928
CPTu-23	13-53065_CP23	10/10/2013	206:T1500F15U500	8.44	75.13	4498512	612857
CPTu-24	13-53065_CP24	10/15/2013	206:T1500F15U500	8.50	75.13	4498513	612822
CPTu-25	13-53065_CP25	10/10/2013	206:T1500F15U500	9.56	54.95	4498549	612847
CPTu-26	13-53065_CP26	10/15/2013	206:T1500F15U500	10.10	75.13	4498602	612811
CPTu-27	13-53065_CP27	10/10/2013	206:T1500F15U500	10.20	75.13	4498624	612838
CPTu-28	13-53065_CP28	10/17/2013	206:T1500F15U500	3.00	48.88	4498723	612865
CPTu-29	13-53065_CP29	10/17/2013	206:T1500F15U500	13.33	52.17	4498784	612888
CPTu-30	13-53065_CP30	10/16/2013	206:T1500F15U500	13.31	56.27	4498872	612923
CPTu-31	13-53065_CP31	10/17/2013	206:T1500F15U500	13.30	50.36	4498891	612888
CPTu-32	13-53065_CP32	10/10/2013	206:T1500F15U500	11.76	51.35	4498957	612933
CPTu-33	13-53065_CP33	10/10/2013	206:T1500F15U500	7.00	75.13	4498987	612874
CPTu-34	13-53065_CP34	10/11/2013	206:T1500F15U500	5.17	41.34	4499055	612900
CPTu-35	13-53065_CP35	10/11/2013	206:T1500F15U500	7.00	69.39	4499030	612966
CPTu-37	13-53065_CP37	10/11/2013	206:T1500F15U500	4.00	57.58	4499107	612923
CPTu-38	13-53065_CP38	10/11/2013	206:T1500F15U500	3.68	40.03	4499104	612999
CPTu-39	13-53065_CP39	10/14/2013	206:T1500F15U500	3.90	44.13	4499111	613069
CPTu-40	13-53065_CP40	10/14/2013	206:T1500F15U500	3.20	75.13	4499072	613107
Totals:	39				2155.32		

Note: Hydrostatic water table assumed for interpretation tables and based on pore pressure dissipations.

Non-Normalized CPT Plots