Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

BORING NUMBER B-1501/ MW1501R

CLIENT American Electric Power
PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plant
CEC PROJECT NUMBER 110-416
PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia
DATE STARTED 6/4/15 **COMPLETED** 7/29/15
GROUND ELEVATION 1158.80 ft **HOLE SIZE** 8.00"
DRILLINGCONTRACTOR AEP
TOP OF PVC ELEVATION 1161.78 ft
DRILLING METHOD 4.25" I.D. HSA: Auto Hammer & Rotary Rock Core
GROUND WATER LEVELS:
LOGGED BY D. Follett **CHECKED BY** RAS
AT END OF DRILLING ---
LOCATION N 484663.0, E 1609913.5

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	Elev.	WELL DIAGRAM
0	SS 1	67	2-2-2 (4)	1.5	Brown LEAN CLAY (CL), trace roots, trace organics, trace moist, medium stiff, highly plastic, cohesive (RESIDUAL)	1157.3	
	SS 2	53	2-2-7 (9)	3.0	Light Brown LEAN CLAY WITH SILT (CL), trace sand, dry, very stiff, low plasticity, massive (RESIDUAL)	1155.8	
	SS 3	60	4-7-8 (15)	4.5	Burgundy LEAN CLAY (CL), dry, very stiff, massive (RESIDUAL)	1154.3	
5	SS 4	60	4-8-17 (25)		Brown LEAN CLAY WITH SILT (CL), trace fine sand, trace organics, very stiff, dry, massive (RESIDUAL)		Bentonite Grout
	SS 5	67	2-2-10 (12)	7.5	Some mottling	1151.3	
	SS 6	100	50		Tan SILT (ML), medium stiff, massive, non cohesive, non plastic (RESIDUAL)		
10	SS 7	100	50	10.5	SILTSTONE gravel in spoon	1148.3	
	SS 8	100	50/4"		Light green SILTSTONE, slightly micaceous, some calcereous limestone inclusions, moderately decomposed, moderately friable, moderate strength		
	RC 1	125 (0)			At 15.1' healed iron stained sub vertical fracture, from 16.6 to 17.0' vertical fracture		
15							4-Inch Solid PVC Riser
20	RC 2	99 (39)		21.7	Interbedded SHALE from 19.5' to 19.6'	1137.1	
				26.4	Blue gray SHALE, strong, hard, laminated, slightly decomposed, moderately friable, non calcereous, moderate to highly fractured Iron stained vertical fractures from 22.2' to 22.7' and 23.1' to 23.2' Iron stained vertical fracture 24.0' to 24.1'	1132.4	
25				26.6	Tan CLAYSTONE, weak, highly decomposed, moderately friable	1132.2	
				30.2	Gray LIMESTONE, strong, hard, microcrystaline, calcereous, massive, slightly decomposed, slightly friable, slightly to moderately fractured	1128.6	
30	RC 3	101 (52)		35.0	Gray CLAYSTONE, weak, calcereous, massive, moderately decomposed, slightly disintegrated, moderately to intensely fractured. Iron stained vertical fracture 33.5' to 34.0' Iron stained sub vertical fracture at 35.0'	1123.8	Bentonite Grout
35							

(Continued Next Page)

BORING NUMBER B-1501/ MW1501R

CLIENT American Electric Power
PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plant
CEC PROJECT NUMBER 110-416
PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	DEPTH (ft)	MATERIAL DESCRIPTION	ELEV.	WELL DIAGRAM
35	RC 4	102 (57)			Gray CLAYSTONE, weak, calcereous, massive, moderately decomposed, slightly friable, moderately to highly fractured. At 35.0' color change to gray burgundy, moderate to strong, massive, slightly decomposed, slightly friable. Iron stained sub vertical fractures at 37.6', 39.0', 39.2' and 39.8'		Bentonite Grout
				40.5	Burgundy CLAYSTONE, moderate to strong, massive, moderately decomposed, moderately friable, very highly fractured. Iron stained sub vertical fractures at 40.7', 41.0' and 41.4'	1118.3	
				41.5	Gray CLAYSTONE, strong, massive, few calcereous limestone nodules, moderately decomposed, moderately friable. Iron stained vertical fractured 42.7 to 43.3'	1117.3	
				43.0	Gray LIMESTONE, hard, microcrystaline, calcereous, moderately decomposed, slightly friable, some styolites. Iron stained sub vertical fractured at 44.3'	1115.8	
				44.0	Brown SILTSTONE, strong, micaceous, some limestone inclusions, slightly decomposed, slightly friable, highly fractured. Iron stained vertical fracture from 44.7' to 45.2'	1114.8	
45	RC 5	102 (81)		45.0	Gray SHALE, strong, hard, slightly decomposed, slightly friable, few gray calcereous nodules. Iron stained vertical fracture at 49.0'	1113.8	
				52.3	Burgundy CLAYSTONE, strong, fresh, massive, slightly friable, moderately fractured	1106.5	
55	RC 6	99 (84)		55.0	Gray CLAYSTONE, moderate strength, few limestone clasts, slightly decomposed, slightly friable. At 56.4' sharp contact	1103.8	4-Inch Solid PVC Riser
				56.4	Brown SANDSTONE, strong, micaceous, trace mangenese, very thinly bedded, cross bedded, moderately decomposed, moderately friable, few limestone inclusions, moderately fractured. Iron stained vertical fracture from 57.1' to 57.5' and 60.5' to 60.7'	1102.4	
				62.1	Gray & Burgundy CLAYSTONE, weak, micaceous, massive, slightly decomposed, moderately friable, moderately fractured, sharp contact. Sub vertical fracture 63.5' to 64.0'	1096.7	
65	RC 7	100 (78)		67.0	Blue gray SHALE, moderate to strong, laminated, slightly decomposed, slightly friable, some limestone nodules, some CLAYSTONE interbeds, slightly fractured	1091.8	Bentonite Grout
75				73.0	Gray & Burgundy CLAYSTONE, weak to moderate strength, fresh, slightly friable, moderately fractured	1085.8	

(Continued Next Page)

CLIENT American Electric Power
PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plant
CEC PROJECT NUMBER 110-416
PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MATERIAL DESCRIPTION	WELL DIAGRAM
75				Gray & Burgundy CLAYSTONE, weak to moderate strength, fresh, slightly friable, moderately fractured *(continued)*	
80	RC 8	95 (76)			Bentonite Grout
82.2 / 82.4				1076.6 / 1076.4 Dark gray LIMESTONE, strong, hard, medium bedded, slightly decomposed, slightly friable	
				Gray & Burgundy CLAYSTONE, weak to moderate strength, fresh, slightly friable, moderately fractured	
85.2				1073.6 Light green SANDSTONE, strong, fine grained, some calcereous clasts, fresh, trace mica, trace manganese, slightly friable, slightly to moderately fractured Lost part of core run # 9, picked up core on core run # 10	
90	RC 9	45 (28)			
92.0 / 92.6				1066.8 / 1066.2 Dark green SILTSTONE, fresh, massive, competent, slightly to moderately fractured	
				Light green SANDSTONE, strong, fresh, very fine grained, micaceous, thinly bedded, few cross beds, competent, well cemented, slightly to moderately fractured Fresh sub vertical fracture from 97.3' to 97.7'	4-Inch Solid PVC Riser
95	RC 10	199 (171)			
100					
101.0	RC 11	94 (76)		1057.8 Gray CLAYSTONE, strong, massive, slightly decomposed, slightly friable, moderately fractured	
102.2				1056.6 Color change to dark gray at 101.9', moderately friable	
104.0				1054.8 Light green SILTSTONE, strong, fresh, massive, slightly decomposed, slightly friable, moderately fractured	
105				Light green gray SANDSTONE, strong, micaceous, very fine grained, fresh, competent, well cemented, calcereous, slightly to moderately fractured Sharp contact at 108.1'	
108.1	RC 12	102 (101)		1050.7 Green CLAYSTONE, strong, massive, interbedded with very fine grained SANDSTONE, slightly to moderately fractured	
110					Bentonite Grout
113.5				1045.3 Dark gray to black SHALE, strong, massive, slightly decomposed, slightly friable, moderately fractured	
114.4 / 114.8				1044.4 / 1044.0	
115					

(Continued Next Page)

Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

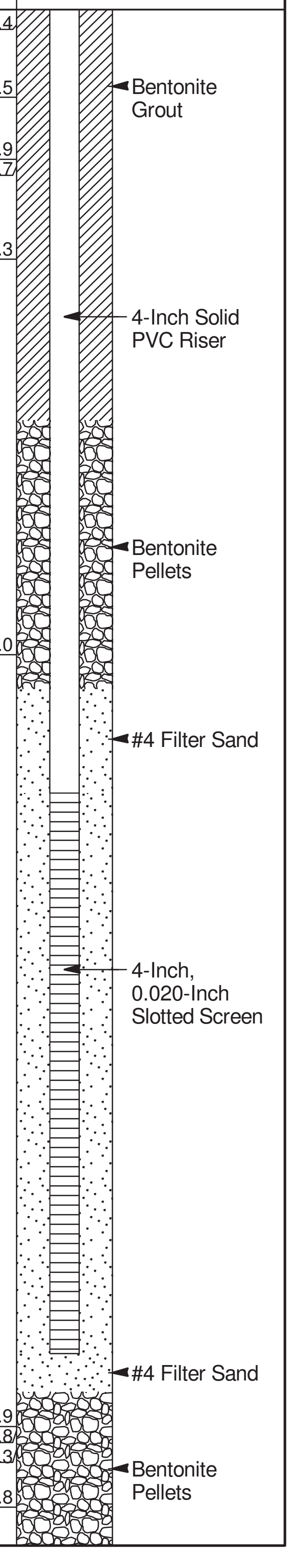
BORING NUMBER B-1501/ MW1501R

CLIENT American Electric Power
PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plant
CEC PROJECT NUMBER 110-416
PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)
115	RC 13	102 (64)	
	RC 14	100 (98)	
	RC 15	100 (100)	
	RC 16	99 (92)	
	RC 17	99 (84)	
155			

Depth (ft)	MATERIAL DESCRIPTION	Elevation
115.4	Burgundy CLAYSTONE, strong, massive, moderately decomposed, moderately friable, moderately fractured	1043.4
117.3	Dark Gray to Black CLAYSTONE, strong, massive, carbonaceous, moderately decomposed, moderately friable Grades to light green CLAYSTONE *(continued)*	1041.5
118.9	Light green SANDSTONE, strong, fresh, fine grained, thinly bedded, competent, well cemented	1039.9
119.1	Black SHALE, strong, laminated, carbonaceous, pyrite stringers, slightly decomposed, moderately friable, slightly fractured	1039.7
121.5	Black COAL, weak, massive, blocky	1037.3
	Gray LIMESTONE, strong, microcrystaline, calcereous, unfractured Sub vertical fracture 120.4' to 120.8'	
	Light gray SILTSTONE, strong, thick bedded, limestone nodules throughout, slightly decomposed, slightly friable At 123.4' interbedded with fine grained cross bedded SANDSTONE	
131.8	Gray SANDSTONE, strong, hard, fine grained, well sorted, micaceous, some thin to medium bedded cross beds, well cemented, dark gray mica seams <1/16" , slightly fractured to unfractured Horizontial fractures along medium grained mica at 135.2', 135.55', and 143.5' Sub horizontial fracture at 138.8' and 145.5'	1027.0
151.9		1006.9
152.0	Light green gray CLAYSTONE, weak, massive, slightly decomposed, slightly friable	1006.8
152.5	Dark gray SHALE, moderate strength, carbonaceous, laminated, few red CLAYSTONE stringers, slightly decomposed, slightly friable, moderately fractured	1006.3
154.0		1004.8

WELL DIAGRAM



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Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

BORING NUMBER B-1501/ MW1501R

CLIENT American Electric Power
PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plant
CEC PROJECT NUMBER 110-416
PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
155	RC 18	96 (58)			Gray to dark gray LIMESTONE, strong, hard, microcrystaline, slightly decomposed, slightly friable, moderately fractured Sub vertical fracture at 152.8' Sub horizontial fracture at 153.6' and 153.8'		
159.0					Dark gray to burgundy CLAYSTONE, strong, massive, calcereous, slightly decomposed, slightly friable, moderately fractured Sub horizontial fractures / slickenslides at 155.0', 155.7', 156.5', 157.5' and 157.8' Very highly fractured from 158.0' to 158.7' *(continued)*	999.8	
160	RC 19	101 (101)			Light green SANDSTONE, strong, fine grained, thin to thickly bedded, fresh, competent, slight to unfractured, some dark thinly bedded mica beds <1/16" Vertical fracture 168.9' to 169.0'		Bentonite Pellets
165							
169.0						989.8	
169.6					Green gray SHALE, weak, laminated, slightly decomposed, slightly friable, highly fractured	989.2	
170	RC 20	77 (52)			Gray to Burgundy CLAYSTONE, moderate strength, massive, moderately decomposed, moderately friable, moderately fractured Sub horizontial fractures / slickenslides at 171.1', 171.8' and 172.4'		
173.1						985.7	
175					Light green gray SILTSTONE, strong, massive, fresh, competent, slightly decomposed, interbedded with few CLAYSTONE beds, moderately fractured Lost part of core run # 20, retrieved on core run # 21		Bentonite Pellets
179.7						979.1	
180	RC 21	104 (104)			Light green gray SANDSTONE, strong, fine grained, thinly bedded, calcereous, fresh, competent, slightly fractured		
181.4						977.4	
					Burgundy to gray SHALE, moderate strength, laminated, slightly decomposed, slightly friable, highly fractured		
183.7					Very highly fractured at 183.0' Vertical healed fracture at 183.4'	975.1	
184.0					Light green gray SANDSTONE, strong, fine grained, thinly bedded, calcereous, fresh, competent, slightly fractured	974.8	

Bottom of hole at 184.0 feet

Monitoring well installed on 8/05/2015

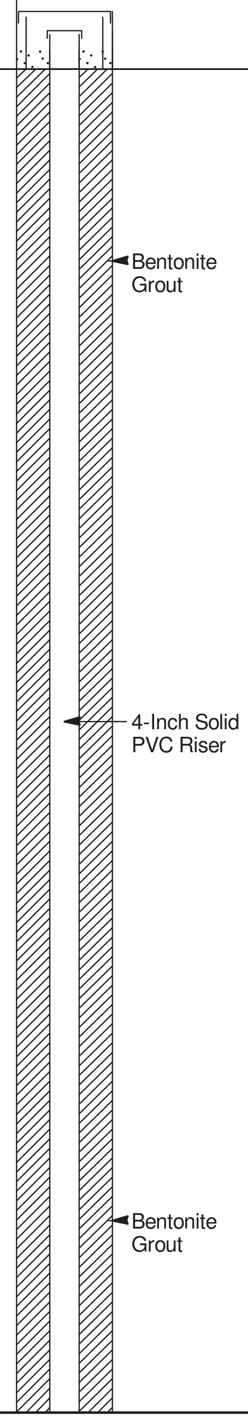
Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

BORING NUMBER MW1501F

CLIENT American Electric Power
PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plant
CEC PROJECT NUMBER 110-416
PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia
DATE STARTED 7/30/15 **COMPLETED** 7/30/15
GROUND ELEVATION 1158.84 ft **HOLE SIZE** 8.00"
DRILLINGCONTRACTOR AEP
TOP OF PVC ELEVATION 1161.83 ft
DRILLING METHOD 4.25" I.D. HSA: Auto Hammer & Rotary Rock Core
GROUND WATER LEVELS:
LOGGED BY D. Follett **CHECKED BY** RAS
AT END OF DRILLING ---
LOCATION N 484662.0, E 1609917.5

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION
0			Blind drilled from 0' to 107'. See B-1501 boring log for description.
5			
10			
15			
20			
25			
30			
35			

WELL DIAGRAM



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Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

BORING NUMBER MW1501F

CLIENT American Electric Power

PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416

PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35			Blind drilled from 0' to 107'. See B-1501 boring log for description. *(continued)*	
40				Bentonite Grout
45				
50				
55				4-Inch Solid PVC Riser
60				
65				
70				Bentonite Grout
75				

(Continued Next Page)

Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

BORING NUMBER MW1501F

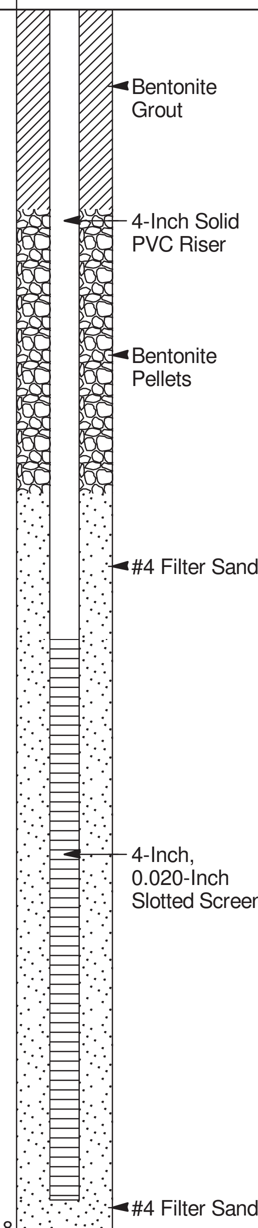
CLIENT American Electric Power

PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416

PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
75			Blind drilled from 0' to 107'. See B-1501 boring log for description. *(continued)*	
80				
85				
90				
95				
100				
105				
			107.0	1051.8
			Bottom of hole at 107.0 feet	
			Monitoring well installed on 8/06/2015	



BORING NUMBER MW1502R

Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

CLIENT American Electric Power
PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plant
CEC PROJECT NUMBER 110-416
PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia
DATE STARTED 6/3/15 **COMPLETED** 7/31/15
GROUND ELEVATION 1045.23 ft **HOLE SIZE** 8.00"
DRILLINGCONTRACTOR AEP
TOP OF PVC ELEVATION 1047.41 ft
DRILLING METHOD 4.25" I.D. HSA: Auto Hammer & Rotary Rock Core
GROUND WATER LEVELS:
LOGGED BY D. Follett **CHECKED BY** RAS
AT END OF DRILLING ---
LOCATION N 484648.8, E 1610218.1

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	SS 1	53	12-7-5 (12)		Gray GRAVEL (FILL), moist, some silt, some sand	
1.5	SS 2	40	6-3-3 (6)		1043.7 Brown LEAN CLAY (CL), stiff, moist, medium plasticity, cohesive, massive, trace gravel, trace organics, trace mica	
3.0	SS 3	53	4-6-5 (11)		1042.2 Brown LEAN CLAY WITH GRAVEL (CL), medium stiff, moist, massive, low plasticity, non cohesive, sub angular gravel	
5	SS 4	67	5-4-3 (7)			Bentonite Grout
	SS 5	53	5-5-7 (12)		Some gray SILTSTONE	
	SS 6	40	4-4-4 (8)			
9.0	SS 7	60	3-2-5 (7)		1036.2 Brown LEAN CLAY (CL), stiff, moist, some wood, trace mica, trace sand, trace roots	
10.5	SS 8	67	4-15-26 (41)		1034.7 Light brown SILT (ML), hard, dry, non plastic, non cohesive, some iron stained gravel	4-Inch Solid PVC Riser
12.0	SS 9	100	50/4"		1033.2 Brown SILTSTONE, very weak, dry, trace mica	
15						
	SS 10	100	26-50/3"			
20						Bentonite Pellets
20.5	SS 11	100	50/1"		1024.7 Gray SANDSTONE, hard, dry, fine grained, micaceous	
21.3	RC 1	98 (57)			1023.9 Gray SANDSTONE, hard, fine to medium grained, very thin to thick bedded, micaceous, well cemented calcite, moderately fractured Iron stained vertical fracture 21.4' to 22.1' Fine bedded SILTSTONE interbeds 23.1' to 23.2', color change to tan Horizontial fractures at 23.1', 23.2', 23.7', 23.8' and 23.9'	#4 Filter Sand
25	RC 2	101 (57)			At 25.1' color change to gray At 27.3' color change to light brown, slightly friable Iron stained sub vertical fractures at 29.5' and 30.7' Highly to moderately fractured from 27.5' to 31.2', moderately decomposed Very highly fractured from 31.2' to 32.0'	4-Inch, 0.020-Inch Slotted Screen
30						
33.7					1011.5	#4 Filter Sand
35						

(Continued Next Page)

BORING NUMBER MW1502R	

Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

CLIENT American Electric Power

PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416

PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35					Gray SILTSTONE, hard, slightly calcereous along fractures, slightly micaceous, moderate to highly fractured Moderately friable and weak from 33.7' to 34.3', few limestone inclusions Slightly decomposed 34.3' to 38.0' *(continued)*	Bentonite Pellets
38.0					Dark gray SHALE, hard, carbonaceous, laminated, few limestone nodules, fresh	1007.2
39.1					Gray SILTSTONE, hard, slightly calcereous along fractures, slightly micaceous, slightly decomposed, moderate to highly fractured	1006.1
40	RC 3	98 (56)				
44.0					Burgundy CLAYSTONE, weak to moderate strength, calcereous, massive, gray mud stringers throughout, moderately decomposed, intensely fractured	1001.2
45						
46.0					Subvertical fracture at 44.5' CLAYSTONE BRECCIA 45.8' to 45.9', calcereous	999.2
					Gray SANDSTONE, strong, hard, micaceous, very fine grained to medium grained, fresh to slightly decomposed, slightly friable, very thinly bedded, cross bedded, calcereous, slightly to moderately fractured Subvertical fractures at 48.0', 49.1' and 49.9' Very highly fractured 51.1' to 51.6', weak, iron stained, calcereous Subvertical iron stained calcereous fractures at 53.9', 54.25' and 54.9'	
50	RC 4	101 (68)				
55						Natural Backfill
56.4					Gray to burgundy CLAYSTONE, weak to moderate strength, massive, moderate to highly decomposed, moderately friable	988.8
58.9					Gray SILTSTONE, hard, slightly micaceous, fresh, very thinly bedded, slightly friable, moderately fractured	986.3
60	RC 5	77 (39)				
64.3					Bottom of hole at 64.3 feet	980.9

Monitoring well installed on 8/06/2015

Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

BORING NUMBER B-1503/ MW1503R

CLIENT American Electric Power
PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plant
CEC PROJECT NUMBER 110-416
PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia
DATE STARTED 6/11/15 **COMPLETED** 7/20/15
GROUND ELEVATION 1108.86 ft **HOLE SIZE** 8.00"
DRILLINGCONTRACTOR AEP
TOP OF PVC ELEVATION 1111.96 ft
DRILLING METHOD 4.25" I.D. HSA: Auto Hammer & Rotary Rock Core
GROUND WATER LEVELS:
LOGGED BY D. Follett **CHECKED BY** RAS
AT END OF DRILLING ---
LOCATION N 484596.7, E 1610487.6

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	DEPTH / ELEV.	MATERIAL DESCRIPTION	WELL DIAGRAM
0	SS 1	67	3-2-3 (5)	1.5 / 1107.4	Yellow brown LEAN CLAY (CL), stiff, highly plastic, few mica, trace sand, trace sandstone gravel, trace mottled (FILL)	
	SS 2	80	3-4-7 (11)		Yellow brown LEAN CLAY with SILT (CL), stiff, dry, trace gravel, trace mica Some mottling at 3.0'	
	SS 3	80	5-5-8 (13)	4.5 / 1104.4		
5	SS 4	80	4-5-8 (13)		Yellow brown LEAN CLAY with GRAVEL (CL), very stiff, moderately plastic, subangular sandstone gravel, some silt, trace sand	Bentonite Grout
	SS 5	67	5-6-6 (12)		Some siltstone gravel at 6.0'	
	SS 6	73	3-6-9 (15)	8.0 / 1100.9		
				9.0 / 1099.9	Burgundy LEAN CLAY with SILT (CL), very stiff, dry, low plasticity, mottled, some gray clay, trace sand, massive	
10	SS 7	100	50/5"	10.5 / 1098.4	Tan SANDSTONE, weak, dry, trace mica, highly weathered	
	SS 8	100	50/5"		Gray SANDSTONE, strong, micaceous, very fine grained, thin to thickly bedded, moderately decomposed, moderately friable, highly fractured	
	RC 1	8 (61)			Vertical fractures 11.0' to 11.5' and 12.4' to 12.8', iron stained calcite filled fractures	
15					Sub horizontial iron stained fractures 13.2'. 13.6' and 13.7'	
				16.1 / 1092.8	Lost water return on core run #1	
	RC 2	73 (38)			Brown CLAYSTONE, weak to strong, slight to moderately decomposed, moderately friable, highly to very highly fractured Very intensely iron stained fractured 16.1' - 16.9'	4-Inch Solid PVC Riser
20				19.9 / 1089.0		
					Light green SILTSTONE, strong, massive, slight to moderately decomposed, slightly friable, trace mica, moderately fractured Sub horizontial iron stained slickenslide at 17.1' Iron stained vertical fractured 19.1' to 20.5'	
				23.9 / 1085.0		
25	RC 3	94 (42)			Green brown CLAYSTONE, moderate strength to strong, massive, moderately decomposed, moderately friable Very highly fractured 23.9' to 28.4 ', iron stained and calcereous Vertical fracture 26.8' to 27.0' and 27.7' to 28.6', iron stained and calcereous Subvertical fracture 29.2' to 29.4', iron stained	
30				31.3 / 1077.6		Bentonite Grout
					Dark brown SILTSTONE, weak to moderate strength, massive, moderate to highly decomposed, moderately friable, very highly fractured, iron stained, mangenese stained Sub horizontial slickenslide at 31.8'	
35				33.9 / 1075.0		

(Continued Next Page)

CLIENT American Electric Power
PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plant
CEC PROJECT NUMBER 110-416
PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
35	RC 4	90 (31)			Water return at end of core run # 3 Burgundy and gray CLAYSTONE, very weak, massive, highly decomposed, slightly friable, trace mica, trace sand, moderately to highly fractured Very highly fractured 34.9' to 35.9', highly weathered *(continued)*		Bentonite Grout
40				42.6	Light green SILTSTONE with SHALE interbeds, strong, thin to medium bedded, slightly decomposed, slightly friable, trace mica, calcereous, moderately fractured	1066.3	
45	RC 5	100 (100)		44.8	Light green SANDSTONE, very strong, fresh, competent, very fine grained, thin to thickly bedded, trace biotite, trace mica, well cemented, trace calcereous nodules, slightly fractured to unfractured Horizontial fractured at 47.5', iron stained Sub horizontial fracture at 49.0', iron stained Very thinly bedded cross beds 50.7' to 54.0'	1064.1	
55	RC 6	99 (70)		54.7	Gray SHALE, strong, laminated, slightly decomposed, slightly friable, moderately fractured	1054.2	4-Inch Solid PVC Riser
				55.5	Dark gray CLAYSTONE, weak, massive, highly decomposed, moderately friable, unfractured	1053.4	
				55.7	Light green SANDSTONE, very strong, fresh, competent, very fine to fine grained, thin to thickly bedded, trace biotite, trace mica, well cemented, trace calcereous nodules, slightly fractured to unfractured	1053.2	
				58.5	Dark gray SHALE, strong, laminated, slightly decomposed, slightly friable, moderately fractured Moderate to highly fractured 54.7' to 55.5'	1050.4	
60				60.5	Light green SANDSTONE, very strong, fresh, competent, very fine to fine grained, thin to thickly bedded, trace biotite, trace mica, well cemented, trace calcereous nodules, slightly to unfractured	1048.4	
65	RC 7	98 (96)		64.7	Dark gray SHALE, strong, laminated, slightly decomposed, slightly friable, moderately fractured	1044.2	
				67.0	Gray to burgundy CLAYSTONE, strong, laminated, slightly decomposed, slightly friable, moderately fractured Sub horizontial slickenslide 67.0' and 67.9' From 68.4' to 69.5', trace red CLAYSTONE stringers, massive	1041.9	
70				69.5	Light green SANDSTONE, very strong, fresh, competent, very fine to fine grained, thin to thickly bedded, trace biotite, trace mica, well cemented, trace calcereous nodules, slightly fractured to unfractured	1039.4	Bentonite Grout
				70.9	Black SHALE with thinly bedded coal stringers, strong, some pyrite nodules and stringers, thinly bedded, moderately decomposed, moderately friable, moderately fractured	1038.0	
75				73.9		1035.0	

(Continued Next Page)

Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

BORING NUMBER B-1503/ MW1503R

CLIENT American Electric Power
PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plant
CEC PROJECT NUMBER 110-416
PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MATERIAL DESCRIPTION	ELEV.
75.6				Sub horizontial slickenslide at 73.5'	1033.3
				Gray LIMESTONE, strong, hard, microcrystaline, massive, fresh, competent, calcereous, some black angular clasts, unfractured	
77.3				Sharp contact at 75.6' *(continued)*	1031.6
	RC 8	101 (97)		Light green gray SILTSTONE, moderate to strong, massive, slight to moderately decomposed, slightly friable, slightly fractured	
				Light green gray SANDSTONE interbeds, strong, fine grained, thin to moderately bedded, micaceous, calcereous inclusions, slightly decomposed, slightly friable	
80.5				Light green gray SHALE, moderate strength, laminated, fresh, slightly friable, moderately fractured	1028.4
84.2					1024.7
84.8				Light gray SANDSTONE, strong, thinly bedded, calcereous, slightly decomposed, slightly friable, slightly fractured	1024.1
	RC 9	100 (100)		Light green gray SANDSTONE, strong, medium to thickly bedded, micaceous, fresh, slightly decomposed, slightly friable, slight to moderately fractured Gradational contact at 89.0'	
89.0				Gray SANDSTONE, strong, hard, very fine to fine grained, well sorted, thinly bedded, well cemented calcereous cement, trace pyrite, slightly decomposed, slightly friable, slightly fractured to unfractured At 94.0' grain size change to fine to medium grained, few dark gray angular clasts From 94.75' to 95.65', some brecciated calcereous siltstone & mudstone interbeds, moderately decomposed Sub vertical fractures at 94.8' and 95.5' Sub vertical iron stained fracture 96.4' to 96.6'	1019.9
	RC 10	100 (92)			
100.1				Gray to dark gray SHALE, strong, laminated, few silt, some calcereous nodules, slightly decomposed, slightly friable At 102.6' black SHALE stringer, 1/2" thick	1008.8
105.6				Gray to burgundy CLAYSTONE, strong, massive to laminated, slightly decomposed, slightly friable, moderately fractured	1003.3
107.0				Gray LIMESTONE, strong, hard, microcrystaline, fresh, competent, calcereous, unfractured	1001.9
107.2	RC 11	100 (89)		Dark gray CLAYSTONE, strong, some coarse grained limestone clasts, calcereous, slightly decomposed, slightly friable, slight to moderately fractured	1001.7
111.0				At 107.4', 45 degree slickenslide	997.9
				Burgundy CLAYSTONE, strong, non calcereous, massive, fresh to slightly decomposed, slightly friable, moderately fractured	
113.9				At 112.0' and 112.4' 45 degree slickenslides	995.0
115.0				Gray green SILTSTONE, strong, thickly bedded, trace mica, fresh to slightly	993.9

WELL DIAGRAM:
- Bentonite Grout
- Bentonite Pellets
- #4 Filter Sand
- 4-Inch, 0.020-Inch Slotted Screen
- #4 Filter Sand
- Bentonite Pellets

(Continued Next Page)

Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

BORING NUMBER B-1503/ MW1503R

CLIENT American Electric Power
PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plant
CEC PROJECT NUMBER 110-416
PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
115					decomposed, slightly friable, unfractured	
	RC 12	99 (93)			Light green gray SANDSTONE, strong, hard, very fine to fine grained, micaceous well cemented, thinly bedded, moderate to unfractured At 118.8' some limestone clasts, hard, calcereous	
120						
					123.1 — 985.8	Bentonite Pellets
125					Gray green SILTSTONE, strong, hard, massive, fresh, competent, slightly fractured	
					126.2 — 982.7	
	RC 13	76 (52)			Gray and burgundy CLAYSTONE, weak to moderate strength, massive, slight to moderately decomposed, slight to moderately friable, non calcereous, moderately fractured Sub horizontial slickenslide at 127.8'	
130						
					133.9 — 975.0	

Bottom of hole at 133.9 feet

6/16/15 8:20 AM at 27.45' bgs (borehole depth = 73.9' bgs)

Monitoring well installed on 8/15/2015

Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

BORING NUMBER MW1503F

CLIENT American Electric Power
PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plant
CEC PROJECT NUMBER 110-416
PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia
DATE STARTED 7/23/15 **COMPLETED** 7/23/15
GROUND ELEVATION 1108.80 ft **HOLE SIZE** 8.00"
DRILLINGCONTRACTOR AEP
TOP OF PVC ELEVATION 1111.93 ft
DRILLING METHOD 4.25" I.D. HSA: Auto Hammer & Rotary Rock Core
GROUND WATER LEVELS:
LOGGED BY D. Follett **CHECKED BY** RAS
AT END OF DRILLING ---
LOCATION N 484591.4, E 1610488.5

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0			Blind drilled from 0' to 64'. See B-1503 boring log for description.	
5				Bentonite Grout
10				
15				
				4-Inch Solid PVC Riser
20				
25				
30				Bentonite Grout
35				

(Continued Next Page)

BORING NUMBER MW1503F

Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road, Suite 250
Worthington, OH 43085

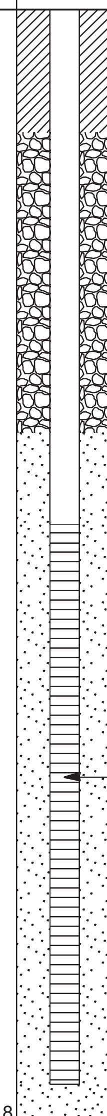
CLIENT American Electric Power

PROJECT NAME Mitchell Landfill, Mitchell Electric Generating Plant

CEC PROJECT NUMBER 110-416

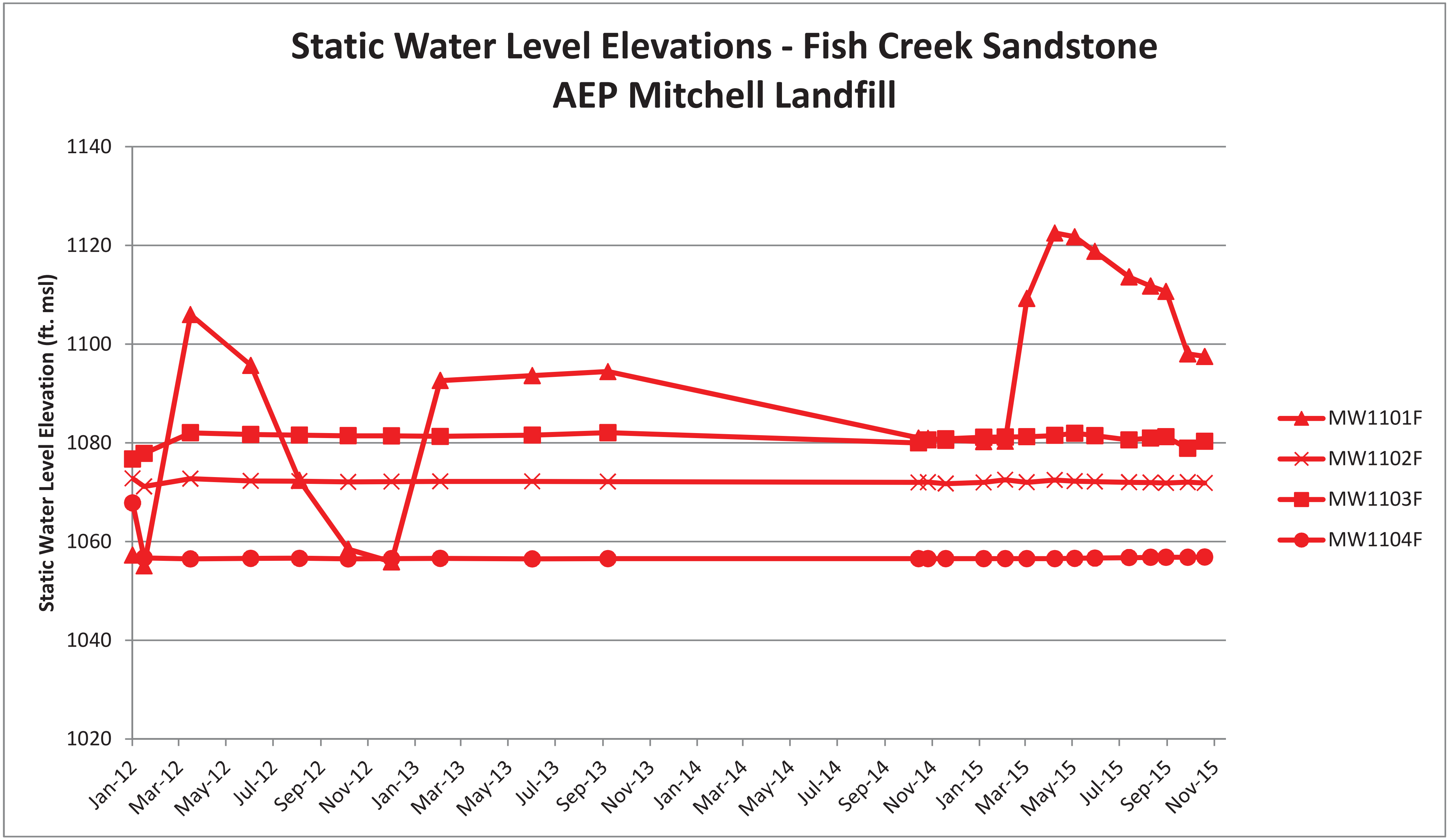
PROJECT LOCATION Gatts Ridge Road, Cresap, West Virginia

DEPTH (ft)	SAMPLE TYPE NUMBER	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
35			Blind drilled from 0' to 64'. See B-1503 boring log for description. *(continued)*	
40				
45				
50				
55				
60				
			64.0 ... 1044.8	
			Bottom of hole at 64.0 feet	



Monitoring well installed on 8/15/2015

APPENDIX B


Static Water Level Elevations - Fish Creek Sandstone
AEP Mitchell Landfill
Static Water Level Elevation (ft. msl)
1140
1120
1100
1080
1060
1040
1020
Jan-12
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
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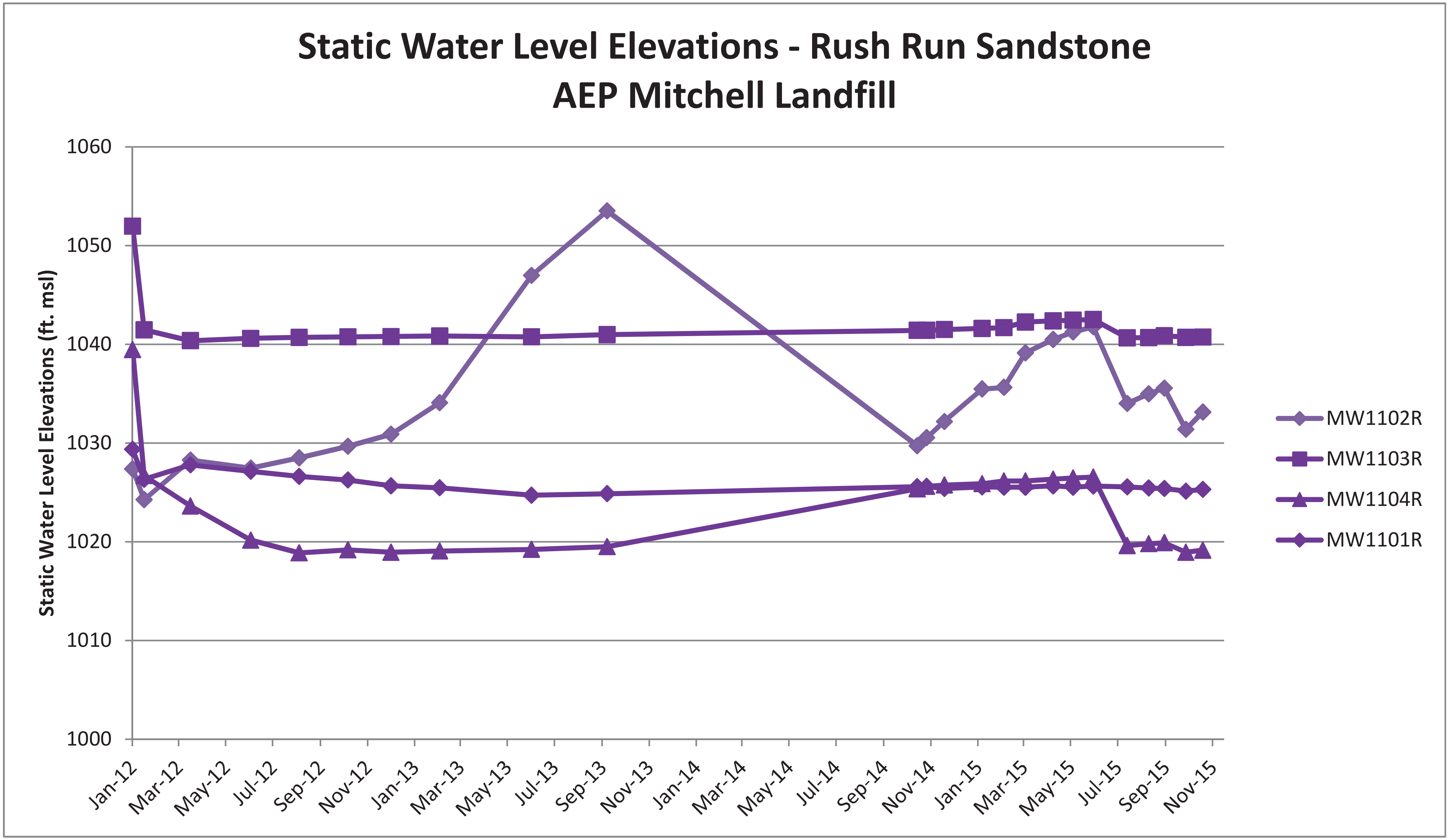
Sep-15
Nov-15
MW1101F
MW1102F
MW1103F
MW1104F


Static Water Level Elevations - Rush Run Sandstone
AEP Mitchell Landfill
Static Water Level Elevations (ft. msl)
1060
1050
1040
1030
1020
1010
1000
Jan-12
Mar-12
May-12
Jul-12
Sep-12
Nov-12
Jan-13
Mar-13
May-13
Jul-13
Sep-13
Nov-13
Jan-14
Mar-14
May-14
Jul-14
Sep-14
Nov-14
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15
MW1102R
MW1103R
MW1104R
MW1101R

Appendix E

Annual Groundwater Monitoring Reports – January 2020

for

Mitchell Plant's

Bottom Ash Pond

and

Landfill

Annual Groundwater Monitoring Report

Kentucky Power Company

Mitchell Plant

Bottom Ash Pond

Moundsville, WV

January 2020

Prepared by:
American Electric Power Service Corporation
1 Riverside Plaza
Columbus, Ohio 43215

KENTUCKY POWER℠

An AEP Company

BOUNDLESS ENERGY℠

Table of Contents

I. Overview

This *Annual Groundwater Monitoring Report* (Report) has been prepared to report the status of activities for the preceding year for the Bottom Ash Pond at Kentucky Power Company's, a wholly owned subsidiary of American Electric Power Company (AEP), Mitchell Power Plant. The USEPA's CCR rules require that the Annual Groundwater Monitoring Report be posted to the operating record for the preceding year no later than January 31st.

In general, the following activities were completed in 2019:

- In accordance with 40 CFR 257.95(d)(1), groundwater samples were collected and analyzed for all Appendix III constituents and those Appendix IV constituents that were detected during the previous sampling in accordance with 40 CFR 257.95(b) in August 2018. This occurred in April/May, 2019. In accordance with 40 CFR 257.95(b), groundwater samples were collected and analyzed for all Appendix IV constituents. This occurred in June 2019. All sampling was performed in accordance with 40 CFR 257.95 *et seq.*, and AEP's *Groundwater Sampling and Analysis Plan (2016)*;
- Groundwater data underwent various validation tests, including tests for completeness, valid values, transcription errors, and consistent units;
- Statistical analysis of the assessment monitoring samples collected in August 2018 and April/May 2019 was completed in January and July 2019, respectively.
- Because no statistically significant levels (SSLs) above the groundwater protection standard were detected, assessment monitoring continued.
- No alternative source demonstrations (ASDs) relative to the Appendix IV SSLs above the groundwater protection standard were pursued.
- As required by 40 CFR 257.95(d)(1), groundwater samples were collected and analyzed for all Appendix III constituents and those Appendix IV constituents that were detected during the June 2019 sampling in accordance with 40 CFR 257.95(b). This occurred in October 2019.

The major components of this annual report, to the extent applicable at this time, are presented in sections that follow:

- A map, aerial photograph or a drawing showing the CCR management unit(s), all groundwater monitoring wells and monitoring well identification numbers;
- All of the monitoring data collected, including the rate and direction of groundwater flow, plus a summary showing the number of samples collected per monitoring well, the dates the samples were collected, and whether the sample was collected as part of detection monitoring or assessment monitoring programs (Attached as **Appendix 1**);

- Statistical comparison of monitoring data to determine if there have been statistically significant levels above the groundwater protection standards (Attached as **Appendix 2**, where applicable);
- A discussion of whether any alternate source demonstration were performed, and the conclusions (Attached as **Appendix 3**, where applicable);
- A summary of any transition between monitoring programs, for example the date and circumstances for transitioning from detection monitoring to assessment monitoring (Notices attached as **Appendix 4**, where applicable);
- Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a statement as to why that happened (Attached as **Appendix 5**, where applicable); and
- Other information required to be included in the annual report such as an alternate monitoring frequency, or assessment of corrective measures, if applicable.

In addition, this report summarizes key actions completed, and where applicable, describes any problems encountered and actions taken to resolve those problems. The report includes a projection of key activities for the upcoming year.

II. Groundwater Monitoring Well Locations and Identification Numbers

A figure that depicts the PE-certified groundwater monitoring network, the monitoring well locations, and their corresponding identification is provided in Appendix 1.

III. Monitoring Wells Installed or Decommissioned

There were no monitoring wells installed or decommissioned in 2019. The network design, as summarized in the *Groundwater Monitoring Network Design Report* (2016) and as posted at the CCR web site for Mitchell Plant, did not change. That design report, viewable on the AEP CCR web site, discusses the facility location, the hydrogeological setting, the hydrostratigraphic units, the uppermost aquifer, downgradient monitoring well locations and the upgradient monitoring well locations.

IV. Groundwater Quality Data and Static Water Elevation Data, With Flow Rate and Direction and Discussion

Appendix 1 contains tables showing the groundwater quality data collected during the establishment of background quality, detection monitoring, and assessment monitoring. Static water elevation data from each monitoring event also are shown in Appendix 1, along with the groundwater velocities, groundwater flow direction, and potentiometric maps developed after each sampling event.

V. Groundwater Quality Data Statistical Analysis

Statistical analysis of the assessment monitoring samples taken in August 2018 and in April/May 2019 was completed in January 2019 and July 2019, respectively. No SSLs above the groundwater protection standards were identified during either analysis. The results of these statistical analyses are documented in the corresponding statistical analysis summary reports, which are provided in Appendix 2.

As required by 40 CFR 257.95(d)(1), groundwater samples were collected and analyzed for all Appendix III constituents and those Appendix IV constituents that were detected during the June 2019 sampling in accordance with 40 CFR 257.95(b). This occurred in October 2019. Based on the results, Appendix IV groundwater protection standards are being calculated and will be statistically compared to Appendix IV concentrations in downgradient wells. Statistical analysis and the setting of Appendix IV groundwater protection standards and will be completed in February 2020.

VI. Alternative Source Demonstrations

ASDs relative to Appendix IV SSLs above the groundwater protection standard were not necessary because no SSLs above the groundwater protection standards were identified in 2019. A statement to this effect is provided in Appendix 3.

VII. Discussion About Transition Between Monitoring Requirements or Alternate Monitoring Frequency

No transition between monitoring requirements occurred in 2019; the CCR unit remained in assessment monitoring over the entire year. A statement to this effect is provided in Appendix 4.

The bottom ash pond will remain in assessment monitoring unless all Appendix III and IV parameters are below background values for two consecutive monitoring events, at which point, the CCR Unit would return to detection monitoring. If one or more Appendix IV parameters exceed the respective groundwater protection standard due to a release from the bottom ash pond, and are not demonstrated to be caused by a source other than the CCR unit or resulting from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality by means of an ASD, an assessment of corrective measures will be undertaken as required by 40 CFR 257.96.

Regarding defining an alternate monitoring frequency, the groundwater velocity and monitoring well production is high enough at this facility that no modification of the semiannual detection monitoring effort is necessary.

VIII. Other Information Required

The bottom ash pond has progressed from detection monitoring to its current status in assessment monitoring. All required information has been included in this annual groundwater monitoring report.

IX. Description of Any Problems Encountered in 2019 and Actions Taken

No significant problems were encountered. The low flow sampling effort went smoothly and the schedule was met to support this annual groundwater report preparation.

X. A Projection of Key Activities for the Upcoming Year

Key activities for 2020 include:

- Assessment monitoring on a semiannual schedule;
- Evaluation of the assessment monitoring results from a statistical analysis viewpoint, looking for any statistically significant increases over an established groundwater protection standard, or whether the concentrations have returned below background concentrations;
- Responding to any new data received in light of what the CCR rule requires;
- Preparation of the next annual groundwater report.

APPENDIX 1 - Groundwater Data Tables and Figures

Tables follow showing the groundwater monitoring data collected, the rate of groundwater flow each time groundwater was sampled, the number of samples collected per monitoring well, dates that the samples were collected, and whether each sample was collected as part of a detection monitoring or an assessment monitoring program. Figures follow showing the PE-certified groundwater monitoring network with the corresponding well identifications along with static water elevation data and groundwater flow directions each time groundwater was sampled in the form of annotated satellite images.

Table 1 - Groundwater Data Summary: MW-1504
Mitchell - BAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
6/13/2016	Background	0.054	220	99.1	0.23	6.9	990	375
8/1/2016	Background	0.070	220	103	0.25	7.0	970	403
9/26/2016	Background	0.098	225	103	0.24	7.1	946	389
11/8/2016	Background	0.053	219	92.8	0.19	7.1	930	369
2/7/2017	Background	0.162	218	81.7	0.20	7.1	904	291
4/4/2017	Background	0.105	237	89.8	0.21	7.3	924	362
5/16/2017	Background	0.113	225	93.5	0.22	7.2	995	371
7/19/2017	Background	0.129	230	96.3	0.15	7.2	999	405
10/9/2017	Detection	0.114	212	93.4	0.24	7.2	982	392
4/11/2018	Assessment	0.063	204	83.6	0.19	7.0	842	291
8/22/2018	Assessment	0.096	230	91.9	0.20	7.3	936	372
5/1/2019	Assessment	0.05 J	220	81.8	0.17	8.0	926	317
6/11/2019	Assessment	0.04 J	183	78.5	0.17	7.6	829	261

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1504
Mitchell - BAP
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/13/2016	Background	0.03 J	0.73	46.2	0.01 J	0.04	0.4	0.523	0.0838	0.23	0.379	0.002	<0.002 U	0.59	0.1	0.02 J
8/1/2016	Background	0.02 J	0.52	42.7	0.009 J	0.04	0.5	0.549	0.248	0.25	0.222	<0.0002 U	0.002 J	0.74	0.07 J	0.02 J
9/26/2016	Background	<0.05 U	0.38	36.7	<0.02 U	0.03 J	0.3	0.362	0.656	0.24	0.104	0.007	<0.002 U	2.31	0.2 J	0.1 J
11/8/2016	Background	0.02 J	0.36	38.4	<0.005 U	0.03	0.469	0.249	1.748	0.19	0.041	0.004	<0.002 U	0.66	<0.03 U	0.089
2/7/2017	Background	0.02 J	0.39	33.8	<0.005 U	0.03	0.53	0.239	0.563	0.20	0.022	0.008	<0.002 U	0.94	<0.03 U	0.09
4/4/2017	Background	0.02 J	0.35	40.5	<0.005 U	0.04	0.283	0.277	0.327	0.21	0.021	0.009	<0.002 U	0.81	0.06 J	0.11
5/16/2017	Background	0.02 J	0.46	37.3	<0.004 U	0.04	0.25	0.319	0.3882	0.22	0.01 J	0.011	<0.002 U	0.55	0.05 J	0.02 J
7/19/2017	Background	0.03 J	0.41	34.9	<0.004 U	0.04	0.175	0.382	0.401	0.15	0.087	0.012	<0.002 U	1.25	<0.03 U	0.03 J
4/11/2018	Assessment	0.02 J	0.36	36.9	0.005 J	0.03	0.562	0.114	0.349	0.19	0.052	0.004	<0.004 U	0.41	0.04 J	0.03 J
8/22/2018	Assessment	0.05 J	0.28	37.9	<0.004 U	0.03	0.331	0.093	1.048	0.20	0.037	0.006	<0.002 U	0.33	0.04 J	0.03 J
5/1/2019	Assessment	<0.02 U	0.22	36.4	<0.02 U	0.03 J	0.305	0.071	0.675	0.17	0.02 J	<0.009 U	<0.002 U	<0.4 U	<0.03 U	<0.1 U
6/11/2019	Assessment	<0.02 U	0.24	33.5	<0.02 U	<0.01 U	0.05 J	0.04 J	0.261	0.17	<0.02 U	<0.009 U	<0.002 U	<0.4 U	0.7	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1505
Mitchell - BAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
6/14/2016	Background	10.8	288	365	<0.05 U	7.1	1530	337
8/1/2016	Background	10.6	294	358	<0.05 U	7.1	1580	337
9/26/2016	Background	10.3	289	345	<0.05 U	7.2	1420	317
11/8/2016	Background	9.12	261	316	<0.05 U	7.2	1470	307
2/7/2017	Background	10.0	296	318	<0.05 U	7.2	1340	317
4/4/2017	Background	8.80	293	303	<0.05 U	7.3	1350	324
5/16/2017	Background	10.1	278	298	<0.05 U	7.2	1550	316
7/19/2017	Background	9.13	267	293	<0.05 U	7.3	1390	318
10/10/2017	Detection	8.70	255	287	<0.05 U	7.2	1270	327
12/27/2017	Detection	8.02	259	288	- -	7.3	1220	- -
4/11/2018	Assessment	8.00	282	289	<0.05 U	7.0	1220	401
8/22/2018	Assessment	8.00	274	284	0.02 J	7.3	1520	383
5/1/2019	Assessment	7.31	287	285	<0.01 U	7.8	1580	408
6/11/2019	Assessment	7.79	279	261	0.03 J	7.7	1450	404

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1505
Mitchell - BAP
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/14/2016	Background	0.06	1.40	57.7	0.049	0.03	33.2	0.966	0.466	<0.05 U	1.02	0.006	0.002 J	2.94	0.2	0.074
8/1/2016	Background	0.11	3.73	81.0	0.150	0.05	10.4	2.69	1.2271	<0.05 U	3.69	0.011	0.013	0.95	0.9	0.093
9/26/2016	Background	<0.05 U	0.79	47.2	<0.02 U	0.03 J	0.9	0.404	0.912	<0.05 U	0.546	0.008	<0.002 U	7.35	0.4 J	0.464
11/8/2016	Background	0.07	2.14	63.3	0.091	0.03	7.07	1.77	1.26	<0.05 U	2.06	0.007	0.006	0.90	0.5	0.093
2/7/2017	Background	0.04 J	1.16	51.7	0.035	0.03	9.06	0.772	1.236	<0.05 U	0.697	0.010	0.002 J	1.21	0.5	0.102
4/4/2017	Background	0.03 J	0.41	47.2	<0.005 U	0.02	11.0	0.509	0.4842	<0.05 U	0.091	0.007	<0.002 U	1.54	0.3	0.057
5/16/2017	Background	0.04 J	0.73	45.5	0.01 J	0.02	4.93	0.594	0.604	<0.05 U	0.224	0.017	<0.002 U	0.85	0.4	0.067
7/19/2017	Background	0.04 J	0.78	45.9	0.02 J	0.03 J	2.38	0.628	1.222	<0.05 U	0.434	0.012	<0.002 U	1.69	0.9	0.08 J
4/11/2018	Assessment	0.03 J	0.44	46.0	0.006 J	0.03	1.16	0.151	0.582	<0.05 U	0.116	0.005	<0.002 U	0.67	0.7	0.065
8/22/2018	Assessment	0.05 J	0.38	48.0	0.007 J	0.03	1.40	0.257	0.576	0.02 J	0.150	0.008	<0.002 U	1.35	0.4	0.070
5/1/2019	Assessment	0.03 J	0.29	48.7	<0.02 U	0.03 J	0.665	0.199	0.2396	<0.01 U	0.07 J	<0.009 U	<0.002 U	0.6 J	0.9	<0.1 U
6/11/2019	Assessment	0.03 J	0.28	49.3	<0.02 U	0.03 J	0.849	0.155	0.526	0.03 J	0.04 J	0.01 J	<0.002 U	0.7 J	0.4	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1506
Mitchell - BAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
6/14/2016	Background	8.04	275	422	0.07 J	7.1	1640	315
8/2/2016	Background	9.72	299	418	0.07 J	7.0	1600	325
9/27/2016	Background	6.77	304	428	<0.05 U	7.2	1610	323
11/9/2016	Background	5.50	281	392	<0.05 U	7.4	1510	285
2/8/2017	Background	5.70	289	395	<0.05 U	7.3	1350	292
4/5/2017	Background	5.59	282	389	<0.05 U	7.4	1430	301
5/17/2017	Background	7.11	278	393	<0.05 U	7.3	1520	307
7/19/2017	Background	6.26	277	379	<0.05 U	7.3	1480	297
10/10/2017	Detection	8.03	257	357	<0.05 U	7.3	1390	326
12/27/2017	Detection	6.14	264	383	- -	7.3	1280	- -
4/11/2018	Assessment	5.73	275	382	<0.05 U	7.1	1300	347
8/22/2018	Assessment	5.91	270	369	0.05 J	7.4	1590	349
5/1/2019	Assessment	5.24	280	331	0.03 J	7.9	1360	347
6/11/2019	Assessment	5.27	265	315	0.05 J	7.8	1370	335

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1506
Mitchell - BAP
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/14/2016	Background	0.07	1.65	73.0	0.053	0.04	1.1	1.31	0.488	0.07 J	1.25	0.006	0.004 J	0.74	0.2	0.070
8/2/2016	Background	0.05 J	1.01	70.4	0.026	0.04	0.8	0.799	0.670	0.07 J	0.601	0.015	0.003 J	0.68	0.09 J	0.060
9/27/2016	Background	0.05 J	1.14	62.0	0.030	0.03	1.0	0.739	1.263	<0.05 U	0.744	0.015	0.002 J	0.55	0.2	0.064
11/9/2016	Background	0.03 J	0.64	57.4	0.01 J	0.02 J	0.959	0.251	2.196	<0.05 U	0.272	0.008	<0.002 U	0.45	0.07 J	0.05 J
2/8/2017	Background	0.03 J	0.62	52.9	0.008 J	0.02 J	4.28	0.305	0.4008	<0.05 U	0.217	0.013	<0.002 U	1.07	<0.03 U	0.066
4/5/2017	Background	0.04 J	0.81	60.1	0.021	0.02	3.87	0.891	0.438	<0.05 U	0.574	0.011	0.002 J	0.49	0.08 J	0.04 J
5/17/2017	Background	0.05 J	1.26	60.9	0.027	0.03	2.83	0.768	0.226	<0.05 U	0.726	0.016	0.002 J	1.22	0.1	0.05 J
7/19/2017	Background	0.18	0.80	54.9	0.02 J	0.02 J	3.15	0.932	0.889	<0.05 U	0.457	0.016	<0.002 U	1.14	<0.06 U	0.06 J
4/11/2018	Assessment	0.03 J	0.73	55.4	0.021	0.02 J	2.01	0.476	0.592	<0.05 U	0.477	0.009	0.002 J	1.23	0.1	0.05 J
8/22/2018	Assessment	0.06	0.46	54.6	0.01 J	0.02	2.47	0.581	1.723	0.05 J	0.319	0.010	<0.002 U	0.50	0.09 J	0.050
5/1/2019	Assessment	0.03 J	0.34	53.5	<0.02 U	0.02 J	0.752	0.256	0.1879	0.03 J	0.135	0.02 J	<0.002 U	2 J	0.07 J	<0.1 U
6/11/2019	Assessment	0.03 J	0.42	49.8	<0.02 U	0.01 J	1.11	0.290	1.009	0.05 J	0.234	<0.009 U	<0.002 U	0.4 J	0.04 J	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1507
Mitchell - BAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
6/14/2016	Background	13.2	333	529	0.06 J	7.0	1070	339
8/2/2016	Background	12.2	323	497	0.07 J	7.0	1890	332
9/27/2016	Background	14.1	355	517	0.06 J	7.1	1840	345
11/9/2016	Background	12.1	325	480	0.06 J	7.1	1840	314
2/8/2017	Background	11.1	312	401	0.06 J	7.1	1480	276
4/5/2017	Background	10.6	324	445	0.05 J	7.2	1630	306
5/17/2017	Background	12.1	308	437	0.05 J	7.2	1680	310
7/19/2017	Background	11.1	298	447	<0.05 U	7.2	1740	308
10/10/2017	Detection	10.7	289	430	0.06 J	7.2	1660	316
12/27/2017	Detection	10.4	284	450	- -	7.2	1380	- -
4/11/2018	Assessment	10.4	296	400	0.06 J	6.9	1390	347
8/21/2018	Assessment	9.29	272	331	0.07	7.2	1430	323
5/1/2019	Assessment	8.36	271	296	0.07	8.0	1270	346
6/11/2019	Assessment	8.41	257	279	0.07	7.8	1340	349

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1507
Mitchell - BAP
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/14/2016	Background	0.05 J	2.19	84.5	0.142	0.07	3.6	3.18	0.521	0.06 J	4.07	0.011	0.025	0.25	0.7	0.051
8/2/2016	Background	0.12	4.54	104	0.168	0.07	10.4	4.10	2.09	0.07 J	4.48	0.019	0.016	2.14	0.5	0.078
9/27/2016	Background	0.10	3.58	92.0	0.134	0.06	14.0	3.06	2.029	0.06 J	2.96	0.020	0.010	1.80	0.5	0.08 J
11/9/2016	Background	0.11	4.15	102	0.202	0.07	12.6	4.50	1.784	0.06 J	3.97	0.016	0.010	12.8	0.5	0.09 J
2/8/2017	Background	0.08	2.16	73.6	0.089	0.04	6.16	1.77	16.587	0.06 J	1.86	0.013	0.007	2.31	0.3	0.081
4/5/2017	Background	0.06	1.51	71.3	0.053	0.04	19.4	1.26	0.600	0.05 J	1.17	0.011	0.006	5.29	0.2	0.053
5/17/2017	Background	0.11	1.30	63.6	0.031	0.04	12.6	0.990	0.767	0.05 J	0.799	0.024	0.003 J	4.54	0.2	0.04 J
7/19/2017	Background	0.06 J	1.29	62.0	0.044	0.04	12.1	2.37	1.215	<0.05 U	0.999	0.018	0.004 J	4.37	0.1 J	0.06 J
4/11/2018	Assessment	0.07	1.67	71.2	0.062	0.04	21.3	1.45	0.701	0.06 J	1.56	0.012	0.006	2.73	0.3	0.059
8/21/2018	Assessment	0.08	0.47	62.1	0.01 J	0.03	2.00	0.426	1.419	0.07	0.308	0.010	0.002 J	0.87	0.08 J	0.05 J
5/1/2019	Assessment	0.03 J	0.43	53.9	<0.02 U	0.03 J	2.35	0.331	0.496	0.07	0.239	<0.009 U	<0.002 U	1 J	0.07 J	<0.1 U
6/11/2019	Assessment	0.03 J	0.24	52.2	<0.02 U	0.03 J	0.315	0.160	1.454	0.07	<0.02 U	0.01 J	0.003 J	0.4 J	0.04 J	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1508
Mitchell - BAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
6/14/2016	Background	0.509	204	211	0.1 J	6.9	1060	291
8/1/2016	Background	0.690	218	237	0.1 J	7.0	1100	302
9/26/2016	Background	1.03	215	238	0.1 J	7.0	1110	304
11/8/2016	Background	1.36	234	227	0.08 J	7.2	1140	304
2/8/2017	Background	1.04	236	220	0.08 J	7.1	1070	301
4/5/2017	Background	0.780	228	215	0.08 J	7.2	1070	311
5/16/2017	Background	0.846	218	208	0.07 J	7.1	1130	296
7/18/2017	Background	1.00	224	214	0.06 J	7.1	1110	305
10/9/2017	Detection	0.881	207	212	0.08 J	7.1	1200	322
4/11/2018	Assessment	0.806	229	200	0.08	6.9	1050	302
8/21/2018	Assessment	0.952	219	204	0.08	7.2	1080	313
5/1/2019	Assessment	0.622	221	178	0.08	8.2	978	287
6/12/2019	Assessment	0.679	209	163	0.08	7.1	988	285

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1508
Mitchell - BAP
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/14/2016	Background	0.04 J	1.05	48.7	0.038	0.09	0.8	3.21	0.763	0.1 J	1.61	0.009	0.003 J	0.93	0.5	0.04 J
8/1/2016	Background	0.04 J	1.07	51.7	0.037	0.07	1.2	2.22	0.0803	0.1 J	1.34	<0.0002 U	0.008	0.74	0.7	0.03 J
9/26/2016	Background	0.06 J	1.65	50.2	0.06 J	0.07 J	2.3	2.34	0.596	0.1 J	1.69	0.007	0.003 J	1.17	0.8	<0.05 U
11/8/2016	Background	0.05 J	1.32	53.9	0.058	0.05	1.70	2.17	2.782	0.08 J	2.06	0.003	0.002 J	0.63	0.7	0.03 J
2/8/2017	Background	0.04 J	0.97	46.1	0.042	0.04	1.34	1.40	12.465	0.08 J	1.32	0.009	0.003 J	0.53	0.7	0.04 J
4/5/2017	Background	0.04 J	1.09	49.9	0.049	0.04	1.74	1.66	0.394	0.08 J	1.71	0.008	0.004 J	0.35	0.9	0.03 J
5/16/2017	Background	0.04 J	1.21	47.0	0.041	0.03	1.32	1.12	0.931	0.07 J	1.13	0.014	<0.002 U	0.46	0.9	0.04 J
7/18/2017	Background	0.04 J	1.11	45.1	0.040	0.04	1.33	1.27	0.597	0.06 J	1.20	0.012	<0.002 U	0.68	0.6	0.04 J
4/11/2018	Assessment	0.04 J	1.04	46.4	0.040	0.04	1.40	1.03	0.236	0.08	1.11	0.008	<0.004 U	0.45	0.7	0.05 J
8/21/2018	Assessment	0.06	0.44	40.1	0.01 J	0.04	0.691	0.678	0.3152	0.08	0.384	0.007	<0.002 U	0.25	0.4	0.03 J
5/1/2019	Assessment	0.03 J	0.60	37.4	0.02 J	0.03 J	0.735	0.637	0.636	0.08	0.540	<0.009 U	<0.002 U	<0.4 U	0.3	<0.1 U
6/12/2019	Assessment	<0.02 U	0.41	35.2	<0.02 U	0.03 J	0.59	0.419	0.295	0.08	0.336	<0.009 U	<0.002 U	<0.4 U	0.2	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1509
Mitchell - BAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
6/14/2016	Background	12.4	280	435	0.16	7.0	1730	380
8/9/2016	Background	11.6	292	401	0.16	7.1	1670	388
9/27/2016	Background	10.6	292	371	0.1 J	7.1	1540	418
11/8/2016	Background	8.29	258	333	0.1 J	7.1	1410	400
2/7/2017	Background	7.65	280	360	0.15	7.1	1450	416
4/5/2017	Background	6.22	290	358	0.1 J	7.2	1560	416
5/17/2017	Background	7.36	284	354	0.1 J	7.2	1520	420
7/19/2017	Background	6.54	279	346	0.1 J	7.2	1560	418
10/10/2017	Detection	6.70	277	345	0.1 J	7.2	1490	432
12/27/2017	Detection	6.31	271	315	- -	7.1	1360	- -
4/11/2018	Assessment	6.81	272	324	0.15	6.9	1390	488
8/21/2018	Assessment	6.97	279	323	0.14	7.2	1540	465
5/1/2019	Assessment	8.73	287	328	0.13	8.5	1480	429
6/11/2019	Assessment	8.37	273	311	0.13	7.8	1410	432

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1509
Mitchell - BAP
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/14/2016	Background	0.03 J	0.55	64.4	0.008 J	0.03	2.5	0.514	0.816	0.16	0.102	0.0009 J	<0.002 U	1.43	0.1	0.03 J
8/9/2016	Background	0.03 J	0.62	64.4	0.01 J	0.02	0.5	0.484	0.45569	0.16	0.251	0.015	<0.002 U	1.00	0.1	0.03 J
9/27/2016	Background	0.03 J	0.39	61.0	<0.005 U	0.02	4.6	0.424	2.664	0.1 J	0.024	0.018	<0.002 U	1.07	0.2	0.04 J
11/8/2016	Background	0.03 J	0.40	62.0	<0.005 U	0.02	0.627	0.253	0.413	0.1 J	0.006 J	0.012	<0.002 U	0.59	0.1	0.05 J
2/7/2017	Background	0.03 J	0.50	56.7	<0.005 U	0.02	0.650	0.130	1.399	0.15	0.056	0.011	<0.002 U	0.66	0.09 J	0.04 J
4/5/2017	Background	0.02 J	0.33	63.5	<0.005 U	0.02 J	1.15	0.189	0.304	0.1 J	0.01 J	0.012	<0.002 U	0.48	0.2	0.03 J
5/17/2017	Background	0.02 J	0.56	61.5	<0.004 U	0.01 J	1.05	0.255	1.673	0.1 J	0.02 J	0.022	0.002 J	0.56	0.2	0.03 J
7/19/2017	Background	0.03 J	0.65	58.5	0.01 J	0.01 J	0.857	0.344	1.134	0.1 J	0.22	0.017	<0.002 U	0.80	0.2 J	0.04 J
4/11/2018	Assessment	0.03 J	0.42	52.8	0.005 J	0.01 J	0.657	0.215	0.792	0.15	0.062	0.009	0.002 J	0.34	0.2	0.057
8/21/2018	Assessment	0.09	0.33	53.8	<0.004 U	0.008 J	0.777	0.132	0.736	0.14	0.035	0.012	<0.002 U	0.32	0.3	0.03 J
5/1/2019	Assessment	0.03 J	0.33	47.2	<0.02 U	0.01 J	2.28	0.324	0.4075	0.13	0.114	<0.009 U	<0.002 U	<0.4 U	0.2 J	<0.1 U
6/11/2019	Assessment	0.03 J	0.28	48.6	<0.02 U	0.02 J	1.47	0.097	0.559	0.13	0.05 J	0.02 J	<0.002 U	<0.4 U	0.2	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1510
Mitchell - BAP
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
6/14/2016	Background	9.36	283	334	0.06 J	7.0	1520	358
8/2/2016	Background	9.18	294	333	0.06 J	7.0	1410	356
9/27/2016	Background	10.1	296	338	0.05 J	7.1	1410	367
11/9/2016	Background	9.22	280	325	<0.05 U	7.1	1420	332
2/8/2017	Background	10.4	281	314	0.06 J	7.2	1270	325
4/5/2017	Background	9.23	261	303	0.06 J	7.3	1330	313
5/17/2017	Background	10.8	249	306	0.05 J	7.2	1340	307
7/18/2017	Background	9.86	255	311	<0.05 U	7.2	1410	309
10/9/2017	Detection	8.70	249	327	0.05 J	7.2	1520	356
12/27/2017	Detection	8.83	261	339	- -	7.2	1300	- -
4/12/2018	Assessment	10.4	292	322	<0.05 U	7.0	1290	398
8/21/2018	Assessment	9.13	268	334	0.09	7.3	1550	428
5/1/2019	Assessment	8.83	287	325	0.10	8.1	1460	467
6/12/2019	Assessment	8.50	266	293	0.10	6.9	1430	469

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1510
Mitchell - BAP
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/14/2016	Background	0.03 J	0.72	50.8	0.02 J	0.01 J	0.6	0.257	0.331	0.06 J	0.282	0.003	<0.002 U	0.65	0.2	0.057
8/2/2016	Background	0.03 J	0.62	49.0	0.02 J	0.009 J	0.7	0.256	1.383	0.06 J	0.269	0.016	<0.002 U	0.92	0.2	0.02 J
9/27/2016	Background	0.03 J	0.70	48.7	0.02 J	0.009 J	0.8	0.329	0.865	0.05 J	0.333	0.014	<0.002 U	0.45	0.2	0.04 J
11/9/2016	Background	0.02 J	0.58	44.6	0.02 J	0.01 J	0.655	0.230	0.88	<0.05 U	0.261	0.009	<0.002 U	0.33	0.1	0.03 J
2/8/2017	Background	0.02 J	0.47	39.5	<0.005 U	0.005 J	0.521	0.073	6.828	0.06 J	0.066	0.013	<0.002 U	0.42	0.08 J	0.02 J
4/5/2017	Background	0.02 J	0.36	41.4	<0.005 U	0.006 J	2.34	0.175	1.12829	0.06 J	0.094	0.011	<0.002 U	0.27	0.07 J	<0.01 U
5/17/2017	Background	0.02 J	0.53	40.2	<0.004 U	0.005 J	1.40	0.138	0.176	0.05 J	0.049	0.015	<0.002 U	0.28	0.1	0.01 J
7/18/2017	Background	0.02 J	0.51	41.0	0.007 J	0.008 J	6.41	0.234	0.97	<0.05 U	0.125	0.014	<0.002 U	0.85	0.1	0.01 J
4/12/2018	Assessment	0.03 J	0.42	43.3	0.01 J	0.005 J	27.4	0.217	0.094	<0.05 U	0.119	0.006	0.002 J	3.30	0.1	0.02 J
8/21/2018	Assessment	0.03 J	0.37	42.6	0.008 J	0.006 J	5.64	0.383	1.237	0.09	0.133	0.011	<0.002 U	0.43	0.1	0.01 J
5/1/2019	Assessment	0.02 J	0.29	41.7	<0.02 U	<0.01 U	1.75	0.172	0.5725	0.1	0.105	0.01 J	<0.002 U	<0.4 U	0.2 J	<0.1 U
6/12/2019	Assessment	0.02 J	0.27	41.3	<0.02 U	<0.01 U	0.697	0.105	0.4098	0.1	0.07 J	0.02 J	<0.002 U	<0.4 U	0.2 J	<0.1 U

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1: Residence Time Calculation Summary
Mitchell Bottom Ash Ponds

			2019-04		2019-06	
CCR Management Unit	Monitoring Well	Well Diameter (inches)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Groundwater Velocity (ft/year)	Groundwater Residence Time (days)
Bottom Ash Pond	MW-1504 [1]	2.0	33.2	1.8	16.4	3.7
	MW-1505 [2]	2.0	23.1	2.6	39.1	1.6
	MW-1506 [2]	2.0	15.6	3.9	38.8	1.6
	MW-1507 [2]	2.0	11.9	5.1	17.2	3.5
	MW-1508 [3]	2.0	45.5	1.3	20.0	3.0
	MW-1509 [2]	2.0	39.5	1.5	14.1	4.3
	MW-1510 [1]	2.0	15.0	4.1	11.4	5.3

Notes:
[1] - Sidegradient Well
[2] - Downgradient Well
[3] - Upgradient Well

Monitoring Well Network
- Compliance Sampling Location
- Upgradient Sampling Location

Bottom Ash Pond

Notes
- Monitoring well coordinates provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.

Site Layout
Bottom Ash Pond

Mitchell Power Generation Plant - Bottom Ash Pond
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2018/01/26

Figure 1

C:\Users\mmuenich\Documents\local_projects\AEP_GIS\Mitchell\MXDs\AEP-Mitchell_BAP_Site_Layout.mxd. MMuenich. 1/26/2018. Project/Phase/Task.

Legend
- Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour

Notes
- Monitoring well coordinates and water level data (collected on April 30, 2019) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater and river elevation units are feet above mean sea level (NAVD 88).

250 125 0 250 Feet

Potentiometric Surface Map - Uppermost Aquifer April 2019

Mitchell Power Generation Plant - Bottom Ash Pond
Marshall County, West Virginia

Geosyntec consultants

Figure 2

Columbus, Ohio | 2019/12/13

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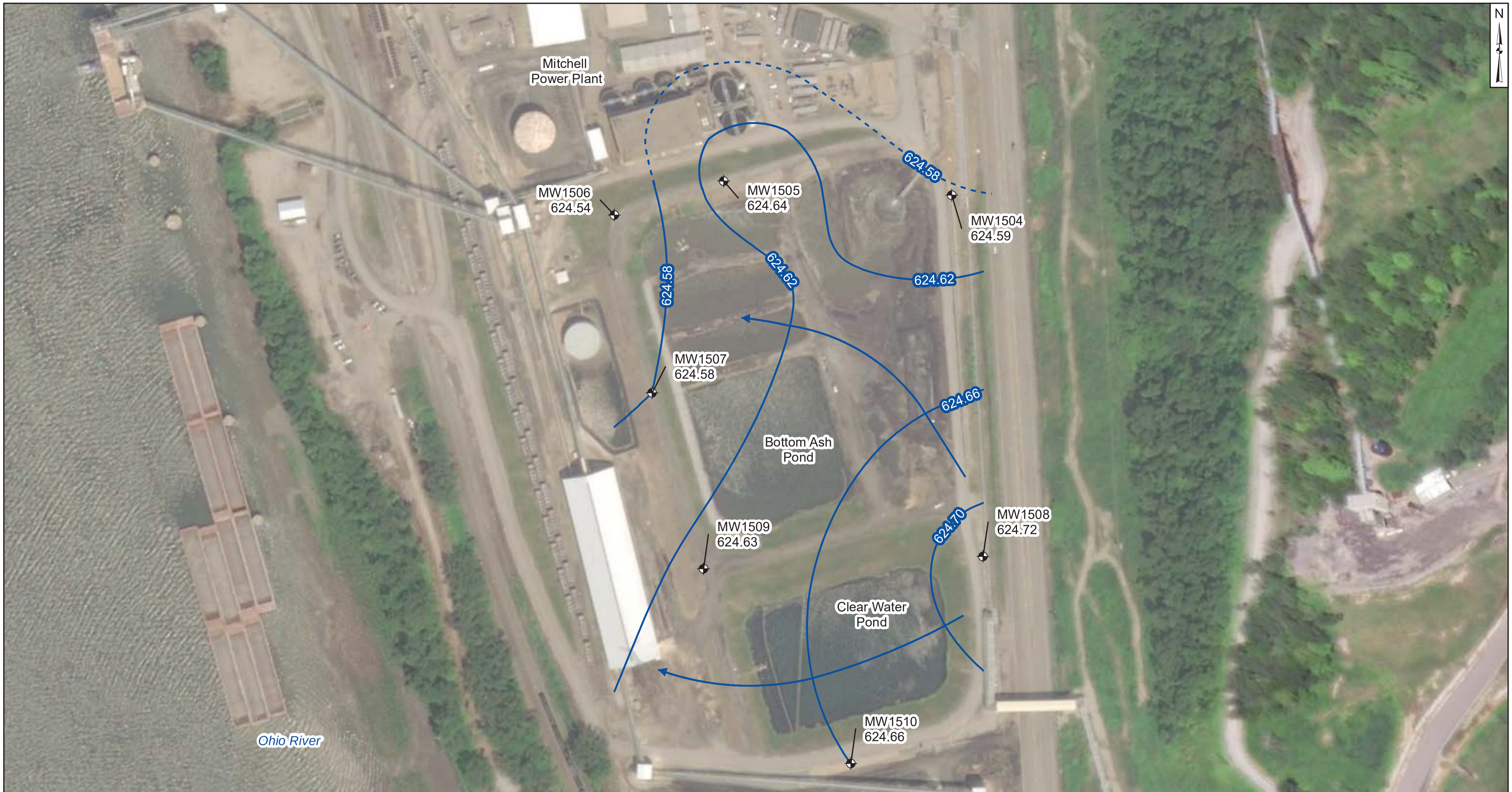


Legend

- Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on June 11, 2019) provided by AEP.
- Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater and river elevation units are feet above mean sea level (NAVD 88).

Potentiometric Surface Map - Uppermost Aquifer June 2019

Mitchell Power Generation Plant - Bottom Ash Pond
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2019/12/11

Figure 3

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\BAP\2019\AEP-Mitchell_Pond_GW_June2019.mxd. ARevezzo. 12/11/2019. Project/Phase/Task.

APPENDIX 2 - Statistical Analyses

The January and July 2019 statistical analysis summaries concluding that no SSLs were identified at the CCR unit follow.

STATISTICAL ANALYSIS SUMMARY
BOTTOM ASH POND
Mitchell Plant
Moundsville, West Virginia

Submitted to

AMERICAN ELECTRIC POWER

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

Geosyntec consultants

engineers | scientists | innovators

941 Chatham Lane
Suite 103
Columbus, Ohio 43221

January 8, 2019

CHA8473

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ATTACHMENTS

LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
BAP	Bottom Ash Pond
CCR	Coal Combustion Residuals
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
GWPS	Groundwater Protection Standard
LCL	Lower Confidence Limit
LFB	Laboratory Fortified Blanks
LRB	Laboratory Reagent Blanks
MCL	Maximum Contaminant Level
NELAP	National Environmental Laboratory Accreditation Program
QA	Quality Assurance
QC	Quality Control
RSL	Regional Screening Level
SSI	Statistically Significant Increase
SSL	Statistically Significant Level
TDS	Total Dissolved Solids
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency
UTL	Upper Tolerance Limit

SECTION 1

EXECUTIVE SUMMARY

In accordance with the United States Environmental Protection Agency's (USEPA's) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257.90-257.98, "CCR rule"), groundwater monitoring has been conducted at the Bottom Ash Pond (BAP), an existing CCR unit at the Mitchell Power Plant located in Moundsville, West Virginia.

Based on detection monitoring conducted in 2017, statistically significant increases (SSIs) over background were concluded for boron, calcium, chloride, and total dissolved solids (TDS) at the BAP. An alternate source was not identified at the time, so two assessment monitoring events were conducted at the BAP in 2018, in accordance with 40 CFR 257.95.

Groundwater data underwent several validation tests, including those for completeness, sample tracking accuracy, transcription errors, and consistent use of measurement units. No data quality issues were identified which would impact the usability of the data.

The monitoring data were submitted to Groundwater Stats Consulting, LLC for statistical analysis. Groundwater protection standards (GWPSs) were established for the Appendix IV parameters. Confidence intervals were calculated for Appendix IV parameters at the compliance wells to assess whether Appendix IV parameters were present at a statistically significant level (SSL) above the GWPS. No SSLs were identified, but Appendix III concentrations for boron, calcium, chloride, sulfate, and TDS remained above background. Thus, either the unit will remain in assessment monitoring or an alternative source demonstration will be conducted to evaluate if the unit can return to detection monitoring. Certification of the selected statistical methods by a qualified professional engineer is documented in Attachment A.

SECTION 2

BOTTOM ASH POND EVALUATION

2.1 Data Validation & QA/QC

During the assessment monitoring program, two sets of samples were collected for analysis from each upgradient and downgradient well to meet the requirements of 40 CFR 257.95(b) and 257.95(d)(1). Samples from both sampling events were analyzed for the Appendix III and Appendix IV parameters. A summary of data collected during assessment monitoring may be found in Table 1.

Chemical analysis was completed by an analytical laboratory certified by the National Environmental Laboratory Accreditation Program (NELAP). Quality assurance and quality control (QA/QC) samples completed by the analytical laboratory included the use of laboratory reagent blanks (LRBs), continuing calibration verification (CCV) samples, and laboratory fortified blanks (LFBs).

The analytical data were imported into a Microsoft Access database, where checks were completed to assess the accuracy of sample location identification and analyte identification. Where necessary, unit conversions were applied to standardize reported units across all sampling events. Exported data files were created for use with the Sanitas™ v.9.5 statistics software. The export file was checked against the analytical data for transcription errors and completeness. No QA/QC issues were noted which would impact data usability.

2.2 Statistical Analysis

Statistical analyses for the BAP were conducted in accordance with the January 2017 *Statistical Analysis Plan* (AEP, 2017), except where noted below. Time series plots and results for all completed statistical tests are provided in Attachment B.

The data obtained to meet the requirements of 40 CFR 257.95(b) and 257.95(d)(1) were screened for potential outliers. No outliers were identified. Outliers identified from the background and detection monitoring events conducted through January 2018 were summarized in a previous report (Geosyntec, 2018).

2.2.1 Establishment of GWPSs

A GWPS was established for each Appendix IV parameter in accordance with 40 CFR 257.95(h) and the *Statistical Analysis Plan* (AEP, 2017). The established GWPS was determined to be the greater value of the background concentration and the maximum contaminant level (MCL) or regional screening level (RSL) for each Appendix IV parameter. To determine background concentrations, an upper tolerance limit (UTL) was calculated using pooled data from the background wells collected during the background monitoring and assessment monitoring events.

Generally, tolerance limits were calculated parametrically with 95% coverage and 95% confidence. Non-parametric tolerance limits were calculated for cadmium, fluoride, mercury, selenium, and thallium due to apparent non-normal distributions. Tolerance limits and the final GWPSs are summarized in Table 2.

2.2.2 Evaluation of Potential Appendix IV SSLs

A confidence interval was constructed for each Appendix IV parameter at each compliance well. Confidence limits were generally calculated parametrically ($\alpha = 0.01$); however, non-parametric confidence limits were calculated in some cases (e.g., when the data did not appear to be normally distributed or when the non-detect frequency was too high). An SSL was concluded if the lower confidence limit (LCL) exceeded the GWPS (i.e., if the entire confidence interval exceeded the GWPS). Calculated confidence limits are shown in Attachment B.

No SSLs were identified at the Mitchell BAP.

2.2.3 Evaluation of Potential Appendix III SSIs

The CCR rule allows CCR units to move from assessment monitoring to detection monitoring if all Appendix III and Appendix IV parameters were at or below background levels for two consecutive sampling events [40 CFR 257.95(e)]. Since no Appendix IV SSLs were identified, Appendix III results were analyzed to assess whether concentrations of Appendix III parameters at the compliance wells exceeded background concentrations.

Prediction limits were calculated for the Appendix III parameters to represent background values. As described in the January 2018 *Statistical Analysis Summary* report (Geosyntec, 2018), intrawell tests were used to evaluate potential SSIs for fluoride and sulfate, whereas interwell tests were used to evaluate potential SSIs for boron, calcium, chloride, pH, and TDS.

Prediction limits for the interwell tests were recalculated using data collected during the 2018 assessment monitoring events. Twelve data points (i.e., two samples from six background wells) were added to the background dataset for each interwell test. New data were tested for outliers prior to being added to the background dataset. The updated prediction limits were calculated for a one-of-two retesting procedure, as during detection monitoring. The values of the updated prediction limits were similar to the values of the prediction limits calculated during detection monitoring. The revised prediction limits were used to evaluate potential SSIs for boron, calcium, chloride, pH, and TDS.

For the intrawell tests, limited data made it possible to add only two data points (i.e., two samples from each compliance well) to each background dataset. Because two sample results are insufficient to compare against the existing background dataset, the prediction limits were not updated for the intrawell tests at this time. The prediction limits calculated during detection monitoring were used to evaluate potential SSIs for fluoride and sulfate.

Data collected during the second assessment monitoring event from each compliance well were compared to the prediction limits to evaluate SSIs. The results from this event and the prediction limits are summarized in Table 3. The following exceedances of the upper prediction limits (UPLs) were noted:

- Boron concentrations exceeded the interwell UPL of 1.36 mg/L at MW-1505 (8.00 mg/L for both events), MW-1506 (5.73 mg/L and 5.91 mg/L), MW-1507 (10.4 mg/L and 9.29 mg/L), MW-1509 (6.81 mg/L and 6.97 mg/L), and MW-1510 (10.3 mg/L and 9.13 mg/L).

- Calcium concentrations exceeded the interwell UPL of 241 mg/L at MW-1505 (282 mg/L and 274 mg/L), MW-1506 (275 mg/L and 270 mg/L), MW-1507 (296 mg/L and 272 mg/L), MW-1509 (272 mg/L and 279 mg/L), and MW-1510 (292 mg/L and 268 mg/L).

- Chloride concentrations exceeded the interwell UPL of 238 mg/L at MW-1505 (289 mg/L and 284 mg/L), MW-1506 (382 mg/L and 369 mg/L), MW-1507 (400 mg/L and 331 mg/L), MW-1509 (324 mg/L and 323 mg/L), and MW-1510 (322 mg/L and 334 mg/L).

- Sulfate concentrations exceeded the intrawell UPL of 351 mg/L at MW-1505 (401 mg/L and 383 mg/L), the intrawell UPL of 345 mg/L at MW-1506 (347 mg/L and 349 mg/L), the intrawell UPL of 450 mg/L at MW-1509 (488 mg/L and 465 mg/L), and the intrawell UPL of 399 mg/L at MW-1510 (428 mg/L).

- TDS concentrations exceeded the interwell UPL of 1193 mg/L at MW-1505 (1220 mg/L and 1520 mg/L), MW-1506 (1300 mg/L and 1590 mg/L), MW-1507 (1390 mg/L and 1430 mg/L), MW-1509 (1390 mg/L and 1540 mg/L), and MW-1510 (1290 mg/L and 1550 mg/L).

Based on these results, concentrations of Appendix III parameters exceeded background levels at compliance wells at the Mitchell BAP during assessment monitoring. As a result, the Mitchell BAP CCR unit will remain in assessment monitoring.

2.3 <u>Conclusions</u>

Two assessment monitoring events were conducted in 2018 in accordance with the CCR Rule. The laboratory and field data were reviewed prior to statistical analysis, with no QA/QC issues identified that impacted data usability. A review of outliers identified no potential outliers in the 2018 data. GWPSs were established for the Appendix IV parameters. A confidence interval was constructed at each compliance well for each Appendix IV parameter; SSLs were concluded if the entire confidence interval exceeded the GWPS. No SSLs were identified.

The Appendix III results were evaluated to assess whether concentrations of Appendix III parameters exceeded background levels. Interwell tests were used to evaluate potential SSIs for boron, calcium, chloride, pH and TDS, and intrawell tests were used to evaluate potential SSIs for fluoride and sulfate. The prediction limits for the interwell tests were updated with additional data collected from the background wells. Prediction limits were recalculated using a one-of-two retesting procedure. The prediction limits calculated during detection monitoring were used for the intrawell tests. Boron, calcium, chloride, sulfate, and TDS results exceeded background levels.

Based on this evaluation, the Mitchell BAP CCR unit will remain in assessment monitoring.

SECTION 3

REFERENCES

American Electric Power (AEP). 2017. Statistical Analysis Plan – Mitchell Plant. January 2017.

Geosyntec Consultants (Geosyntec). 2018. Statistical Analysis Summary – Bottom Ash Pond, Mitchell Plant, Moundsville, West Virginia. January 15, 2018.

TABLES

Table 1 – Groundwater Data Summary
Mitchell – Bottom Ash Pond

Parameter	Unit	MW-1504		MW-1505		MW-1506		MW-1507		MW-1508		MW-1509		MW-1510	
		4/11/2018	8/22/2018	4/11/2018	8/22/2018	4/11/2018	8/22/2018	4/11/2018	8/21/2018	4/11/2018	8/21/2018	4/11/2018	8/21/2018	4/12/2018	8/21/2018
Antimony	µg/L	0.0200 J	0.0500 J	0.0300 J	0.0500 J	0.0300 J	0.0600	0.0700	0.0800	0.0400 J	0.0600	0.0300 J	0.0900	0.0300 J	0.0300 J
Arsenic	µg/L	0.360	0.280	0.440	0.380	0.730	0.460	1.67	0.470	1.04	0.440	0.420	0.330	0.420	0.370
Barium	µg/L	36.9	37.9	46.0	48.0	55.4	54.6	71.2	62.1	46.4	40.1	52.8	53.8	43.3	42.6
Beryllium	µg/L	0.00500 J	0.02 U	0.00600 J	0.00700 J	0.0210	0.0100 J	0.0620	0.0100 J	0.0400	0.0100 J	0.00500 J	0.02 U	0.0100 J	0.00800 J
Boron	mg/L	0.0630	0.0960	8.00	8.00	5.73	5.91	10.4	9.29	0.806	0.952	6.81	6.97	10.4	9.13
Cadmium	µg/L	0.0300	0.0300	0.0300	0.0300	0.0200 J	0.0200	0.0400	0.0300	0.0400	0.0400	0.0100 J	0.00800 J	0.00500 J	0.00600 J
Calcium	mg/L	204	230	282	274	275	270	296	272	229	219	272	279	292	268
Chloride	mg/L	83.6	91.9	289	284	382	369	400	331	200	204	324	323	322	334
Chromium	µg/L	0.562	0.331	1.16	1.40	2.01	2.47	21.3	2.00	1.40	0.691	0.657	0.777	27.4	5.64
Cobalt	µg/L	0.114	0.0930	0.151	0.257	0.476	0.581	1.45	0.426	1.03	0.678	0.215	0.132	0.217	0.383
Combined Radium	pCi/L	0.349	1.05	0.582	0.576	0.592	1.72	0.701	1.42	0.236	0.315	0.792	0.736	0.0940	1.24
Fluoride	mg/L	0.190	0.200	0.20 U	0.0200 J	0.02 U	0.0500 J	0.0600 J	0.0700	0.0800	0.0800	0.150	0.140	0.20 U	0.0900
Lead	µg/L	0.0520	0.0370	0.116	0.150	0.477	0.319	1.56	0.308	1.11	0.384	0.0620	0.0350	0.119	0.133
Lithium	mg/L	0.00400	0.00600	0.00500	0.00800	0.00900	0.0100	0.0120	0.0100	0.00800	0.00700	0.00900	0.0120	0.00600	0.0110
Mercury	µg/L	0.01 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.00600	0.00200 J	0.01 U	0.005 U	0.00200 J	0.005 U	0.00200 J	0.005 U
Molybdenum	µg/L	0.410	0.330	0.670	1.35	1.23	0.500	2.73	0.870	0.450	0.250	0.340	0.320	3.30	0.430
Selenium	µg/L	0.0400 J	0.0400 J	0.700	0.400	0.100	0.0900 J	0.300	0.0800 J	0.700	0.400	0.200	0.300	0.100	0.100
Total Dissolved Solids	mg/L	842	936	1220	1520	1300	1590	1390	1430	1050	1080	1390	1540	1290	1550
Sulfate	mg/L	291	372	401	383	347	349	347	323	302	313	488	465	398	428
Thallium	µg/L	0.0300 J	0.0300 J	0.0650	0.0700	0.0500 J	0.0500	0.0590	0.0500 J	0.0500 J	0.0300 J	0.0570	0.0300 J	0.0200 J	0.0100 J
pH	SU	6.98	7.34	7.02	7.33	7.08	7.40	6.93	7.23	6.90	7.17	6.92	7.24	6.95	7.30

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
SU: standard unit
U: Parameter was not present in concentrations above method detection limit and is reported as the reporting limit
J: Estimated value. Parameter was detected in concentrations below the reporting limit

Table 2: Groundwater Protection Standards
Mitchell Plant - Bottom Ash Pond

Constituent Name	MCL	RSL	Background Limit
Antimony, Total (mg/L)	0.006		0.000091
Arsenic, Total (mg/L)	0.01		0.0018
Barium, Total (mg/L)	2		0.06
Beryllium, Total (mg/L)	0.004		0.000077
Cadmium, Total (mg/L)	0.005		0.00009
Chromium, Total (mg/L)	0.1		0.0024
Cobalt, Total (mg/L)	n/a	0.006	0.0032
Combined Radium, Total (pCi/L)	5		2.41
Fluoride, Total (mg/L)	4		0.25
Lead, Total (mg/L)	n/a	0.015	0.0046
Lithium, Total (mg/L)	n/a	0.04	0.016
Mercury, Total (mg/L)	0.002		0.000008
Molybdenum, Total (mg/L)	n/a	0.1	0.002
Selenium, Total (mg/L)	0.05		0.0009
Thallium, Total (mg/L)	0.002		0.00011

Notes:
Grey cell indicates calculated UTL is higher than MCL.
MCL = Maximum Contaminant Level
RSL = Regional Screening Level
Calculated UTL (Upper Tolerance Limit) represents site-specific background values.
The higher of the calculated UTL or MCL/RSL is used as the GWPS.

Table 3: Appendix III Data Evaluation
Mitchell Plant - Bottom Ash Pond

Parameter	Units	Description	MW-1505		MW-1506		MW-1507		MW-1509		MW-1510	
			4/11/2018	8/22/2018	4/11/2018	8/22/2018	4/11/2018	8/21/2018	4/11/2018	8/21/2018	4/12/2018	8/21/2018
Boron	mg/L	Interwell Background Value (UPL)	1.36									
		Assessment Monitoring Result	**8.00**	**8.00**	**5.73**	**5.91**	**10.4**	**9.29**	**6.81**	**6.97**	**10.3**	**9.13**
Calcium	mg/L	Interwell Background Value (UPL)	241									
		Assessment Monitoring Result	**282**	**274**	**275**	**270**	**296**	**272**	**272**	**279**	**292**	**268**
Chloride	mg/L	Interwell Background Value (UPL)	238									
		Assessment Monitoring Result	**289**	**284**	**382**	**369**	**400**	**331**	**324**	**323**	**322**	**334**
Fluoride	mg/L	Intrawell Background Value (UPL)	0.200		0.200		0.200		0.160		0.200	
		Assessment Monitoring Result	0.050	0.020	0.050	0.050	0.060	0.070	0.150	0.140	0.050	0.090
pH	SU	Interwell Background Value (UPL)	7.35									
		Interwell Background Value (LPL)	6.84									
		Assessment Monitoring Result	7.02	7.33	7.08	**7.40**	6.93	7.23	6.92	7.24	6.95	7.30
Sulfate	mg/L	Intrawell Background Value (UPL)	351		345		377		450		399	
		Assessment Monitoring Result	**401**	**383**	**347**	**349**	347	323	**488**	**465**	398	**428**
Total Dissolved Solids	mg/L	Interwell Background Value (UPL)	1193									
		Assessment Monitoring Result	**1220**	**1520**	**1300**	**1590**	**1390**	**1430**	**1390**	**1540**	**1290**	**1550**

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
Bold values exceed the background value.
Background values are shaded gray.
Based on a 1-of-2 resampling, a statistically significant increase (SSI)
is only identified when both samples in the detection monitoring

ATTACHMENT A

Certification by Qualified Professional Engineer

Certification by Qualified Professional Engineer

I certify that the selected and above described statistical method is appropriate for evaluating the groundwater monitoring data for the Mitchell Bottom Ash Pond CCR management area and that the requirements of 40 CFR 257.93(f) have been met.

DAVID ANTHONY MILLER

Printed Name of Licensed Professional Engineer

David Anthony Miller

Signature

DAVID ANTHONY MILLER
REGISTERED
22663
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

22663	WEST VIRGINIA	01.08.19
License Number	Licensing State	Date

ATTACHMENT B

Statistical Analysis Output

GROUNDWATER STATS
CONSULTING

November 12, 2018

Geosyntec Consultants
Attn: Ms. Allison Kreinberg
150 E. Wilson Bridge Rd., #232
Worthington, OH 43085

Dear Ms. Kreinberg,

Groundwater Stats Consulting, formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the evaluation of groundwater data for American Electric Power Company's Mitchell Bottom Ash Pond. The analysis complies with the federal rule for the Disposal of Coal Combustion Residuals from Electric Utilities (CCR Rule, 2015) as well as with the USEPA Unified Guidance (2009).

Sampling at each of the wells below began at Mitchell Bottom Ash Pond for the CCR program in 2016. The monitoring well network, as provided by Geosyntec Consultants, consists of the following: upgradient wells MW-1504 and MW-1508; and downgradient wells MW-1505, MW-1506, MW-1507, MW-1509 and MW-1510.

Data were sent electronically, and the statistical analysis was conducted according to the Statistical Analysis Plan and screening evaluation prepared by GSC and approved by Dr. Kirk Cameron, PhD Statistician with MacStat Consulting, primary author of the USEPA Unified Guidance, and Senior Advisor to GSC.

The CCR program consists of the following constituents:

- **Appendix III** (Detection Monitoring) **-** boron, calcium, chloride, fluoride, pH, sulfate, and TDS; and
- **Appendix IV** (Assessment Monitoring) **–** antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, combined radium 226 + 228, fluoride, lead, lithium, mercury, molybdenum, selenium, and thallium.

Time series plots for Appendix III and IV parameters are provided for all wells and constituents; and are used to evaluate concentrations over the entire record. Values in background which have previously been flagged as outliers may be seen in a lighter font and disconnected symbol on the graphs. Additionally, a summary of flagged values follows this letter.

Evaluation of Appendix III Parameters

Interwell prediction limits combined with a 1-of-2 resample plan were constructed for boron, calcium, chloride, pH, and TDS; and intrawell prediction limits combined with a 1-of-2 resample plan were constructed for fluoride and sulfate. The statistical method for applicable for each parameter was determined based on the results of the screening analysis performed in December 2017.

In the event of an initial exceedance of compliance well data, the 1-of-2 resample plan allows for collection of one additional sample to determine whether the initial exceedance is confirmed. When the resample confirms the initial exceedance, a statistically significant increase (SSI) is identified and further research would be required to identify the cause of the exceedance (i.e. impact from the site, natural variation, or an off-site source). If the resample falls within the statistical limit, the initial exceedance is considered a false positive result and, therefore, no further action is necessary. SSIs were noted for several of the Appendix III parameters and the results of those findings may be found in the Prediction Limit Summary tables following this letter.

When a statistically significant increase is identified, the data are further evaluated using the Sen's Slope/Mann Kendall trend test to determine whether data are statistically increasing, decreasing or stable. Several statistically significant decreasing trends were noted, but no statistically significant increasing trends were found except for sulfate in downgradient well MW_1509. The Trend Test Summary Table follows this letter.

<u>Appendix IV – Assessment Monitoring Program</u>

Evaluation of Appendix IV Parameters

Parametric tolerance limits were used to calculate background limits from pooled upgradient well data for Appendix IV parameters with a target of 95% confidence and 95% coverage to determine the Alternate Contaminant Level (ACL). The confidence and coverage levels for nonparametric tolerance limits are dependent upon the number of background samples. These limits were compared to the Maximum Contaminant Levels

(MCLs) and Regional Screening Levels (RSLs) in the Groundwater Protection Standards (GWPS) table following this letter to determine the highest limit for use as the GWPS in the Confidence Interval comparisons.

Confidence intervals were then constructed on downgradient wells for each of the Appendix IV parameters using the highest limit of either the MCL, RSL, or ACL as discussed above. Only when the entire confidence interval is above a GWPS is the well/constituent pair considered to exceed its respective standard. No exceedances were noted at any of the downgradient wells. A summary of the confidence interval results follows this letter.

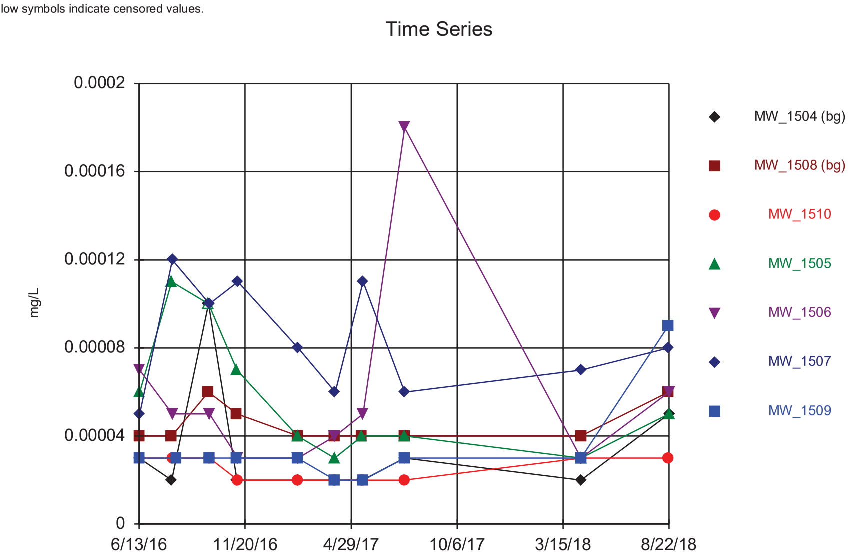
Thank you for the opportunity to assist you in the statistical analysis of groundwater quality for the Mitchell Bottom Ash Pond. If you have any questions or comments, please feel free to contact me.

For Groundwater Stats Consulting,

Kristina Rayner

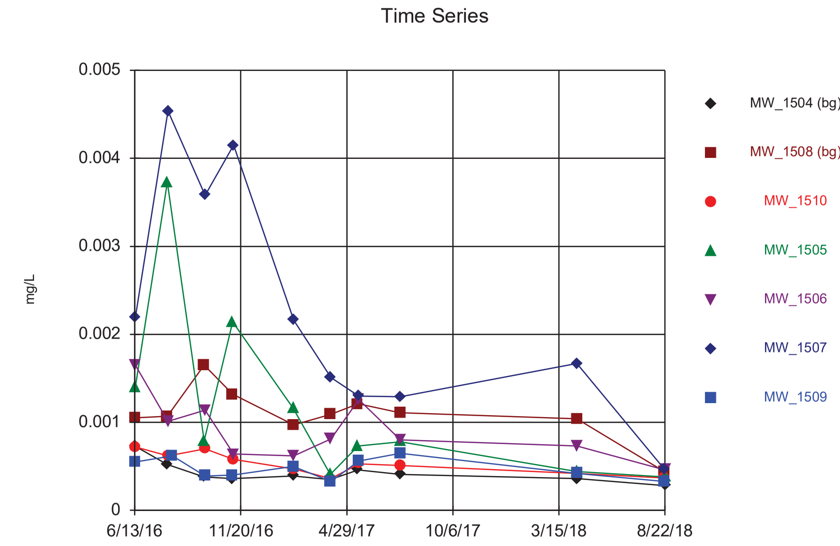
Kristina L. Rayner
Groundwater Statistician

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



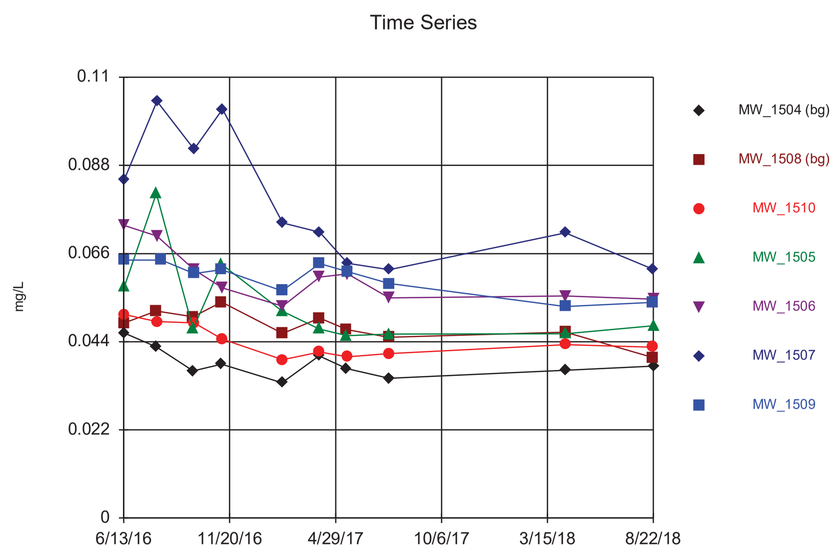
Constituent: Antimony, total Analysis Run 11/11/2018 2:37 PM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG



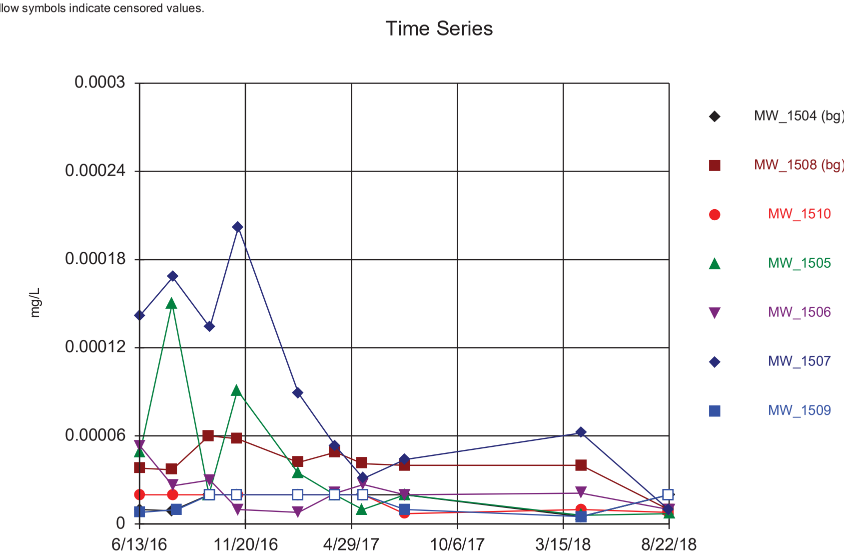
Constituent: Arsenic, Total Analysis Run 11/11/2018 2:37 PM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG



Constituent: Barium, Total Analysis Run 11/11/2018 2:37 PM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

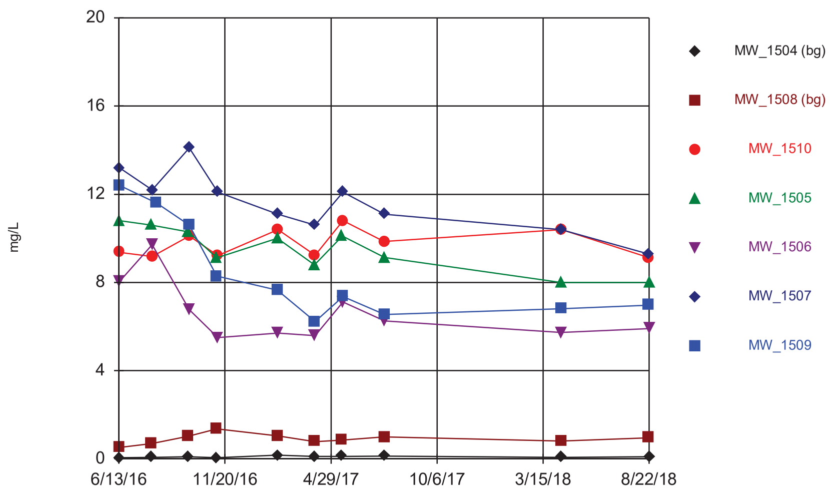
Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



Constituent: Beryllium, total Analysis Run 11/11/2018 2:37 PM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

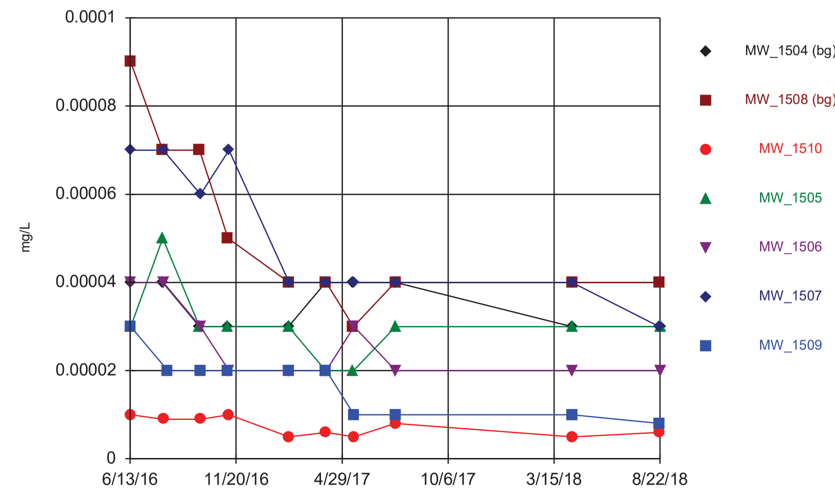
Time Series



Constituent: Boron, total   Analysis Run 11/11/2018 2:37 PM   View: Time Series - All Wells
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

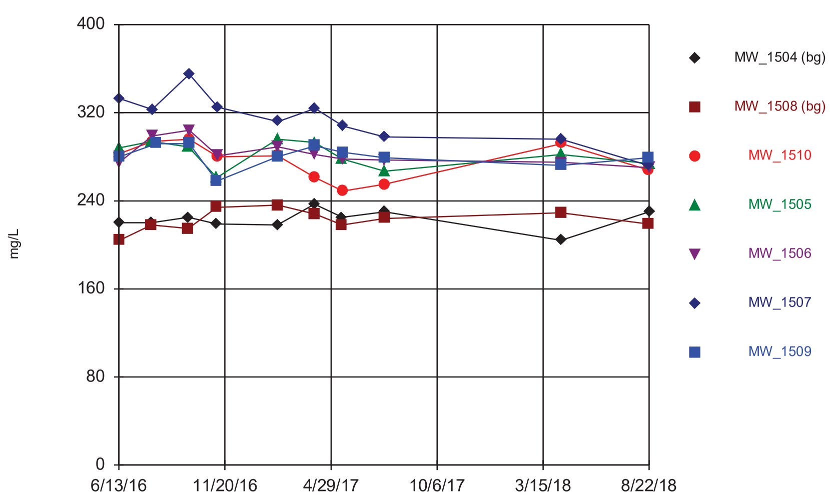
Time Series



Constituent: Cadmium, total   Analysis Run 11/11/2018 2:37 PM   View: Time Series - All Wells
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

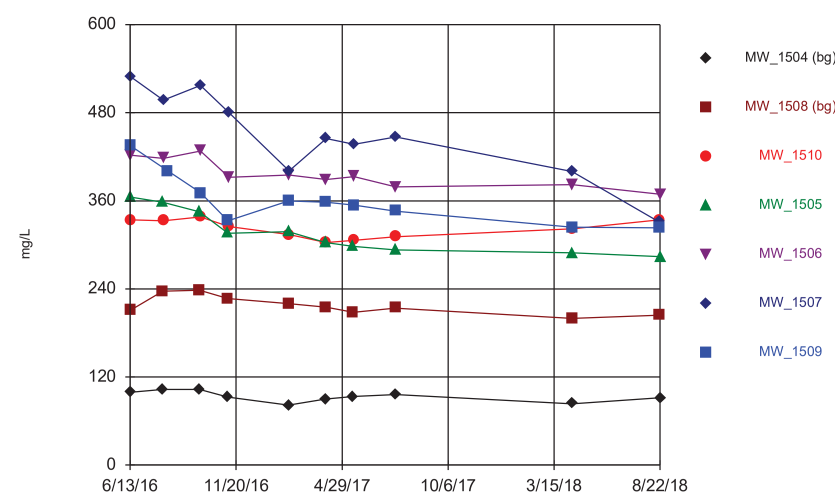
Time Series



Constituent: Calcium, total   Analysis Run 11/11/2018 2:37 PM   View: Time Series - All Wells
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

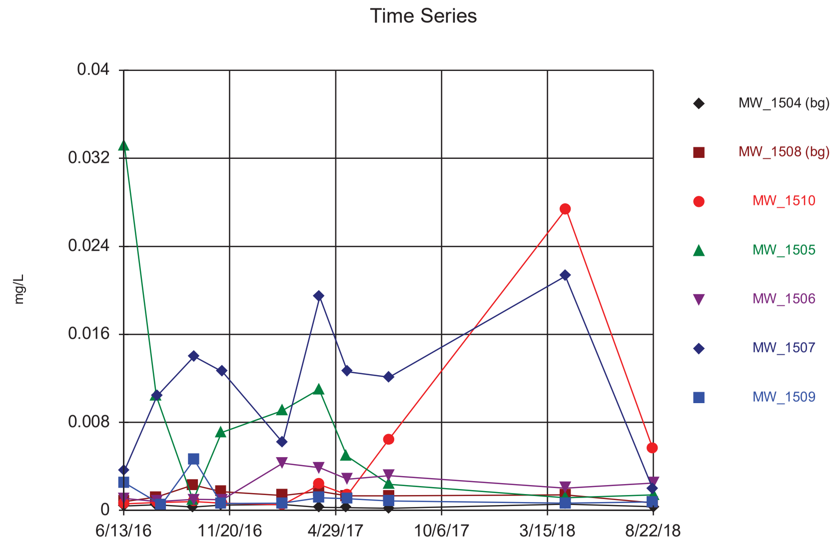
Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Time Series



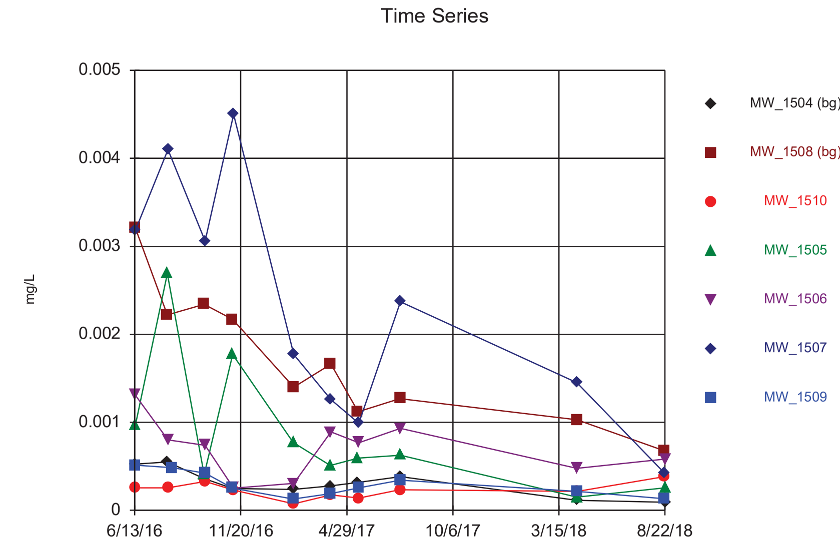
Constituent: Chloride, total   Analysis Run 11/11/2018 2:37 PM   View: Time Series - All Wells
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG



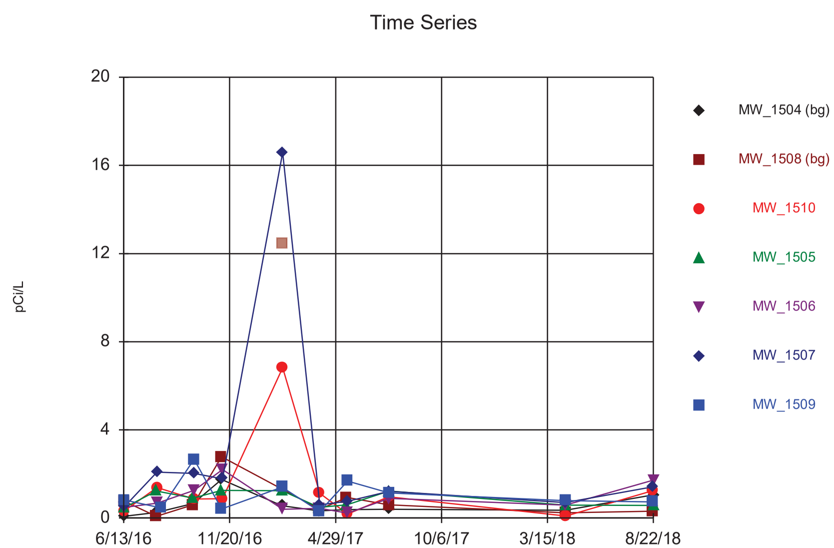
Constituent: Chromium, total Analysis Run 11/11/2018 2:37 PM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG



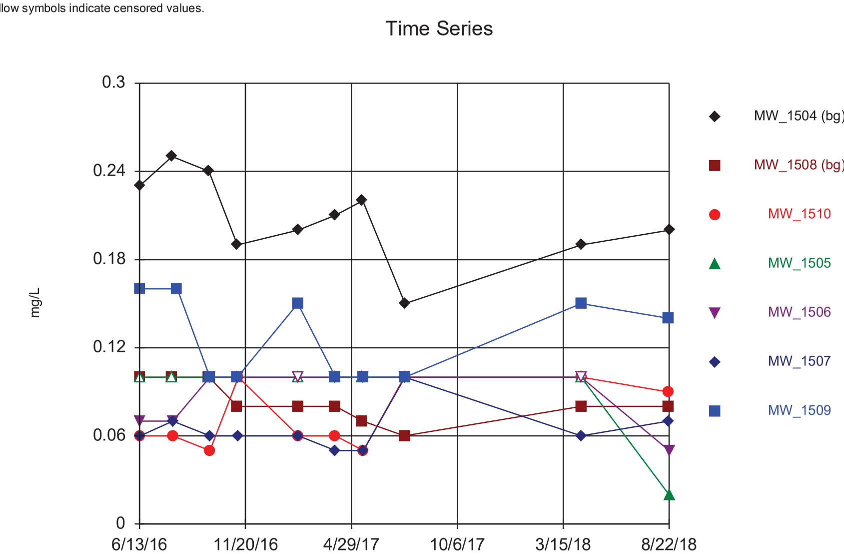
Constituent: Cobalt, total Analysis Run 11/11/2018 2:37 PM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG



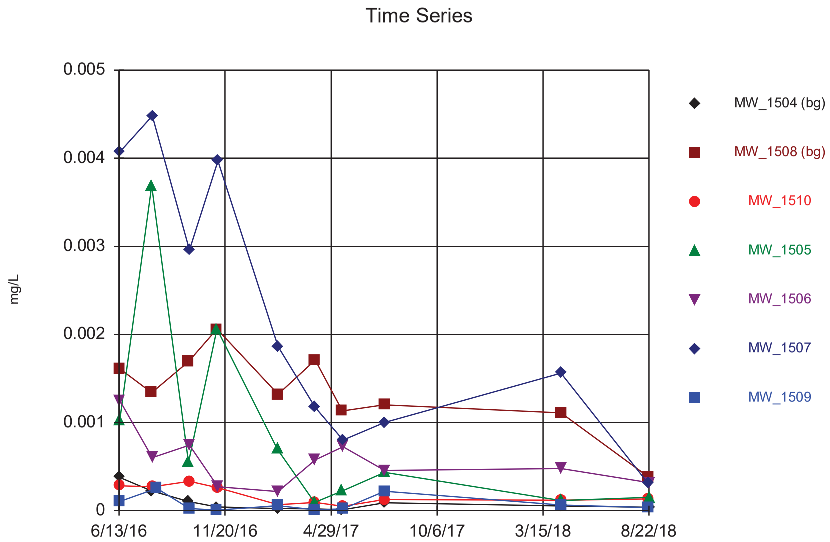
Constituent: Combined Radium 226 + 228 Analysis Run 11/11/2018 2:37 PM View: Time Series - All Well
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



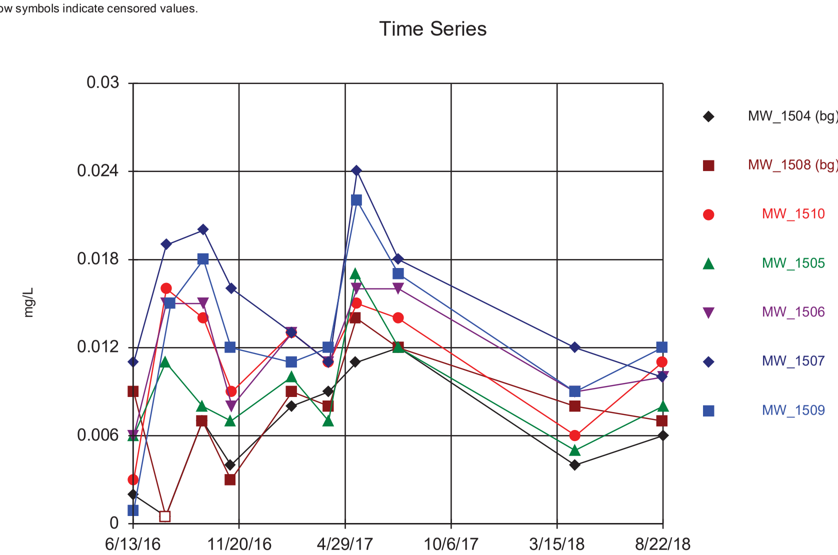
Constituent: Fluoride, total Analysis Run 11/11/2018 2:37 PM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG



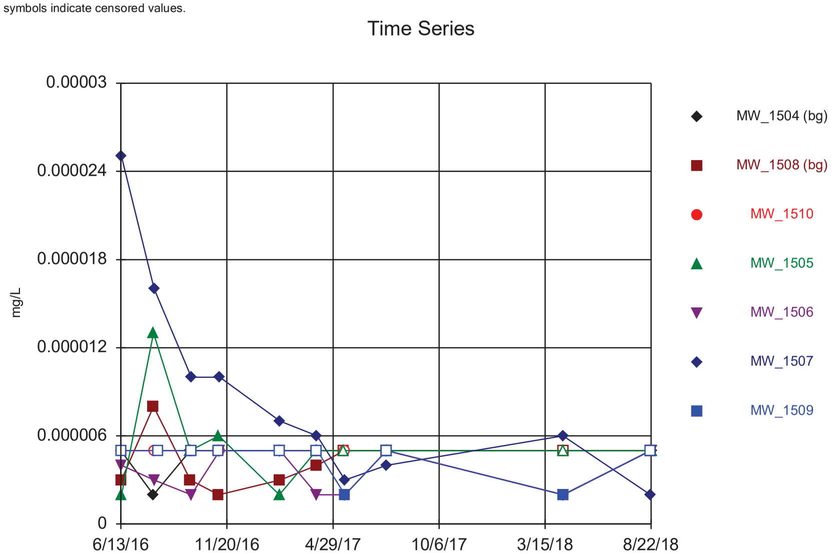
Constituent: Lead, total   Analysis Run 11/11/2018 2:37 PM   View: Time Series - All Wells
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



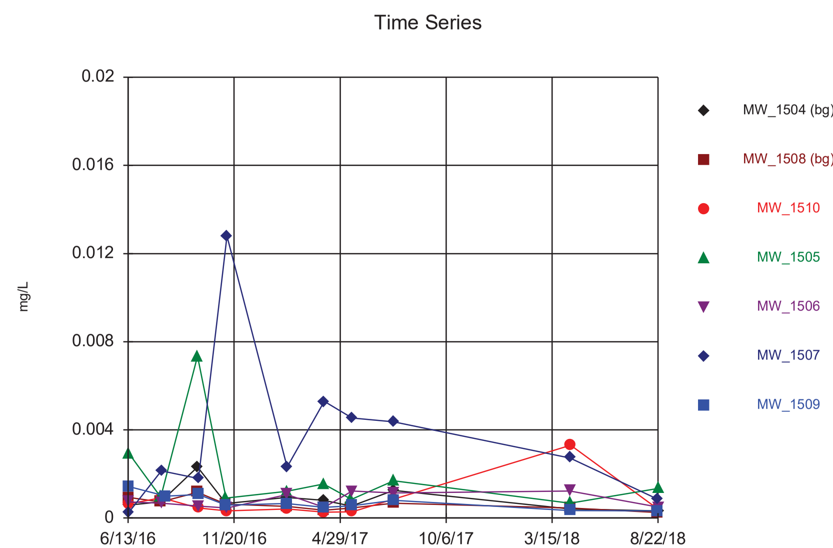
Constituent: Lithium, total   Analysis Run 11/11/2018 2:37 PM   View: Time Series - All Wells
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



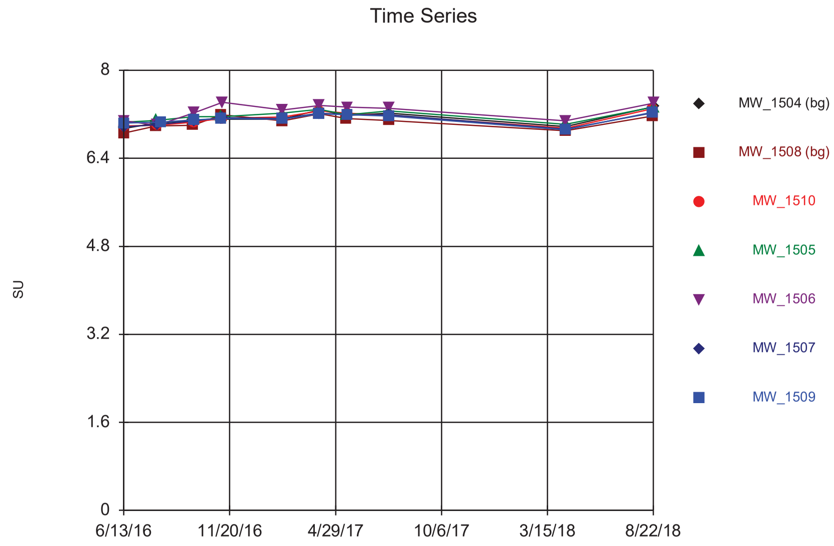
Constituent: Mercury, total   Analysis Run 11/11/2018 2:37 PM   View: Time Series - All Wells
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG



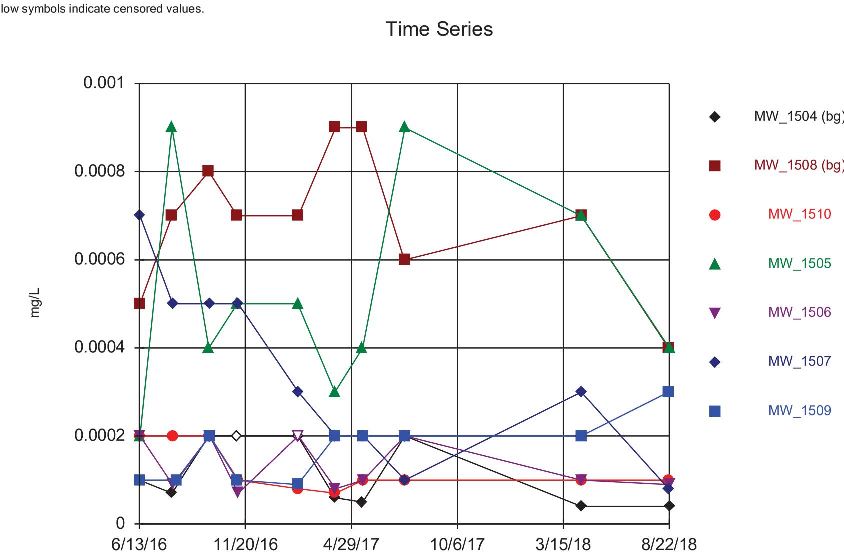
Constituent: Molybdenum, total   Analysis Run 11/11/2018 2:37 PM   View: Time Series - All Wells
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG



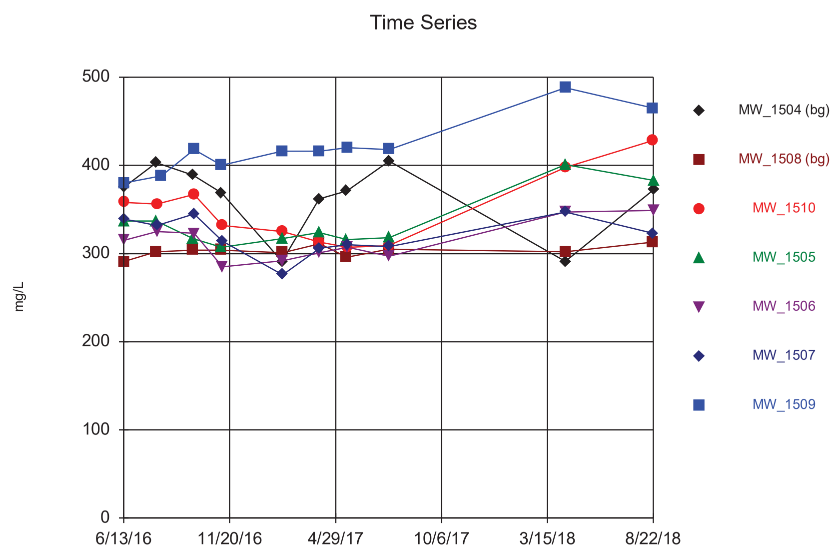
Constituent: pH, field Analysis Run 11/11/2018 2:37 PM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



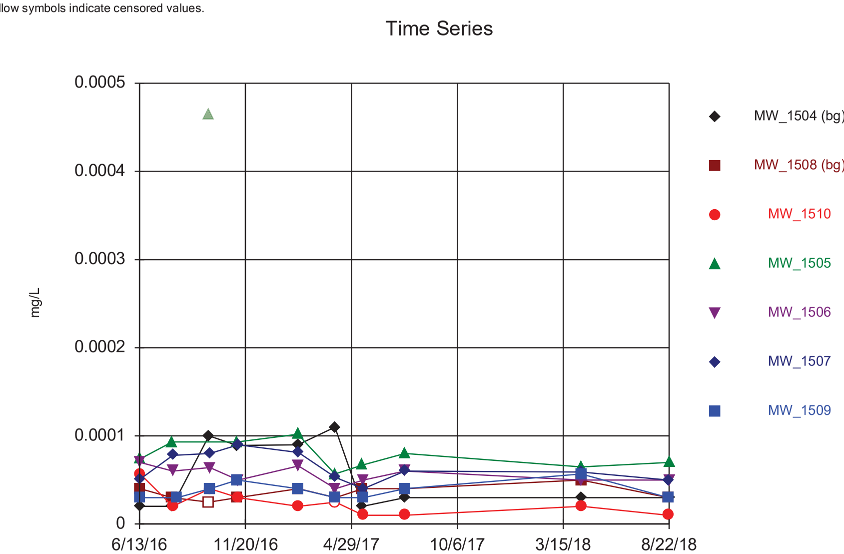
Constituent: Selenium, Total Analysis Run 11/11/2018 2:37 PM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG



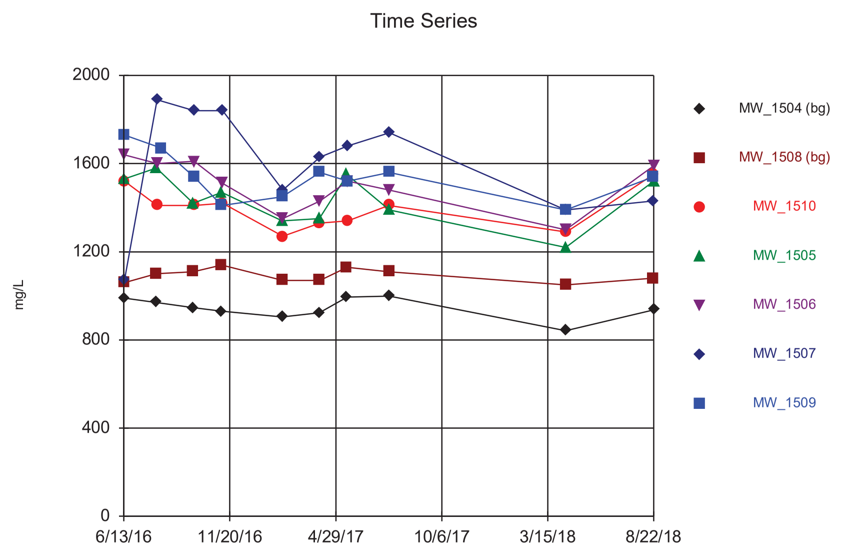
Constituent: Sulfate, total Analysis Run 11/11/2018 2:37 PM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



Constituent: Thallium, Total Analysis Run 11/11/2018 2:37 PM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG



Constituent: Total Dissolved Solids [TDS] Analysis Run 11/11/2018 2:37 PM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Interwell Prediction Limit Summary Table - Significant Results

Mitchell BAP Client: Geosyntec Data: Mitchell BAP Printed 11/11/2018, 2:12 PM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	**MW_1510**	**1.36**	**n/a**	**8/21/2018**	**9.13**	**Yes**	**20**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.004024**	NP (normality) 1 of 2
Boron, total (mg/L)	**MW_1505**	**1.36**	**n/a**	**8/22/2018**	**8**	**Yes**	**20**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.004024**	NP (normality) 1 of 2
Boron, total (mg/L)	**MW_1506**	**1.36**	**n/a**	**8/22/2018**	**5.91**	**Yes**	**20**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.004024**	NP (normality) 1 of 2
Boron, total (mg/L)	**MW_1507**	**1.36**	**n/a**	**8/21/2018**	**9.29**	**Yes**	**20**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.004024**	NP (normality) 1 of 2
Boron, total (mg/L)	**MW_1509**	**1.36**	**n/a**	**8/21/2018**	**6.97**	**Yes**	**20**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.004024**	NP (normality) 1 of 2
Calcium, total (mg/L)	**MW_1510**	**241.2**	**n/a**	**8/21/2018**	**268**	**Yes**	**20**	**222.7**	**9.069**	**0**	**None**	**No**	**0.001504**	Param 1 of 2
Calcium, total (mg/L)	**MW_1505**	**241.2**	**n/a**	**8/22/2018**	**274**	**Yes**	**20**	**222.7**	**9.069**	**0**	**None**	**No**	**0.001504**	Param 1 of 2
Calcium, total (mg/L)	**MW_1506**	**241.2**	**n/a**	**8/22/2018**	**270**	**Yes**	**20**	**222.7**	**9.069**	**0**	**None**	**No**	**0.001504**	Param 1 of 2
Calcium, total (mg/L)	**MW_1507**	**241.2**	**n/a**	**8/21/2018**	**272**	**Yes**	**20**	**222.7**	**9.069**	**0**	**None**	**No**	**0.001504**	Param 1 of 2
Calcium, total (mg/L)	**MW_1509**	**241.2**	**n/a**	**8/21/2018**	**279**	**Yes**	**20**	**222.7**	**9.069**	**0**	**None**	**No**	**0.001504**	Param 1 of 2
Chloride, total (mg/L)	**MW_1510**	**238**	**n/a**	**8/21/2018**	**334**	**Yes**	**20**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.004024**	NP (normality) 1 of 2
Chloride, total (mg/L)	**MW_1505**	**238**	**n/a**	**8/22/2018**	**284**	**Yes**	**20**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.004024**	NP (normality) 1 of 2
Chloride, total (mg/L)	**MW_1506**	**238**	**n/a**	**8/22/2018**	**369**	**Yes**	**20**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.004024**	NP (normality) 1 of 2
Chloride, total (mg/L)	**MW_1507**	**238**	**n/a**	**8/21/2018**	**331**	**Yes**	**20**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.004024**	NP (normality) 1 of 2
Chloride, total (mg/L)	**MW_1509**	**238**	**n/a**	**8/21/2018**	**323**	**Yes**	**20**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.004024**	NP (normality) 1 of 2
pH, field (SU)	**MW_1506**	**7.352**	**6.838**	**8/22/2018**	**7.4**	**Yes**	**20**	**7.095**	**0.1256**	**0**	**None**	**No**	**0.000752**	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	**MW_1509**	**1193**	**n/a**	**8/21/2018**	**1540**	**Yes**	**20**	**1018**	**85.7**	**0**	**None**	**No**	**0.001504**	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	**MW_1510**	**1193**	**n/a**	**8/21/2018**	**1550**	**Yes**	**20**	**1018**	**85.7**	**0**	**None**	**No**	**0.001504**	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	**MW_1505**	**1193**	**n/a**	**8/22/2018**	**1520**	**Yes**	**20**	**1018**	**85.7**	**0**	**None**	**No**	**0.001504**	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	**MW_1506**	**1193**	**n/a**	**8/22/2018**	**1590**	**Yes**	**20**	**1018**	**85.7**	**0**	**None**	**No**	**0.001504**	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	**MW_1507**	**1193**	**n/a**	**8/21/2018**	**1430**	**Yes**	**20**	**1018**	**85.7**	**0**	**None**	**No**	**0.001504**	Param 1 of 2

Interwell Prediction Limit Summary Table - All Results

Mitchell BAP Client: Geosyntec Data: Mitchell BAP Printed 11/11/2018, 2:12 PM

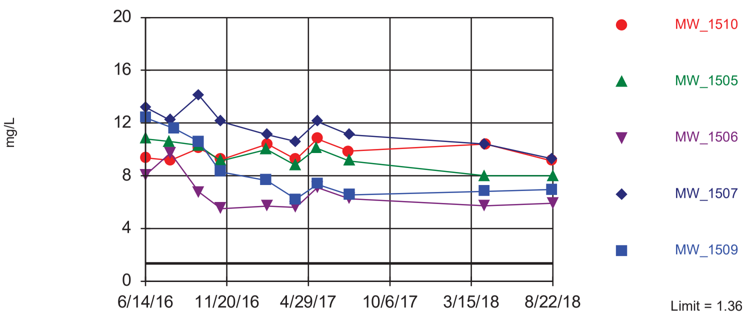
Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	MW_1505	1.36	n/a	8/22/2018	8	Yes	20	n/a	n/a	0	n/a	n/a	0.004024	NP (normality) 1 of 2
Boron, total (mg/L)	MW_1506	1.36	n/a	8/22/2018	5.91	Yes	20	n/a	n/a	0	n/a	n/a	0.004024	NP (normality) 1 of 2
Boron, total (mg/L)	MW_1507	1.36	n/a	8/21/2018	9.29	Yes	20	n/a	n/a	0	n/a	n/a	0.004024	NP (normality) 1 of 2
Boron, total (mg/L)	MW_1509	1.36	n/a	8/21/2018	6.97	Yes	20	n/a	n/a	0	n/a	n/a	0.004024	NP (normality) 1 of 2
Boron, total (mg/L)	MW_1510	1.36	n/a	8/21/2018	9.13	Yes	20	n/a	n/a	0	n/a	n/a	0.004024	NP (normality) 1 of 2
Calcium, total (mg/L)	MW_1505	241.2	n/a	8/22/2018	274	Yes	20	222.7	9.069	0	None	No	0.001504	Param 1 of 2
Calcium, total (mg/L)	MW_1506	241.2	n/a	8/22/2018	270	Yes	20	222.7	9.069	0	None	No	0.001504	Param 1 of 2
Calcium, total (mg/L)	MW_1507	241.2	n/a	8/21/2018	272	Yes	20	222.7	9.069	0	None	No	0.001504	Param 1 of 2
Calcium, total (mg/L)	MW_1509	241.2	n/a	8/21/2018	279	Yes	20	222.7	9.069	0	None	No	0.001504	Param 1 of 2
Calcium, total (mg/L)	MW_1510	241.2	n/a	8/21/2018	268	Yes	20	222.7	9.069	0	None	No	0.001504	Param 1 of 2
Chloride, total (mg/L)	MW_1505	238	n/a	8/22/2018	284	Yes	20	n/a	n/a	0	n/a	n/a	0.004024	NP (normality) 1 of 2
Chloride, total (mg/L)	MW_1506	238	n/a	8/22/2018	369	Yes	20	n/a	n/a	0	n/a	n/a	0.004024	NP (normality) 1 of 2
Chloride, total (mg/L)	MW_1507	238	n/a	8/21/2018	331	Yes	20	n/a	n/a	0	n/a	n/a	0.004024	NP (normality) 1 of 2
Chloride, total (mg/L)	MW_1509	238	n/a	8/21/2018	323	Yes	20	n/a	n/a	0	n/a	n/a	0.004024	NP (normality) 1 of 2
Chloride, total (mg/L)	MW_1510	238	n/a	8/21/2018	334	Yes	20	n/a	n/a	0	n/a	n/a	0.004024	NP (normality) 1 of 2
pH, field (SU)	MW_1505	7.352	6.838	8/22/2018	7.33	No	20	7.095	0.1256	0	None	No	0.000752	Param 1 of 2
pH, field (SU)	MW_1506	7.352	6.838	8/22/2018	7.4	Yes	20	7.095	0.1256	0	None	No	0.000752	Param 1 of 2
pH, field (SU)	MW_1507	7.352	6.838	8/21/2018	7.23	No	20	7.095	0.1256	0	None	No	0.000752	Param 1 of 2
pH, field (SU)	MW_1509	7.352	6.838	8/21/2018	7.24	No	20	7.095	0.1256	0	None	No	0.000752	Param 1 of 2
pH, field (SU)	MW_1510	7.352	6.838	8/21/2018	7.3	No	20	7.095	0.1256	0	None	No	0.000752	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW_1505	1193	n/a	8/22/2018	1520	Yes	20	1018	85.7	0	None	No	0.001504	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW_1506	1193	n/a	8/22/2018	1590	Yes	20	1018	85.7	0	None	No	0.001504	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW_1507	1193	n/a	8/21/2018	1430	Yes	20	1018	85.7	0	None	No	0.001504	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW_1509	1193	n/a	8/21/2018	1540	Yes	20	1018	85.7	0	None	No	0.001504	Param 1 of 2
Total Dissolved Solids [TDS] (mg/L)	MW_1510	1193	n/a	8/21/2018	1550	Yes	20	1018	85.7	0	None	No	0.001504	Param 1 of 2

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit: MW_1510, MW_1505, MW_1506, MW_1507, MW_1509

Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 20 background values. Annual per-constituent alpha = 0.03952. Individual comparison alpha = 0.004024 (1 of 2). Comparing 5 points to limit.

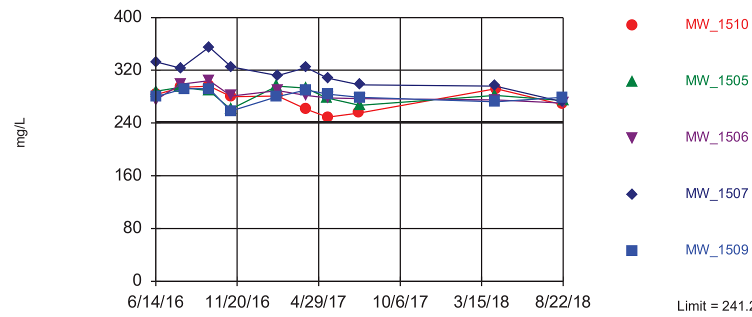
Constituent: Boron, total Analysis Run 11/11/2018 2:10 PM View: PLs - Interwell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit: MW_1510, MW_1505, MW_1506, MW_1507, MW_1509

Prediction Limit

Interwell Parametric



Background Data Summary: Mean=222.7, Std. Dev.=9.069, n=20. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9422, critical = 0.868. Kappa = 2.048 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.001504. Comparing 5 points to limit.

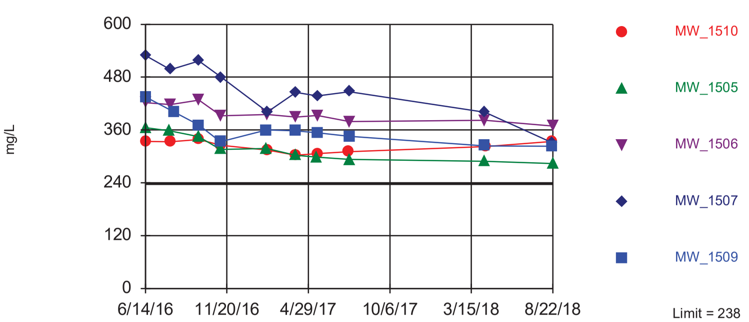
Constituent: Calcium, total Analysis Run 11/11/2018 2:10 PM View: PLs - Interwell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit: MW_1510, MW_1505, MW_1506, MW_1507, MW_1509

Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 20 background values. Annual per-constituent alpha = 0.03952. Individual comparison alpha = 0.004024 (1 of 2). Comparing 5 points to limit.

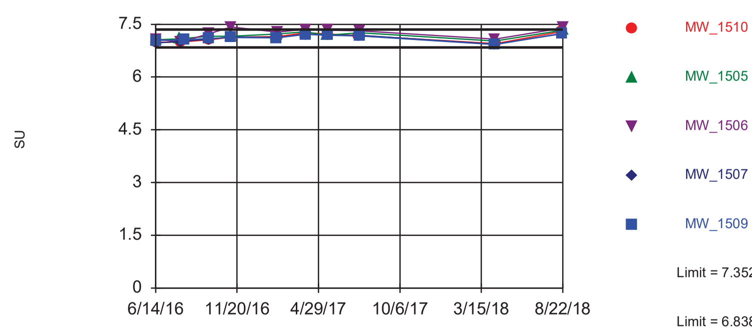
Constituent: Chloride, total Analysis Run 11/11/2018 2:10 PM View: PLs - Interwell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limits: MW_1506

Prediction Limit

Interwell Parametric



Background Data Summary: Mean=7.095, Std. Dev.=0.1256, n=20. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9864, critical = 0.868. Kappa = 2.048 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.000752. Comparing 5 points to limit.

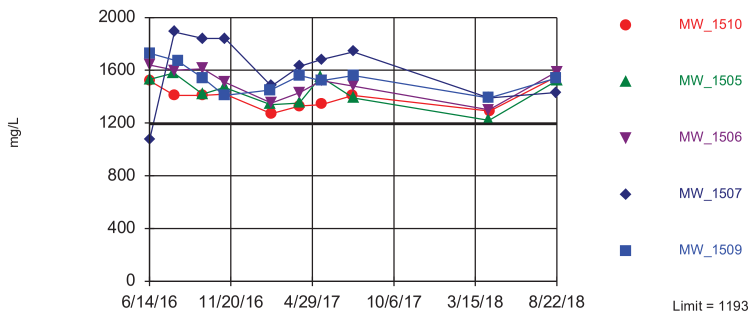
Constituent: pH, field Analysis Run 11/11/2018 2:10 PM View: PLs - Interwell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit: MW_1510, MW_1505, MW_1506, MW_1507, MW_1509

Prediction Limit

Interwell Parametric



Background Data Summary: Mean=1018, Std. Dev.=85.7, n=20. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9477, critical = 0.868. Kappa = 2.048 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.001504. Comparing 5 points to limit.

Constituent: Total Dissolved Solids [TDS] Analysis Run 11/11/2018 2:10 PM View: PLs - Interwell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Intrawell Prediction Limit Summary - Significant Results

Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP   Printed 1/8/2019, 9:26 AM

Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Sulfate, total (mg/L)	**MW_1510**	**399.1**	**n/a**	**8/21/2018**	**428**	**Yes**	**8**	**333.4**	**23.98**	**0**	**None**	**No**	**0.001504**	Param 1 of 2
Sulfate, total (mg/L)	**MW_1505**	**350.5**	**n/a**	**8/22/2018**	**383**	**Yes**	**8**	**321.6**	**10.56**	**0**	**None**	**No**	**0.001504**	Param 1 of 2
Sulfate, total (mg/L)	**MW_1506**	**345.4**	**n/a**	**8/22/2018**	**349**	**Yes**	**8**	**305.6**	**14.51**	**0**	**None**	**No**	**0.001504**	Param 1 of 2
Sulfate, total (mg/L)	**MW_1509**	**449.9**	**n/a**	**8/21/2018**	**465**	**Yes**	**8**	**407**	**15.64**	**0**	**None**	**No**	**0.001504**	Param 1 of 2

Intrawell Prediction Limit Summary - All Results

Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP   Printed 1/8/2019, 9:26 AM

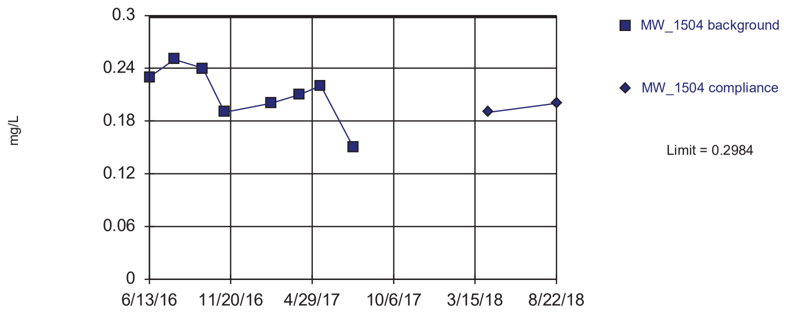
Constituent	Well	Upper Lim.	Lower Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Fluoride, total (mg/L)	MW_1504	0.2984	n/a	8/22/2018	0.2	No	8	0.2113	0.03182	0	None	No	0.001504	Param 1 of 2
Fluoride, total (mg/L)	MW_1508	0.125	n/a	8/21/2018	0.08	No	8	0.08375	0.01506	0	None	No	0.001504	Param 1 of 2
Fluoride, total (mg/L)	MW_1510	0.2	n/a	8/21/2018	0.09	No	8	n/a	n/a	25	n/a	n/a	0.02144	NP (normality) 1 of 2
Fluoride, total (mg/L)	MW_1505	0.2	n/a	8/22/2018	0.02	No	8	n/a	n/a	100	n/a	n/a	0.02144	NP (NDs) 1 of 2
Fluoride, total (mg/L)	MW_1506	0.2	n/a	8/22/2018	0.05	No	8	n/a	n/a	75	n/a	n/a	0.02144	NP (NDs) 1 of 2
Fluoride, total (mg/L)	MW_1507	0.2	n/a	8/21/2018	0.07	No	8	n/a	n/a	12.5	n/a	n/a	0.02144	NP (normality) 1 of 2
Fluoride, total (mg/L)	MW_1509	0.16	n/a	8/21/2018	0.14	No	8	n/a	n/a	0	n/a	n/a	0.02144	NP (normality) 1 of 2
Sulfate, total (mg/L)	MW_1504	468.9	n/a	8/22/2018	372	No	8	370.6	35.86	0	None	No	0.001504	Param 1 of 2
Sulfate, total (mg/L)	MW_1508	318.3	n/a	8/21/2018	313	No	8	301.8	6.042	0	None	No	0.001504	Param 1 of 2
Sulfate, total (mg/L)	**MW_1510**	**399.1**	**n/a**	**8/21/2018**	**428**	**Yes**	**8**	**333.4**	**23.98**	**0**	**None**	**No**	**0.001504**	Param 1 of 2
Sulfate, total (mg/L)	**MW_1505**	**350.5**	**n/a**	**8/22/2018**	**383**	**Yes**	**8**	**321.6**	**10.56**	**0**	**None**	**No**	**0.001504**	Param 1 of 2
Sulfate, total (mg/L)	**MW_1506**	**345.4**	**n/a**	**8/22/2018**	**349**	**Yes**	**8**	**305.6**	**14.51**	**0**	**None**	**No**	**0.001504**	Param 1 of 2
Sulfate, total (mg/L)	MW_1507	376.9	n/a	8/21/2018	323	No	8	316.3	22.13	0	None	No	0.001504	Param 1 of 2
Sulfate, total (mg/L)	**MW_1509**	**449.9**	**n/a**	**8/21/2018**	**465**	**Yes**	**8**	**407**	**15.64**	**0**	**None**	**No**	**0.001504**	Param 1 of 2

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=0.2113, Std. Dev.=0.03182, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9517, critical = 0.749. Kappa = 2.74 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

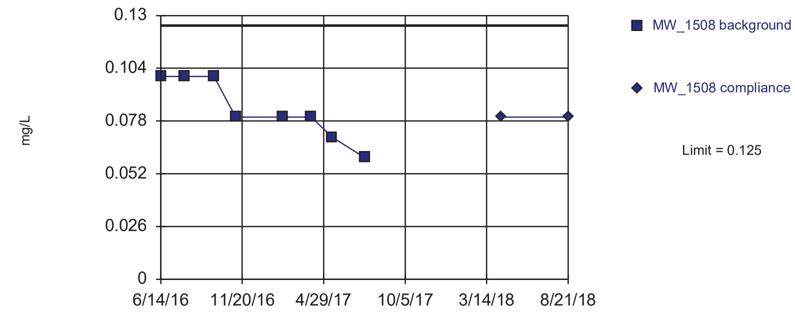
Constituent: Fluoride, total Analysis Run 1/7/2019 7:40 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=0.08375, Std. Dev.=0.01506, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8711, critical = 0.749. Kappa = 2.74 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

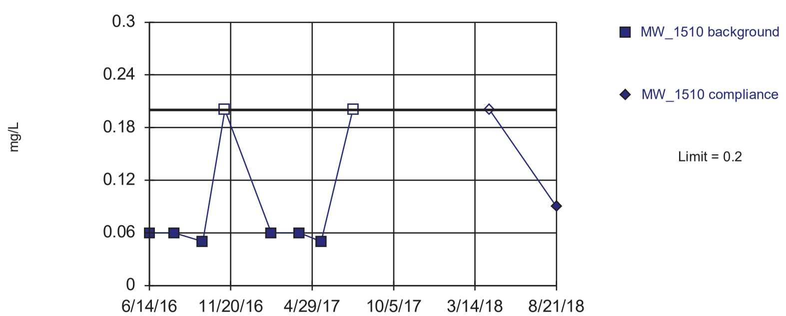
Constituent: Fluoride, total Analysis Run 1/7/2019 7:40 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 8 background values. 25% NDs. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

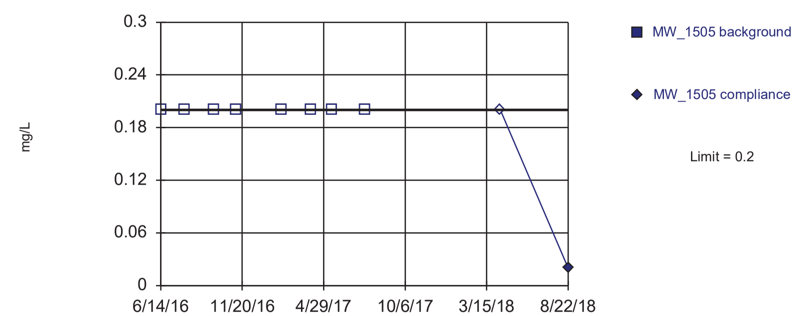
Constituent: Fluoride, total Analysis Run 1/7/2019 7:40 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. All background values (n = 8) were censored; limit is most recent reporting limit. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

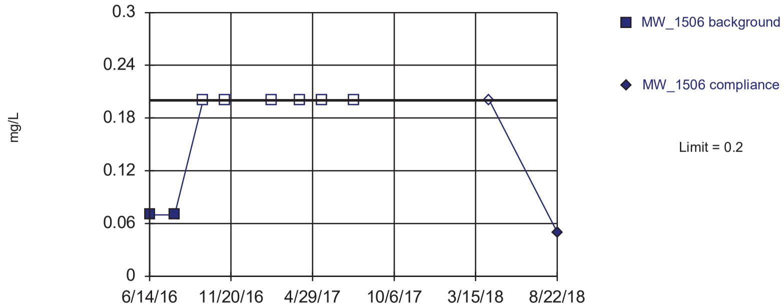
Constituent: Fluoride, total Analysis Run 1/7/2019 7:40 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 8 background values. 75% NDs. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

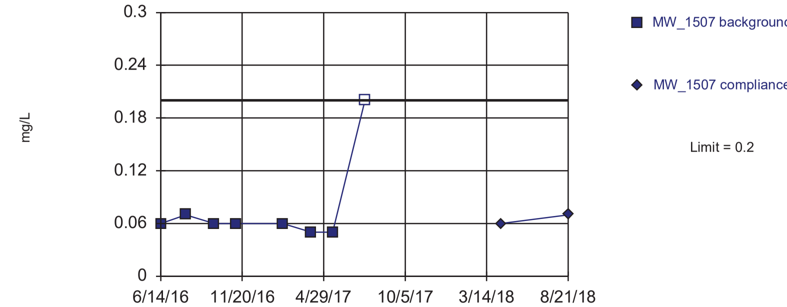
Constituent: Fluoride, total Analysis Run 1/7/2019 7:40 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 8 background values. 12.5% NDs. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

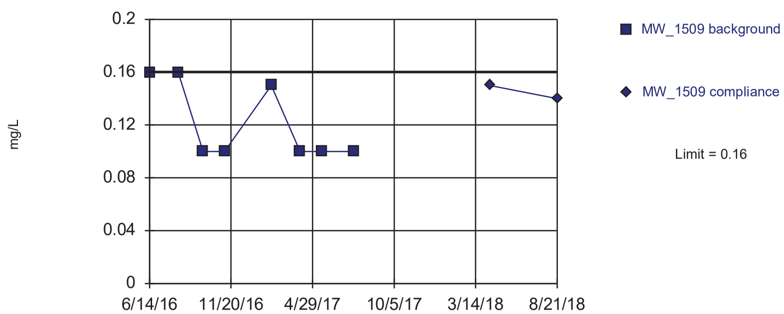
Constituent: Fluoride, total Analysis Run 1/7/2019 7:40 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 8 background values. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

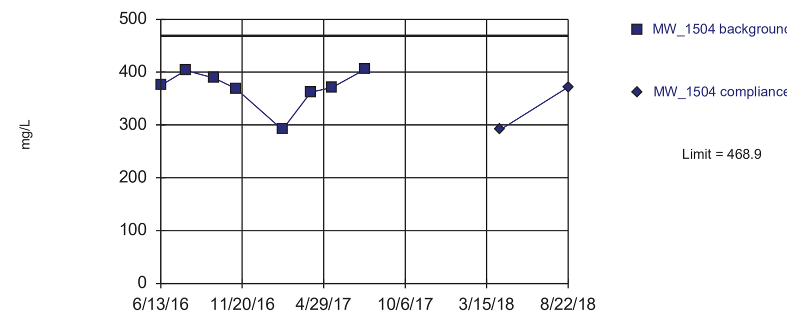
Constituent: Fluoride, total Analysis Run 1/7/2019 7:40 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=370.6, Std. Dev.=35.86, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8152, critical = 0.749. Kappa = 2.74 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

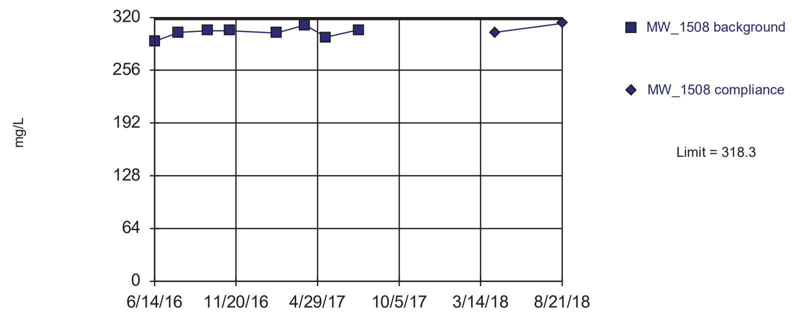
Constituent: Sulfate, total Analysis Run 1/7/2019 7:40 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=301.8, Std. Dev.=6.042, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9509, critical = 0.749. Kappa = 2.74 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

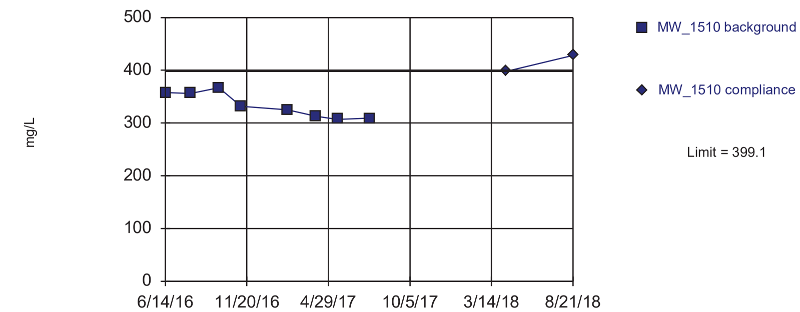
Constituent: Sulfate, total Analysis Run 1/7/2019 7:40 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=333.4, Std. Dev.=23.98, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8854, critical = 0.749. Kappa = 2.74 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

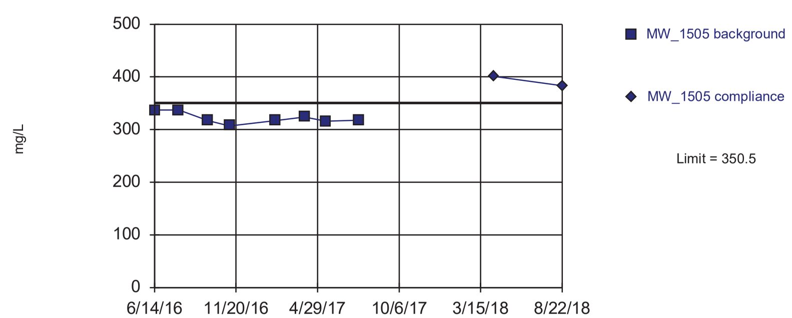
Constituent: Sulfate, total Analysis Run 1/7/2019 7:40 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=321.6, Std. Dev.=10.56, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8719, critical = 0.749. Kappa = 2.74 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

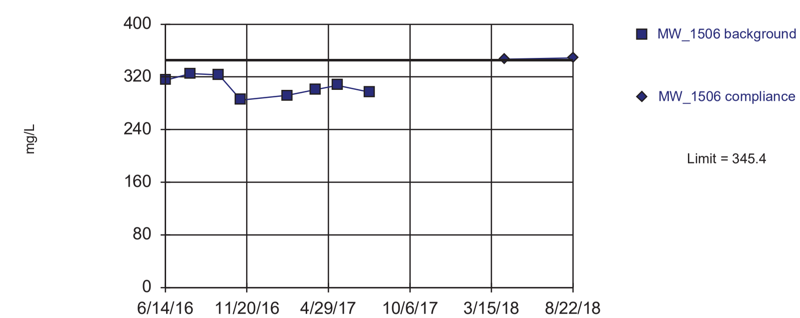
Constituent: Sulfate, total Analysis Run 1/7/2019 7:40 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11 Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit

Prediction Limit

Intrawell Parametric



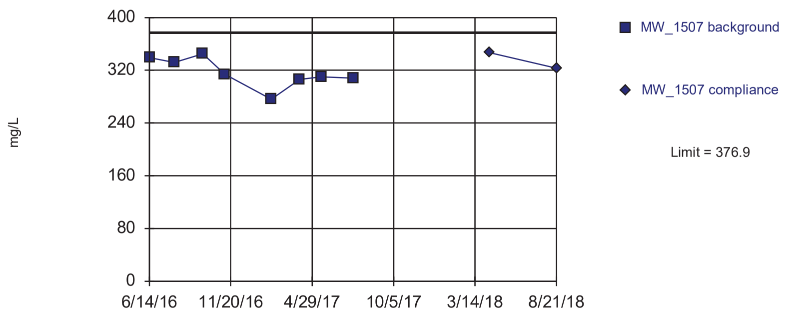
Background Data Summary: Mean=305.6, Std. Dev.=14.51, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9536, critical = 0.749. Kappa = 2.74 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

Constituent: Sulfate, total Analysis Run 1/7/2019 7:40 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Within Limit

Prediction Limit

Intrawell Parametric



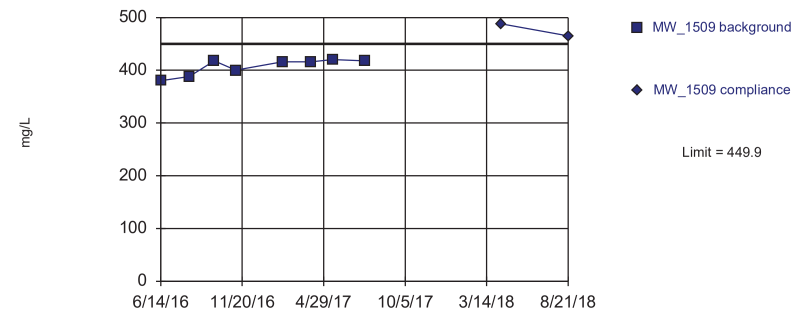
Background Data Summary: Mean=316.3, Std. Dev.=22.13, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9344, critical = 0.749. Kappa = 2.74 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

Constituent: Sulfate, total Analysis Run 1/7/2019 7:40 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Exceeds Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=407, Std. Dev.=15.64, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7926, critical = 0.749. Kappa = 2.74 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

Constituent: Sulfate, total Analysis Run 1/7/2019 7:40 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Trend Test Summary Table - Significant Results

Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP   Printed 11/11/2018, 2:30 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron, total (mg/L)	**MW_1505**	**-1.301**	**-32**	**-30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Boron, total (mg/L)	**MW_1507**	**-1.66**	**-33**	**-30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Boron, total (mg/L)	**MW_1509**	**-2.866**	**-31**	**-30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Calcium, total (mg/L)	**MW_1507**	**-27.55**	**-35**	**-30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	**MW_1505**	**-41.65**	**-43**	**-30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	**MW_1506**	**-29.8**	**-33**	**-30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	**MW_1507**	**-77.15**	**-33**	**-30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	**MW_1509**	**-33.28**	**-37**	**-30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Sulfate, total (mg/L)	**MW_1509**	**38.88**	**33**	**30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**

Trend Test Summary Table - All Results

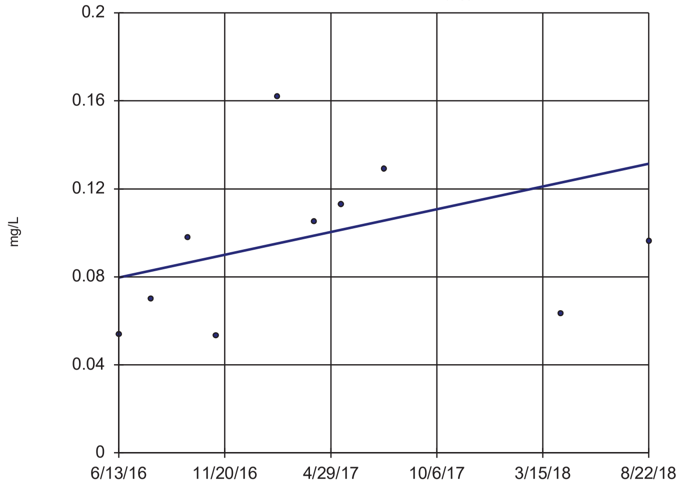
Mitchell BAP Client: Geosyntec Data: Mitchell BAP Printed 11/11/2018, 2:30 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron, total (mg/L)	MW_1504 (bg)	0.0236	11	30	No	10	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW_1508 (bg)	0.08374	7	30	No	10	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW_1510	0.1475	6	30	No	10	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	**MW_1505**	**-1.301**	**-32**	**-30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Boron, total (mg/L)	MW_1506	-0.7273	-11	-30	No	10	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	**MW_1507**	**-1.66**	**-33**	**-30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Boron, total (mg/L)	**MW_1509**	**-2.866**	**-31**	**-30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Calcium, total (mg/L)	MW_1504 (bg)	3.942	6	30	No	10	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW_1508 (bg)	6.239	12	30	No	10	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW_1510	-14.75	-17	-30	No	10	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW_1505	-7.878	-13	-30	No	10	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW_1506	-8.69	-24	-30	No	10	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	**MW_1507**	**-27.55**	**-35**	**-30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Calcium, total (mg/L)	MW_1509	-3.959	-16	-30	No	10	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW_1504 (bg)	-6.065	-16	-30	No	10	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW_1508 (bg)	-17.1	-27	-30	No	10	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW_1510	-7.449	-12	-30	No	10	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	**MW_1505**	**-41.65**	**-43**	**-30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	**MW_1506**	**-29.8**	**-33**	**-30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	**MW_1507**	**-77.15**	**-33**	**-30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	**MW_1509**	**-33.28**	**-37**	**-30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
pH, field (SU)	MW_1504 (bg)	0.1587	26	30	No	10	0	n/a	n/a	0.01	NP
pH, field (SU)	MW_1508 (bg)	0.0876	15	30	No	10	0	n/a	n/a	0.01	NP
pH, field (SU)	MW_1506	0.08941	14	30	No	10	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW_1504 (bg)	-14.8	-8	-30	No	10	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW_1508 (bg)	5.353	17	30	No	10	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW_1510	-28.08	-5	-30	No	10	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW_1505	11.41	7	30	No	10	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW_1506	13.67	9	30	No	10	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	**MW_1509**	**38.88**	**33**	**30**	**Yes**	**10**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Total Dissolved Solids [TDS] (m...	MW_1504 (bg)	-42.26	-9	-30	No	10	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (m...	MW_1508 (bg)	0	-1	-30	No	10	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (m...	MW_1510	-39.25	-6	-30	No	10	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (m...	MW_1505	-115.4	-13	-30	No	10	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (m...	MW_1506	-130	-19	-30	No	10	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (m...	MW_1507	-156	-12	-30	No	10	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (m...	MW_1509	-86.9	-15	-30	No	10	0	n/a	n/a	0.01	NP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1504 (bg)



n = 10

Slope = 0.0236 units per year.

Mann-Kendall statistic = 11 critical = 30

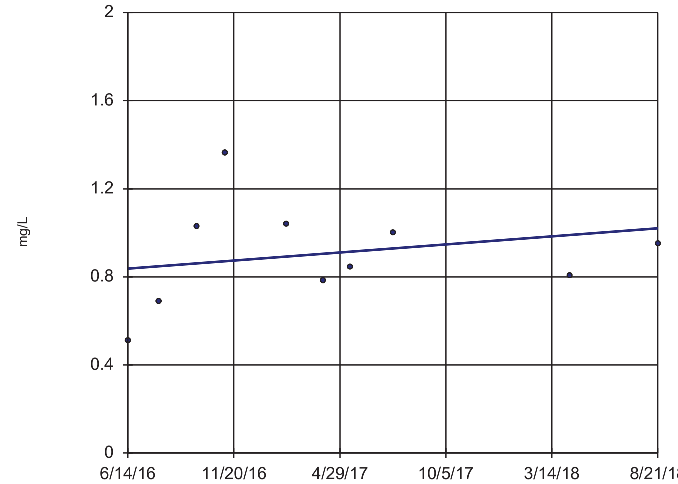
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 11/11/2018 2:28 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1508 (bg)



n = 10

Slope = 0.08374 units per year.

Mann-Kendall statistic = 7 critical = 30

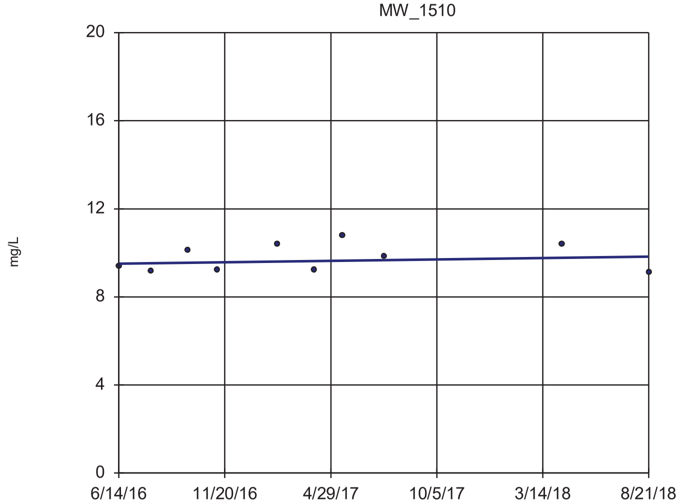
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 11/11/2018 2:28 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1510



n = 10

Slope = 0.1475 units per year.

Mann-Kendall statistic = 6 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 11/11/2018 2:28 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

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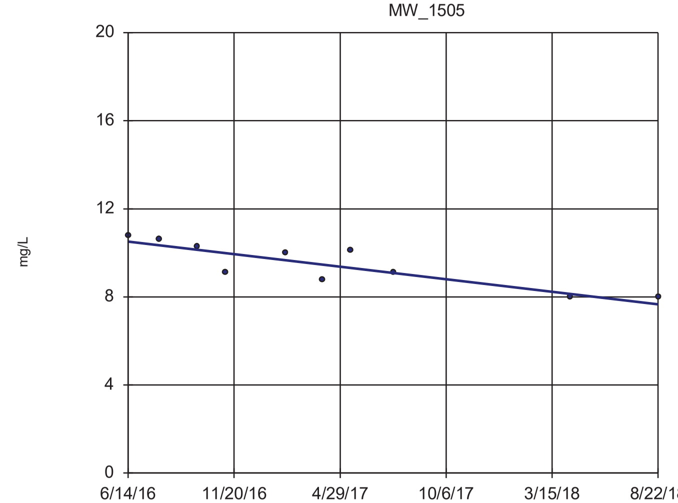
Sen's Slope Estimator

MW_1505



n = 10

Slope = -1.301 units per year.

Mann-Kendall statistic = -32 critical = -30

Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 11/11/2018 2:28 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

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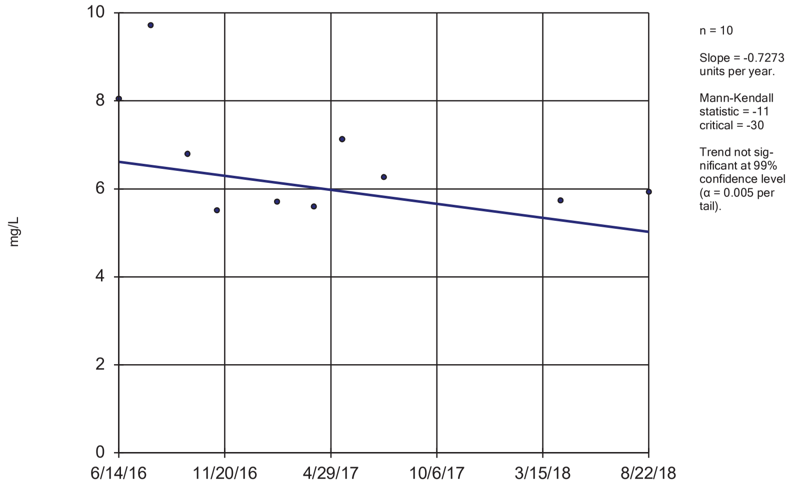
Sen's Slope Estimator

MW_1506

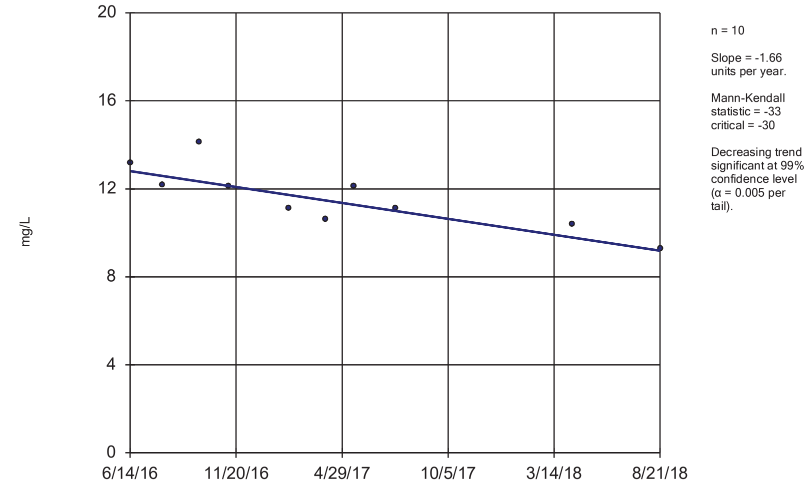


Constituent: Boron, total   Analysis Run 11/11/2018 2:28 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1507

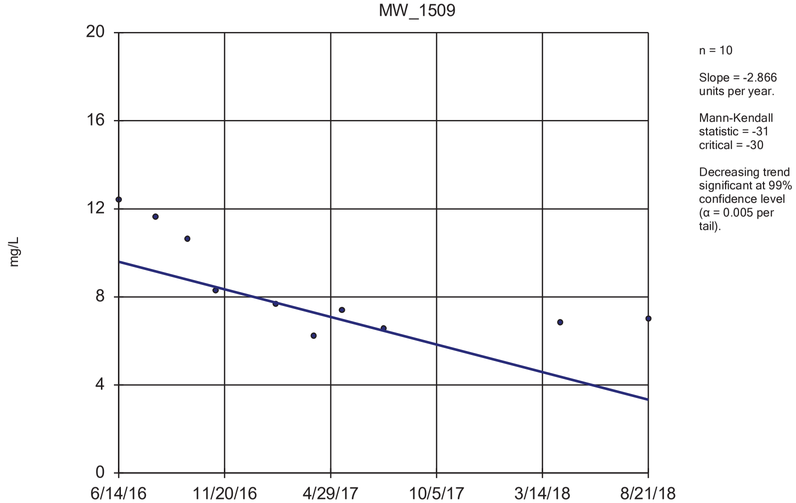


Constituent: Boron, total   Analysis Run 11/11/2018 2:28 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1509



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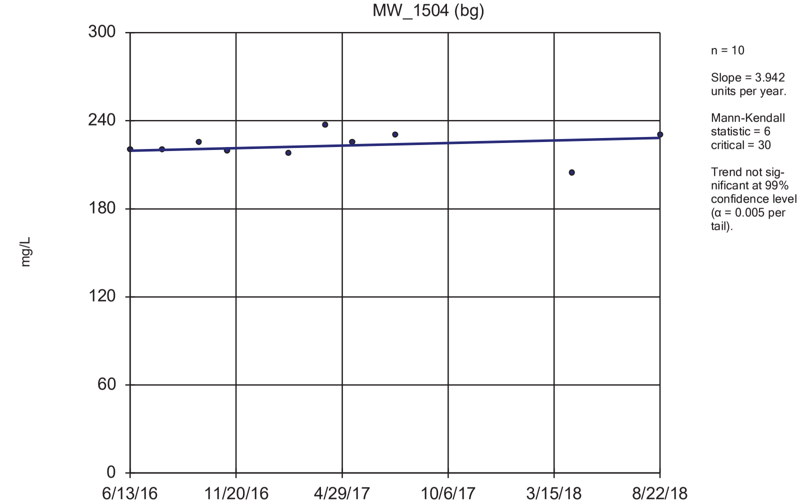
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1504 (bg)

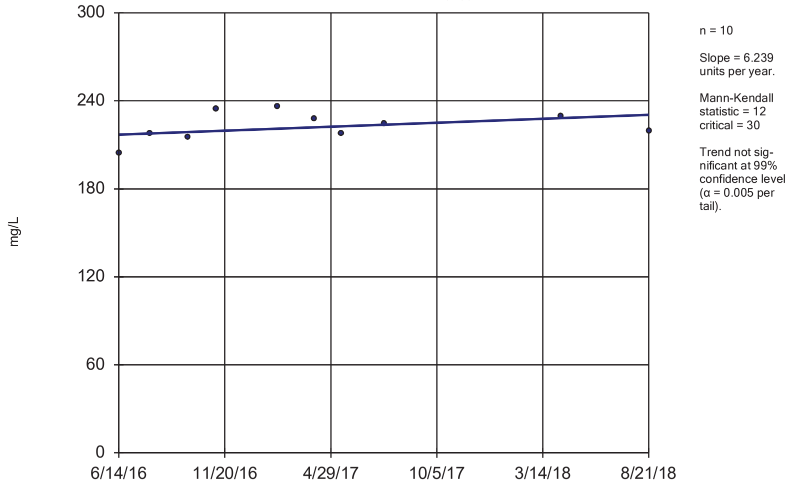


Constituent: Calcium, total   Analysis Run 11/11/2018 2:28 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1508 (bg)



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Mitchell BAP Client: Geosyntec Data: Mitchell BAP

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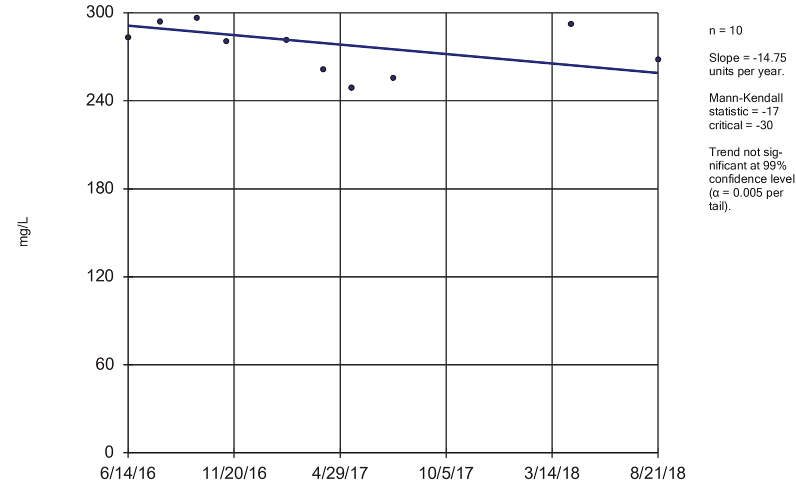
Sen's Slope Estimator

MW_1510



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Mitchell BAP Client: Geosyntec Data: Mitchell BAP

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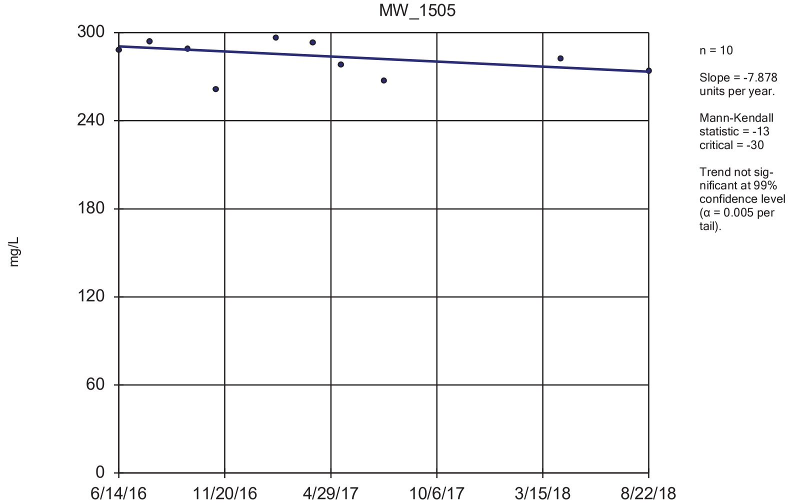
Sen's Slope Estimator

MW_1505



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Mitchell BAP Client: Geosyntec Data: Mitchell BAP

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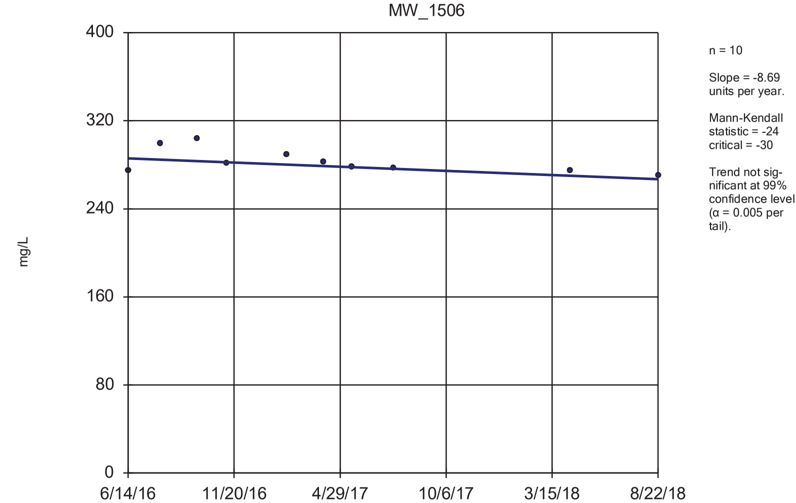
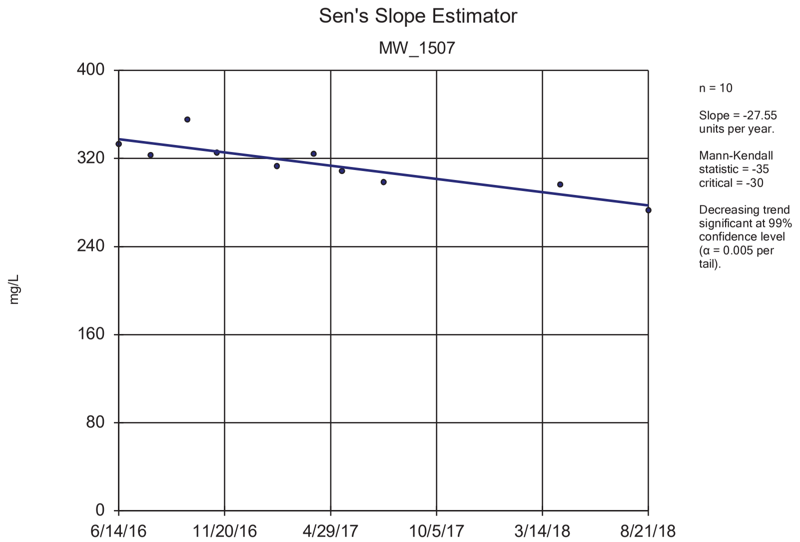
Sen's Slope Estimator

MW_1506



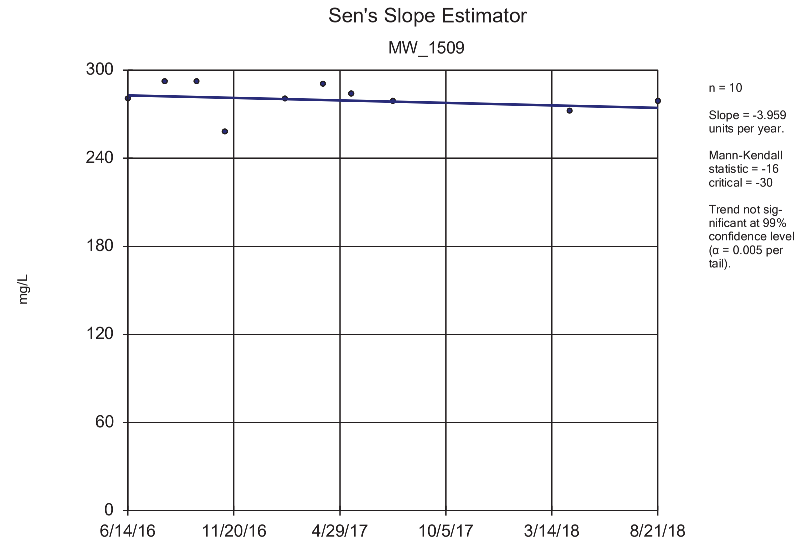
Constituent: Calcium, total Analysis Run 11/11/2018 2:28 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG



Constituent: Calcium, total   Analysis Run 11/11/2018 2:29 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG



Constituent: Calcium, total   Analysis Run 11/11/2018 2:29 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

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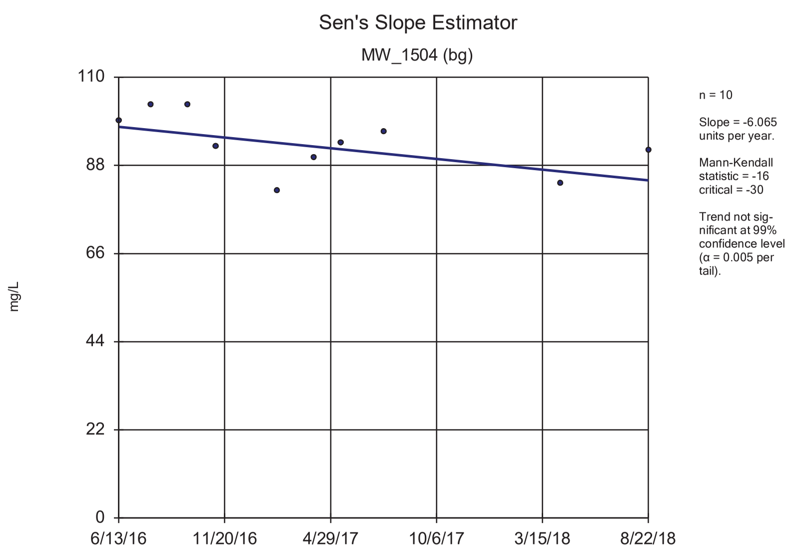

Constituent: Chloride, total   Analysis Run 11/11/2018 2:29 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

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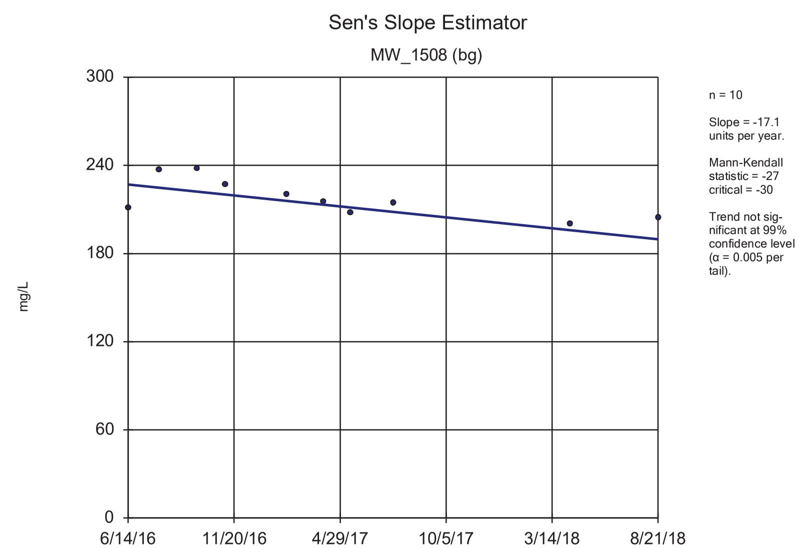
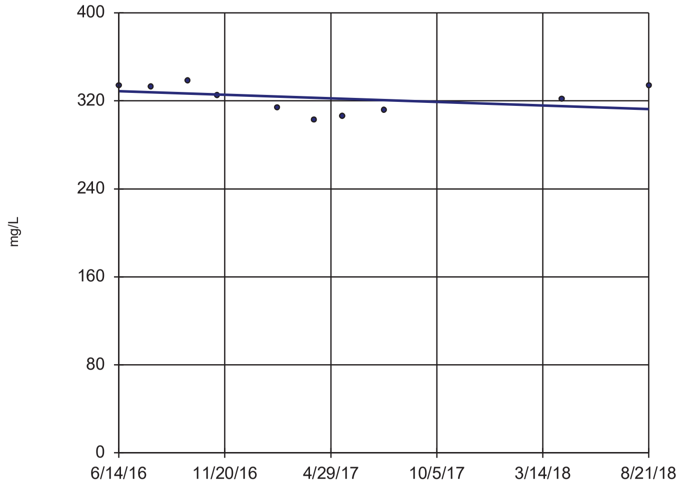


Constituent: Chloride, total   Analysis Run 11/11/2018 2:29 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1510



n = 10

Slope = -7.449 units per year.

Mann-Kendall statistic = -12 critical = -30

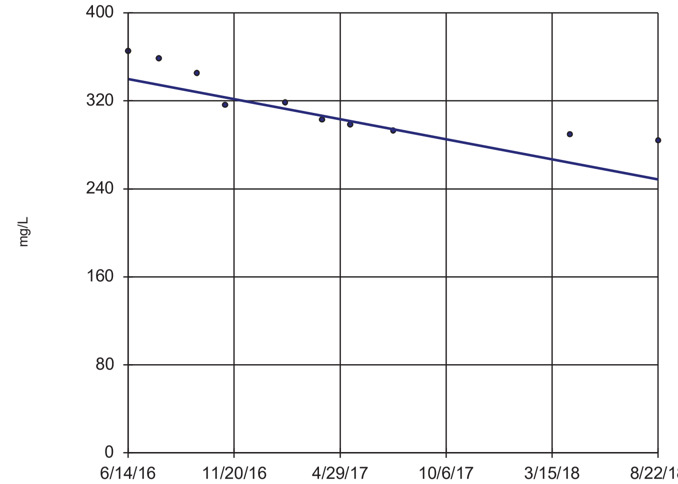
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total   Analysis Run 11/11/2018 2:29 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1505



n = 10

Slope = -41.65 units per year.

Mann-Kendall statistic = -43 critical = -30

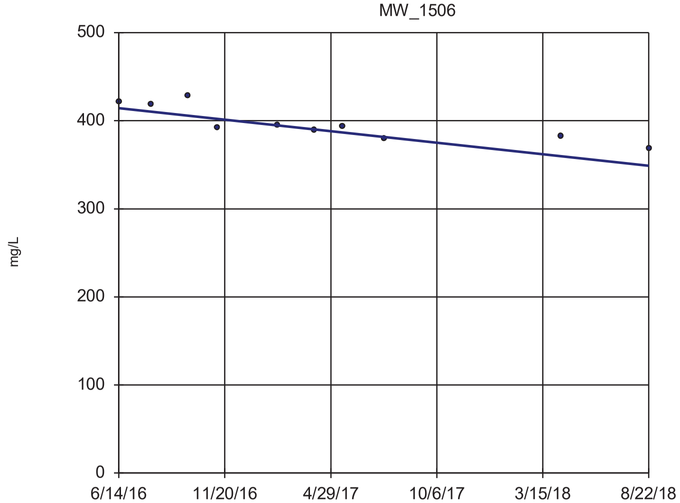
Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total   Analysis Run 11/11/2018 2:29 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1506



n = 10

Slope = -29.8 units per year.

Mann-Kendall statistic = -33 critical = -30

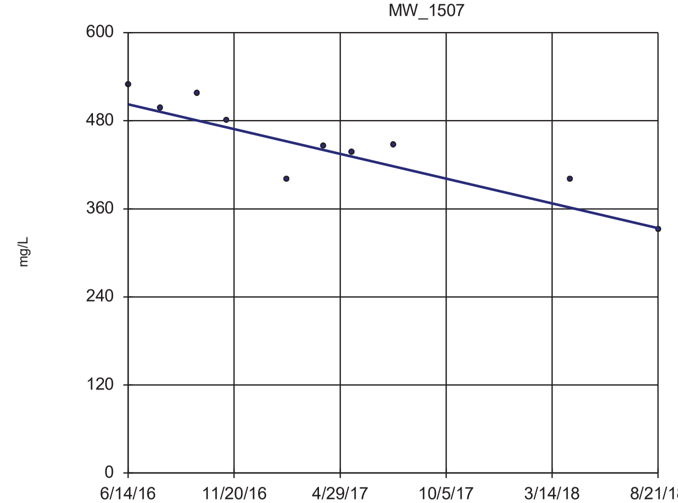
Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total   Analysis Run 11/11/2018 2:29 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1507



n = 10

Slope = -77.15 units per year.

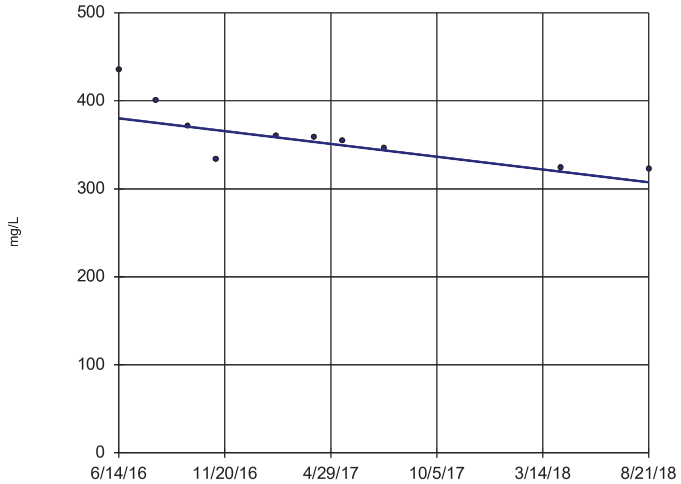
Mann-Kendall statistic = -33 critical = -30

Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total   Analysis Run 11/11/2018 2:29 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sen's Slope Estimator

MW_1509



n = 10

Slope = -33.28 units per year.

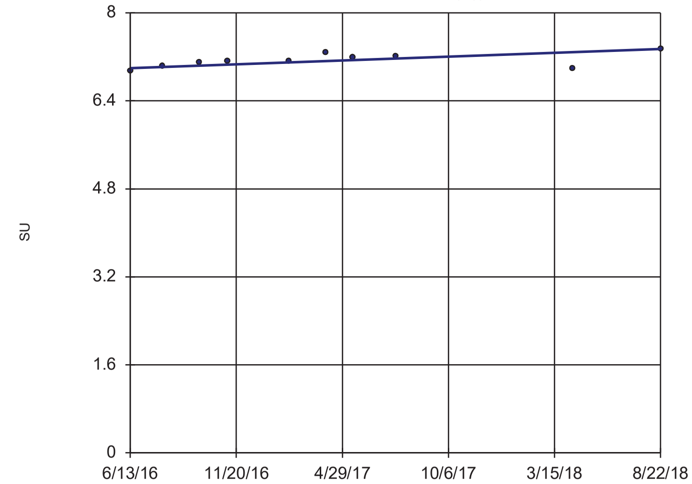
Mann-Kendall statistic = -37 critical = -30

Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 11/11/2018 2:29 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sen's Slope Estimator

MW_1504 (bg)



n = 10

Slope = 0.1587 units per year.

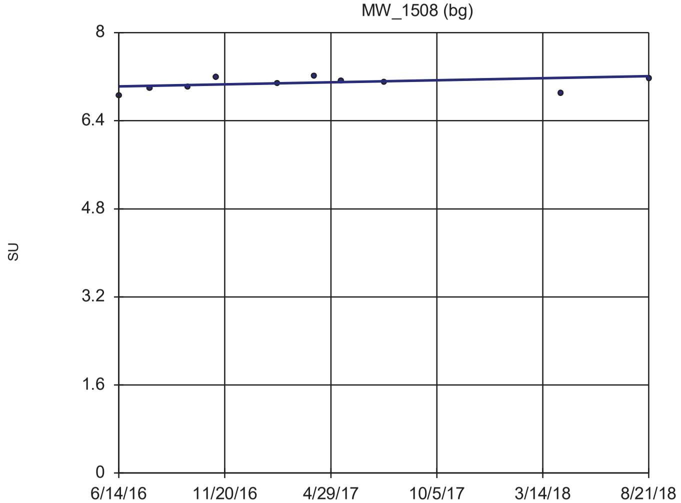
Mann-Kendall statistic = 26 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: pH, field Analysis Run 11/11/2018 2:29 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sen's Slope Estimator

MW_1508 (bg)



n = 10

Slope = 0.0876 units per year.

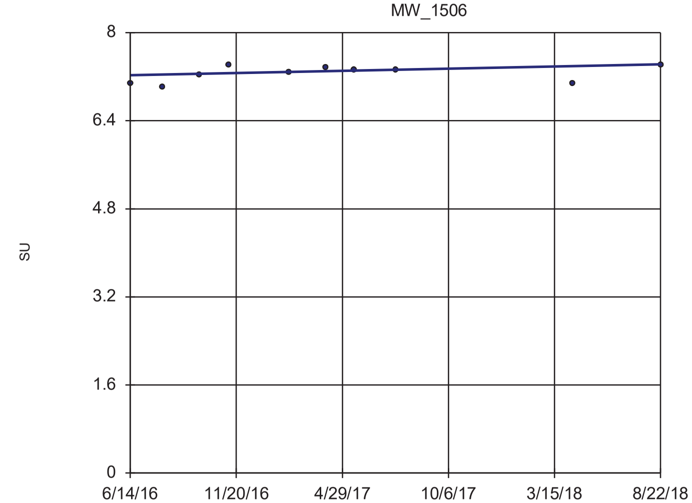
Mann-Kendall statistic = 15 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: pH, field Analysis Run 11/11/2018 2:29 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sen's Slope Estimator

MW_1506



n = 10

Slope = 0.08941 units per year.

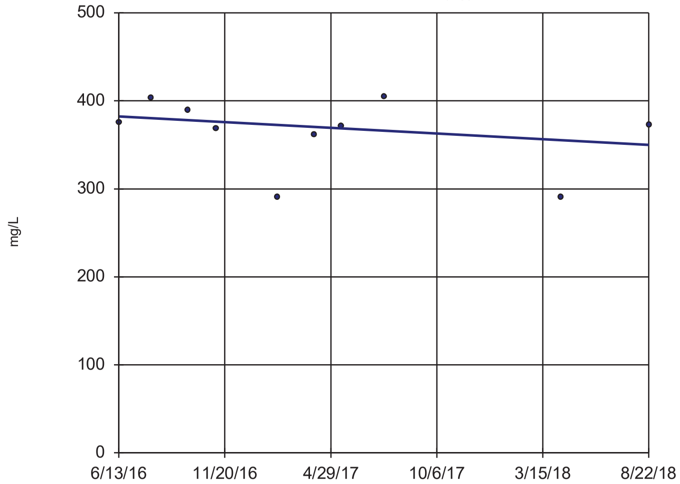
Mann-Kendall statistic = 14 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: pH, field Analysis Run 11/11/2018 2:29 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sen's Slope Estimator

MW_1504 (bg)



n = 10

Slope = -14.8 units per year.

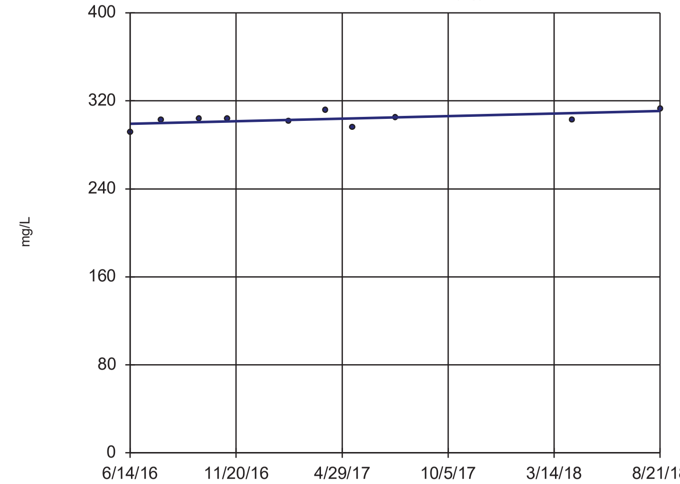
Mann-Kendall statistic = -8 critical = -30

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 11/11/2018 2:29 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sen's Slope Estimator

MW_1508 (bg)



n = 10

Slope = 5.353 units per year.

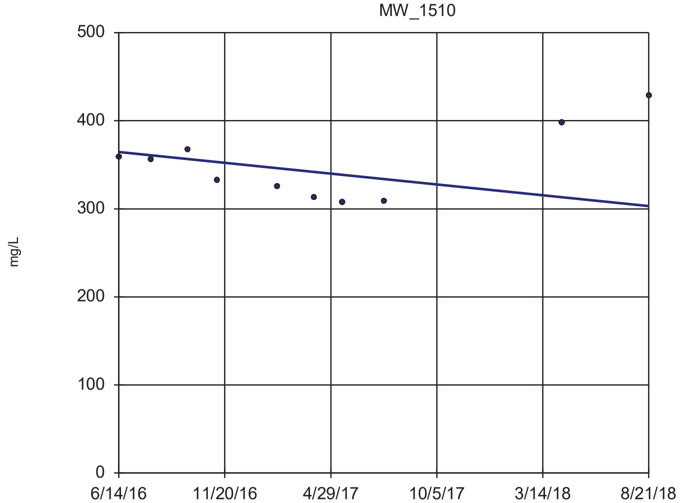
Mann-Kendall statistic = 17 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 11/11/2018 2:29 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sen's Slope Estimator

MW_1510



n = 10

Slope = -28.08 units per year.

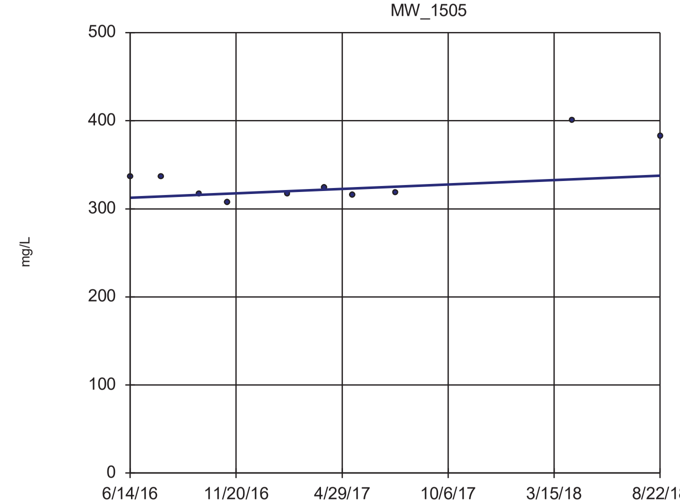
Mann-Kendall statistic = -5 critical = -30

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Sulfate, total Analysis Run 11/11/2018 2:29 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sen's Slope Estimator

MW_1505



n = 10

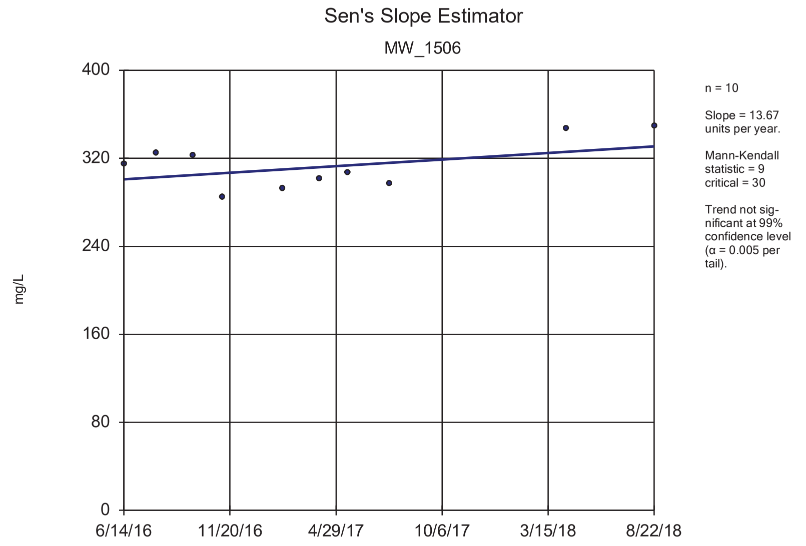
Slope = 11.41 units per year.

Mann-Kendall statistic = 7 critical = 30

Trend not significant at 99% confidence level (α = 0.005 per tail).

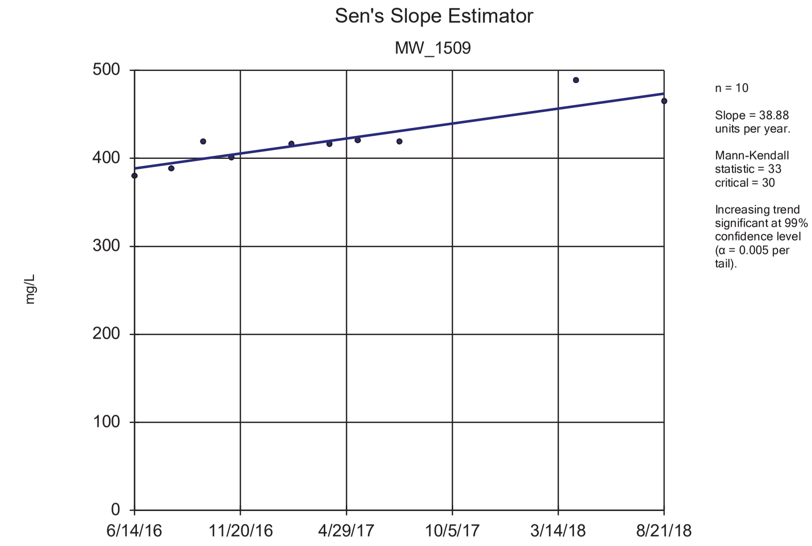
Constituent: Sulfate, total Analysis Run 11/11/2018 2:29 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG



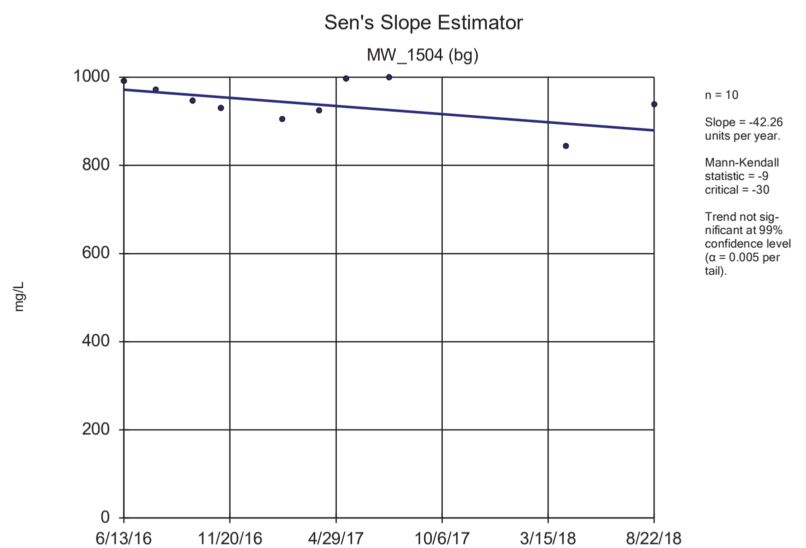
Constituent: Sulfate, total Analysis Run 11/11/2018 2:29 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG



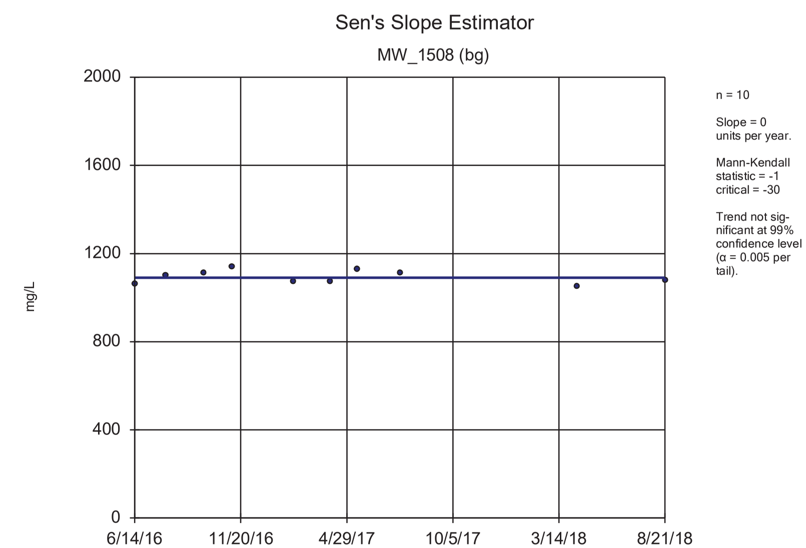
Constituent: Sulfate, total Analysis Run 11/11/2018 2:29 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG



Constituent: Total Dissolved Solids [TDS] Analysis Run 11/11/2018 2:29 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

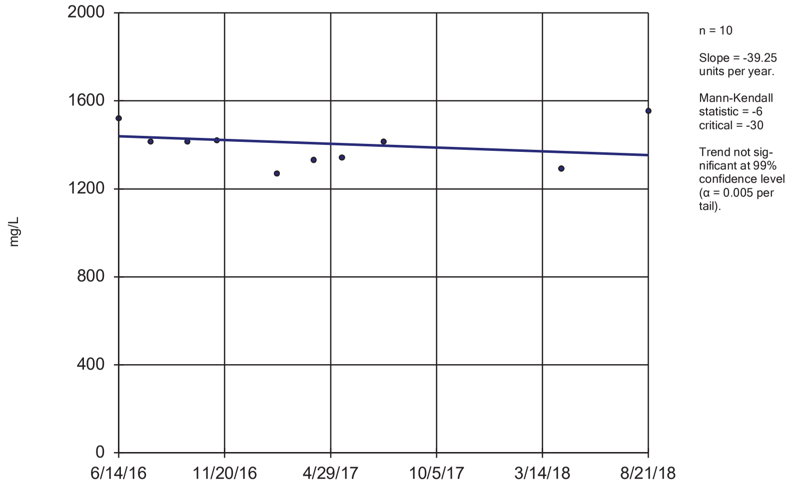


Constituent: Total Dissolved Solids [TDS] Analysis Run 11/11/2018 2:29 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1510

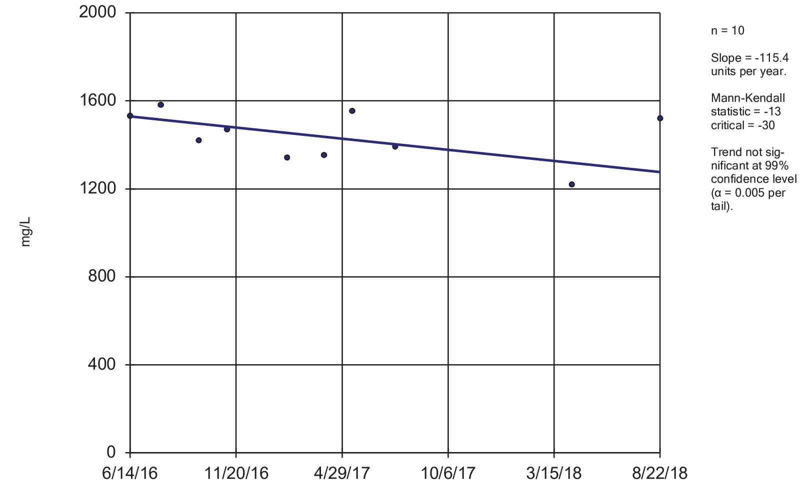


Constituent: Total Dissolved Solids [TDS] Analysis Run 11/11/2018 2:29 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1505

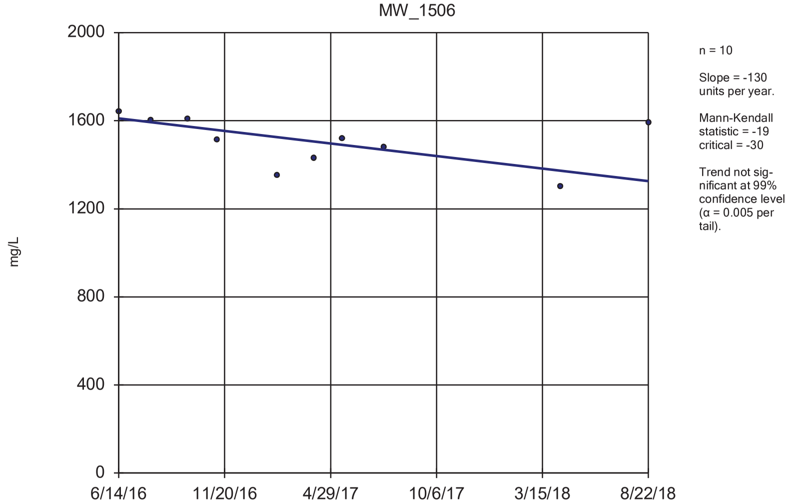


Constituent: Total Dissolved Solids [TDS] Analysis Run 11/11/2018 2:29 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1506

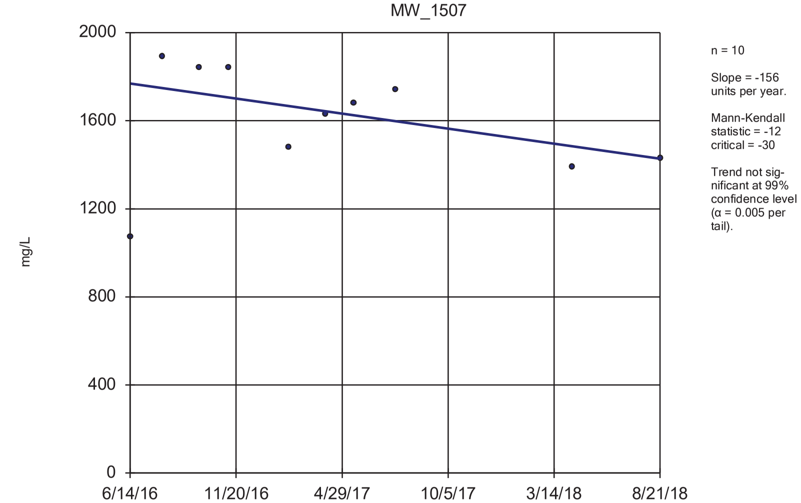


Constituent: Total Dissolved Solids [TDS] Analysis Run 11/11/2018 2:29 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

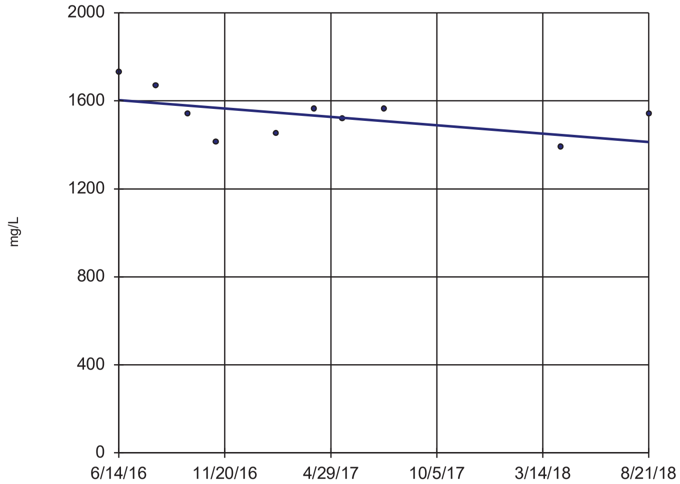
MW_1507



Constituent: Total Dissolved Solids [TDS] Analysis Run 11/11/2018 2:29 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sen's Slope Estimator

MW_1509



n = 10

Slope = -86.9 units per year.

Mann-Kendall statistic = -15 critical = -30

Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Total Dissolved Solids [TDS] Analysis Run 11/11/2018 2:29 PM View: Trend Testing

Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Upper Tolerance Limits

Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP   Printed 11/11/2018, 2:18 PM

Constituent	Well	Upper Lim.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony, total (mg/L)	n/a	0.00009103	20	0.006085	0.001443	5	None	sqrt(x)	0.05	Inter
Arsenic, Total (mg/L)	n/a	0.001745	20	0.0007595	0.0004114	0	None	No	0.05	Inter
Barium, Total (mg/L)	n/a	0.05775	20	0.04322	0.006065	0	None	No	0.05	Inter
Beryllium, total (mg/L)	n/a	0.00007696	20	0.00002304	0.00002251	35	Cohen`s	No	0.05	Inter
Cadmium, total (mg/L)	n/a	0.00009	20	n/a	n/a	0	n/a	n/a	0.3585	NP Inter(normality)
Chromium, total (mg/L)	n/a	0.002346	20	0.0008811	0.0006116	0	None	No	0.05	Inter
Cobalt, total (mg/L)	n/a	0.003159	20	0.00101	0.0008968	0	None	No	0.05	Inter
Combined Radium 226 + 228 (pCi/L)	n/a	2.412	19	0.7433	0.3343	0	None	sqrt(x)	0.05	Inter
Fluoride, total (mg/L)	n/a	0.25	20	n/a	n/a	0	n/a	n/a	0.3585	NP Inter(normality)
Lead, total (mg/L)	n/a	0.004584	20	0.07481	0.0381	0	None	x^(1/3)	0.05	Inter
Lithium, total (mg/L)	n/a	0.01616	20	0.00705	0.003801	10	None	No	0.05	Inter
Mercury, total (mg/L)	n/a	0.000008	20	n/a	n/a	65	n/a	n/a	0.3585	NP Inter(normality)
Molybdenum, total (mg/L)	n/a	0.001907	20	0.02624	0.007275	0	None	sqrt(x)	0.05	Inter
Selenium, Total (mg/L)	n/a	0.0009	20	n/a	n/a	15	n/a	n/a	0.3585	NP Inter(normality)
Thallium, Total (mg/L)	n/a	0.00011	20	n/a	n/a	5	n/a	n/a	0.3585	NP Inter(normality)

Confidence Interval - All Results (No Significant Results)

Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP   Printed 11/11/2018, 2:34 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	%NDs	Transform	Alpha	Method
Antimony, total (mg/L)	MW_1505	0.00008225	0.00003175	0.006	No	10	10	No	0.01	Param.
Antimony, total (mg/L)	MW_1506	0.00007	0.00003	0.006	No	10	0	No	0.011	NP (normality)
Antimony, total (mg/L)	MW_1507	0.0001059	0.00006206	0.006	No	10	0	No	0.01	Param.
Antimony, total (mg/L)	MW_1509	0.00003	0.00002	0.006	No	10	0	No	0.011	NP (normality)
Arsenic, Total (mg/L)	MW_1505	0.001934	0.0004216	0.01	No	10	0	sqrt(x)	0.01	Param.
Arsenic, Total (mg/L)	MW_1506	0.001231	0.0005935	0.01	No	10	0	No	0.01	Param.
Arsenic, Total (mg/L)	MW_1507	0.003494	0.001078	0.01	No	10	0	No	0.01	Param.
Arsenic, Total (mg/L)	MW_1509	0.0005793	0.0003707	0.01	No	10	0	No	0.01	Param.
Barium, Total (mg/L)	MW_1505	0.0633	0.0455	2	No	10	0	No	0.011	NP (normality)
Barium, Total (mg/L)	MW_1506	0.06622	0.0541	2	No	10	0	No	0.01	Param.
Barium, Total (mg/L)	MW_1507	0.09293	0.06433	2	No	10	0	No	0.01	Param.
Barium, Total (mg/L)	MW_1509	0.06364	0.05608	2	No	10	0	No	0.01	Param.
Beryllium, total (mg/L)	MW_1505	0.000091	0.000006	0.004	No	10	20	No	0.011	NP (Cohens/xfrm)
Beryllium, total (mg/L)	MW_1506	0.00003432	0.00001088	0.004	No	10	0	No	0.01	Param.
Beryllium, total (mg/L)	MW_1507	0.0001509	0.00003606	0.004	No	10	0	No	0.01	Param.
Beryllium, total (mg/L)	MW_1509	0.00001	0.000005	0.004	No	10	60	No	0.011	NP (normality)
Cadmium, total (mg/L)	MW_1505	0.00003	0.00002	0.005	No	10	0	No	0.011	NP (normality)
Cadmium, total (mg/L)	MW_1506	0.00004	0.00002	0.005	No	10	0	No	0.011	NP (normality)
Cadmium, total (mg/L)	MW_1507	0.00007	0.00003	0.005	No	10	0	No	0.011	NP (normality)
Cadmium, total (mg/L)	MW_1509	0.00002294	0.00001051	0.005	No	10	0	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	MW_1505	0.01444	0.001413	0.1	No	10	0	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	MW_1506	0.003385	0.001108	0.1	No	10	0	No	0.01	Param.
Chromium, total (mg/L)	MW_1507	0.01698	0.005854	0.1	No	10	0	No	0.01	Param.
Chromium, total (mg/L)	MW_1509	0.001897	0.00055	0.1	No	10	0	ln(x)	0.01	Param.
Cobalt, total (mg/L)	MW_1505	0.00144	0.0002788	0.006	No	10	0	sqrt(x)	0.01	Param.
Cobalt, total (mg/L)	MW_1506	0.0009874	0.000423	0.006	No	10	0	No	0.01	Param.
Cobalt, total (mg/L)	MW_1507	0.003528	0.001093	0.006	No	10	0	No	0.01	Param.
Cobalt, total (mg/L)	MW_1509	0.0004193	0.0001687	0.006	No	10	0	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW_1505	1.236	0.466	5	No	10	0	No	0.011	NP (normality)
Combined Radium 226 + 228 (pCi/L)	MW_1506	1.462	0.3149	5	No	10	0	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW_1507	2.09	0.521	5	No	10	0	No	0.011	NP (normality)
Combined Radium 226 + 228 (pCi/L)	MW_1509	1.68	0.3969	5	No	10	0	No	0.01	Param.
Fluoride, total (mg/L)	MW_1505	0.1	0.02	4	No	10	90	No	0.011	NP (NDs)
Fluoride, total (mg/L)	MW_1506	0.1	0.05	4	No	10	70	No	0.011	NP (normality)
Fluoride, total (mg/L)	MW_1507	0.07	0.05	4	No	10	10	No	0.011	NP (normality)
Fluoride, total (mg/L)	MW_1509	0.16	0.1	4	No	10	0	No	0.011	NP (normality)
Lead, total (mg/L)	MW_1505	0.001631	0.0001178	0.015	No	10	0	sqrt(x)	0.01	Param.
Lead, total (mg/L)	MW_1506	0.0008323	0.0002951	0.015	No	10	0	No	0.01	Param.
Lead, total (mg/L)	MW_1507	0.00358	0.0008556	0.015	No	10	0	No	0.01	Param.
Lead, total (mg/L)	MW_1509	0.00014	0.00001278	0.015	No	10	0	sqrt(x)	0.01	Param.
Lithium, total (mg/L)	MW_1505	0.01226	0.00594	0.04	No	10	0	No	0.01	Param.
Lithium, total (mg/L)	MW_1506	0.01512	0.008684	0.04	No	10	0	No	0.01	Param.
Lithium, total (mg/L)	MW_1507	0.01961	0.01119	0.04	No	10	0	No	0.01	Param.
Lithium, total (mg/L)	MW_1509	0.018	0.007779	0.04	No	10	0	No	0.01	Param.
Mercury, total (mg/L)	MW_1505	0.000006	0.000002	0.002	No	10	60	No	0.011	NP (normality)
Mercury, total (mg/L)	MW_1506	0.000003	0.000002	0.002	No	10	40	No	0.011	NP (normality)
Mercury, total (mg/L)	MW_1507	0.00001513	0.000002669	0.002	No	10	0	No	0.01	Param.
Mercury, total (mg/L)	MW_1509	0.0000025	0.000002	0.002	No	10	80	No	0.011	NP (NDs)
Molybdenum, total (mg/L)	MW_1505	0.002746	0.0007789	0.1	No	10	0	ln(x)	0.01	Param.
Molybdenum, total (mg/L)	MW_1506	0.001095	0.0005189	0.1	No	10	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW_1507	0.00628	0.0009915	0.1	No	10	0	sqrt(x)	0.01	Param.
Molybdenum, total (mg/L)	MW_1509	0.00104	0.0004104	0.1	No	10	0	No	0.01	Param.
Selenium, Total (mg/L)	MW_1505	0.0007336	0.0003064	0.05	No	10	0	No	0.01	Param.
Selenium, Total (mg/L)	MW_1506	0.0002	0.00007	0.05	No	10	20	No	0.011	NP (normality)
Selenium, Total (mg/L)	MW_1507	0.0005199	0.0001561	0.05	No	10	0	No	0.01	Param.

Confidence Interval - All Results (No Significant Results)

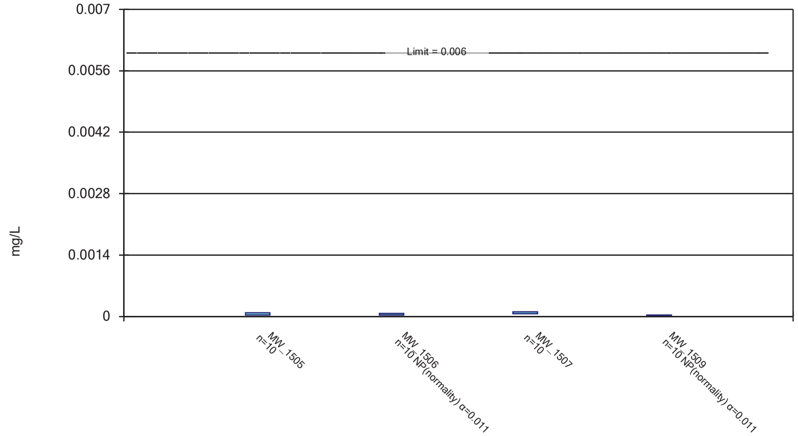
Mitchell BAP Client: Geosyntec Data: Mitchell BAP Printed 11/11/2018, 2:34 PM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Sig.	N	%NDs	Transform	Alpha	Method
Selenium, Total (mg/L)	MW_1509	0.0002	0.00009	0.05	No	10	0	No	0.011	NP (normality)
Thallium, Total (mg/L)	MW_1505	0.00009253	0.00006324	0.002	No	9	0	No	0.01	Param.
Thallium, Total (mg/L)	MW_1506	0.00006437	0.00004763	0.002	No	10	0	No	0.01	Param.
Thallium, Total (mg/L)	MW_1507	0.00007913	0.00004927	0.002	No	10	0	No	0.01	Param.
Thallium, Total (mg/L)	MW_1509	0.00005	0.00003	0.002	No	10	0	No	0.011	NP (normality)

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

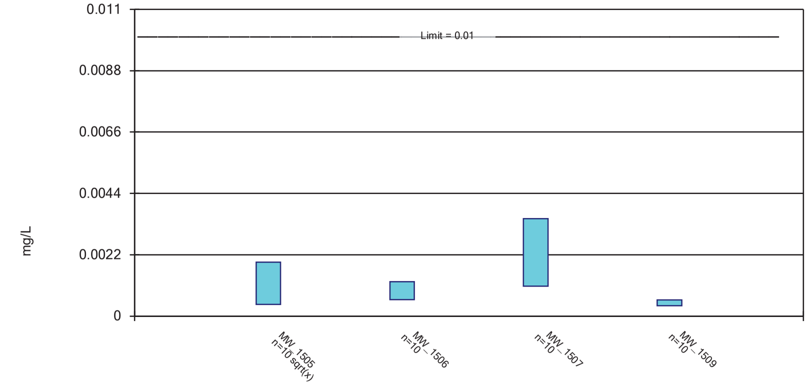


Constituent: Antimony, total Analysis Run 11/11/2018 2:32 PM View: Confidence Intervals - Appendix IV
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

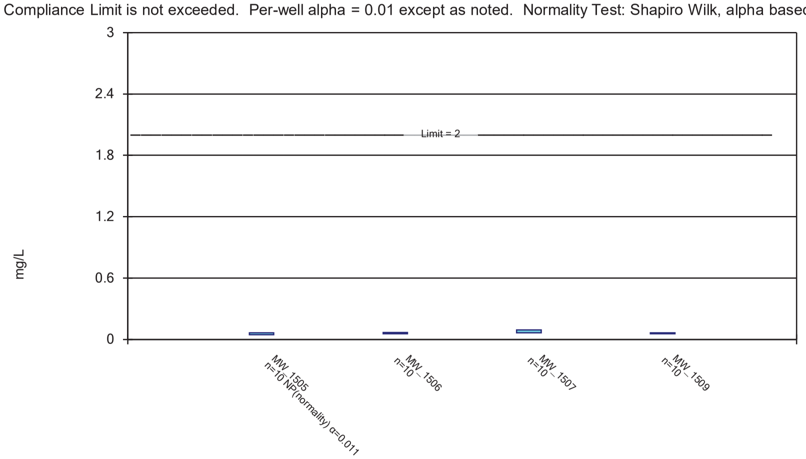


Constituent: Arsenic, Total Analysis Run 11/11/2018 2:32 PM View: Confidence Intervals - Appendix IV
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

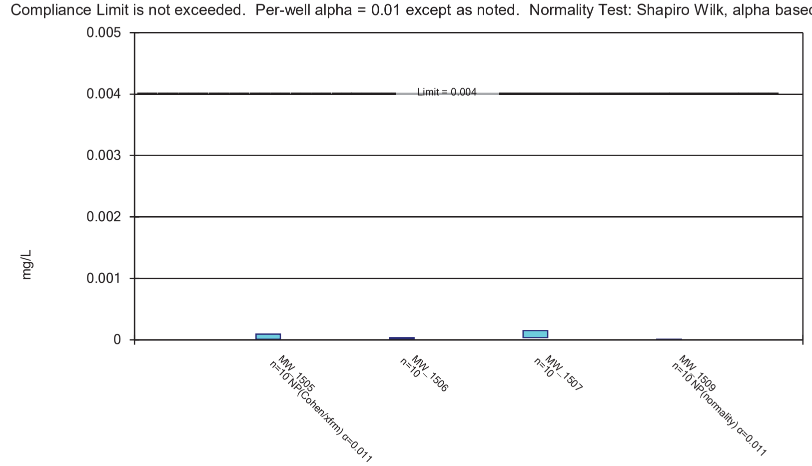


Constituent: Barium, Total Analysis Run 11/11/2018 2:32 PM View: Confidence Intervals - Appendix IV
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

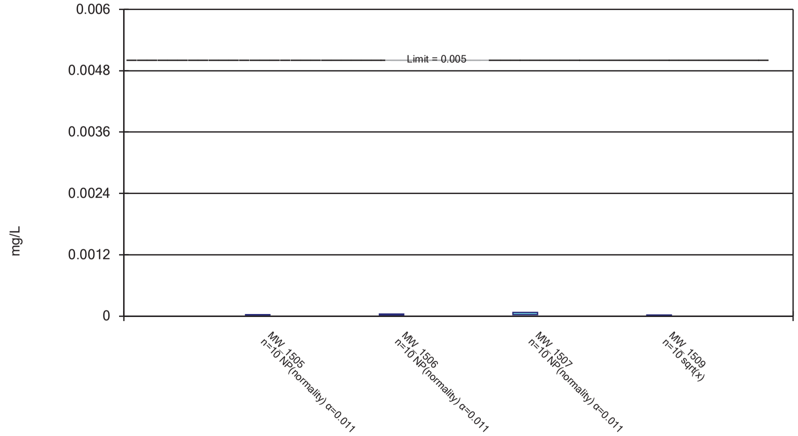


Constituent: Beryllium, total Analysis Run 11/11/2018 2:32 PM View: Confidence Intervals - Appendix IV
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

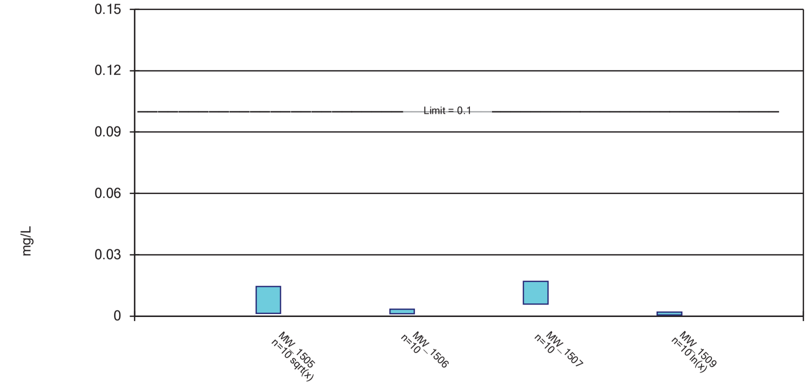


Constituent: Cadmium, total   Analysis Run 11/11/2018 2:32 PM   View: Confidence Intervals - Appendix IV
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

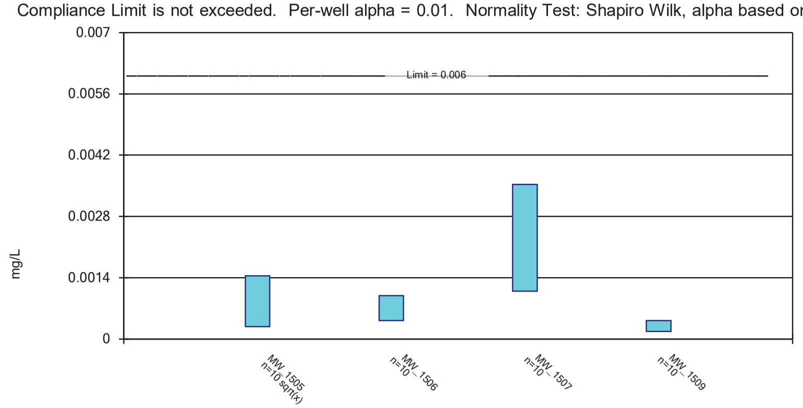


Constituent: Chromium, total   Analysis Run 11/11/2018 2:32 PM   View: Confidence Intervals - Appendix IV
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

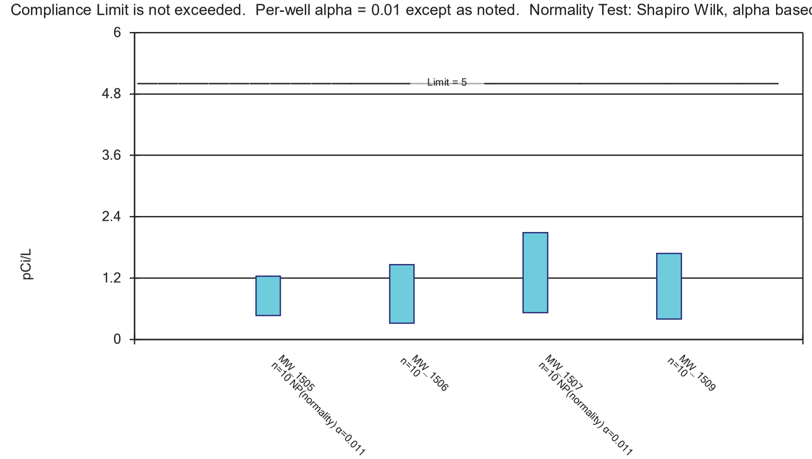


Constituent: Cobalt, total   Analysis Run 11/11/2018 2:32 PM   View: Confidence Intervals - Appendix IV
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

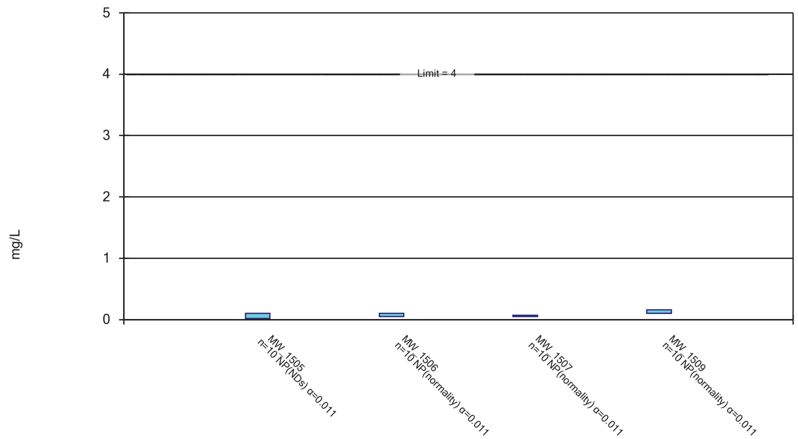


Constituent: Combined Radium 226 + 228   Analysis Run 11/11/2018 2:32 PM   View: Confidence Intervals -
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.

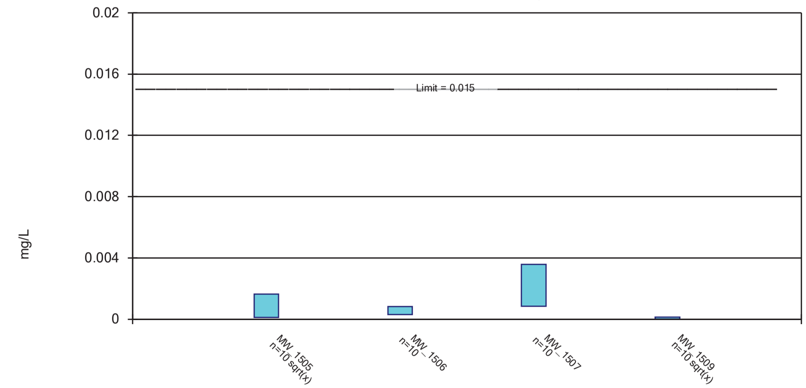


Constituent: Fluoride, total Analysis Run 11/11/2018 2:32 PM View: Confidence Intervals - Appendix IV
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

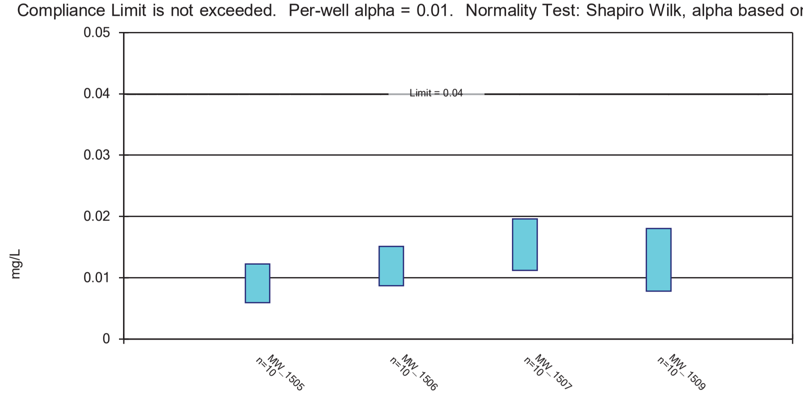


Constituent: Lead, total Analysis Run 11/11/2018 2:32 PM View: Confidence Intervals - Appendix IV
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

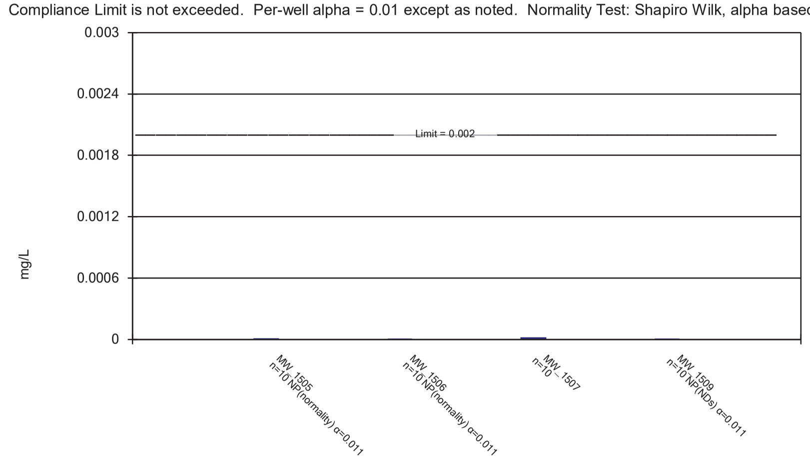


Constituent: Lithium, total Analysis Run 11/11/2018 2:32 PM View: Confidence Intervals - Appendix IV
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

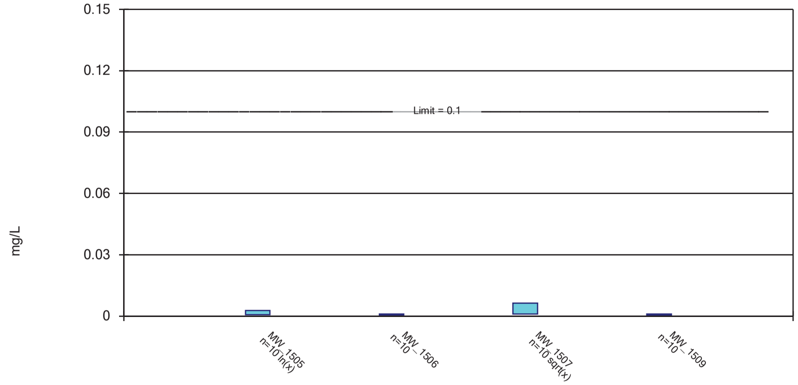


Constituent: Mercury, total Analysis Run 11/11/2018 2:33 PM View: Confidence Intervals - Appendix IV
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

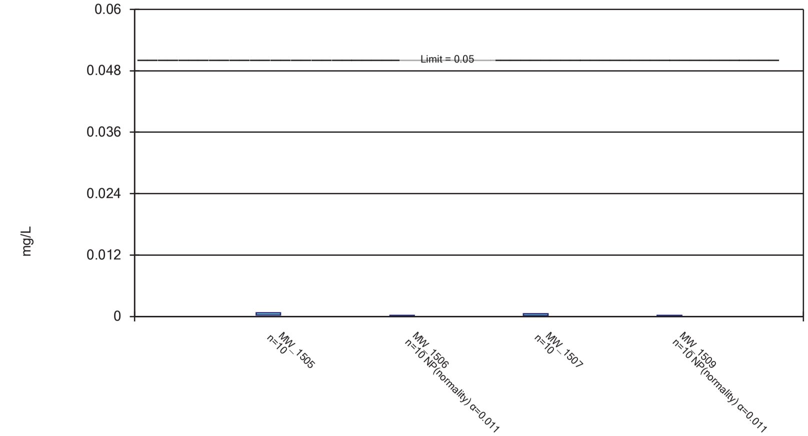


Constituent: Molybdenum, total Analysis Run 11/11/2018 2:33 PM View: Confidence Intervals - Appendix I
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

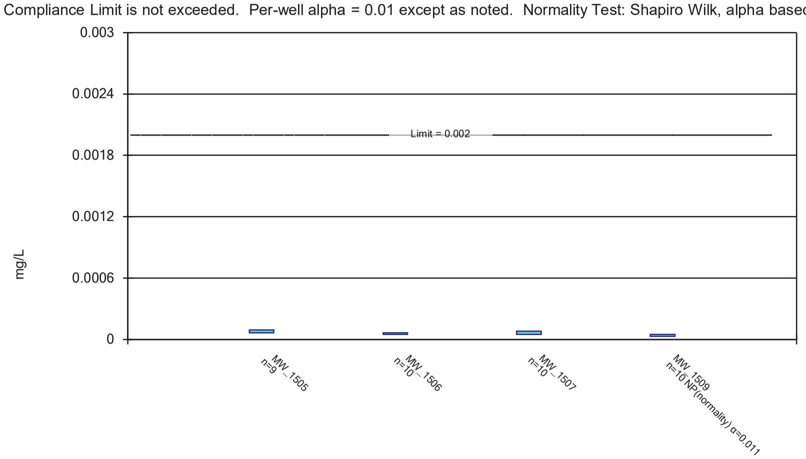


Constituent: Selenium, Total Analysis Run 11/11/2018 2:33 PM View: Confidence Intervals - Appendix IV
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.11e Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.



Constituent: Thallium, Total Analysis Run 11/11/2018 2:33 PM View: Confidence Intervals - Appendix IV
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

STATISTICAL ANALYSIS SUMMARY
BOTTOM ASH POND
Mitchell Plant
Moundsville, West Virginia

Submitted to

AMERICAN ELECTRIC POWER

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

Geosyntec consultants

engineers | scientists | innovators

941 Chatham Lane
Suite 103
Columbus, Ohio 43221

July 10, 2019

CHA8473

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ATTACHMENTS

LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	Alternative Source Demonstration
BAP	Bottom Ash Pond
CCR	Coal Combustion Residuals
CCV	Continuing Calibration Verification
CFR	Code of Federal Regulations
GWPS	Groundwater Protection Standard
LCL	Lower Confidence Limit
LFB	Laboratory Fortified Blanks
LRB	Laboratory Reagent Blanks
MCL	Maximum Contaminant Level
NELAP	National Environmental Laboratory Accreditation Program
QA	Quality Assurance
QC	Quality Control
RSL	Regional Screening Level
SSI	Statistically Significant Increase
SSL	Statistically Significant Level
TDS	Total Dissolved Solids
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency
UTL	Upper Tolerance Limit

SECTION 1

EXECUTIVE SUMMARY

In accordance with the United States Environmental Protection Agency's (USEPA's) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257.90-257.98, "CCR rule"), groundwater monitoring has been conducted at the Bottom Ash Pond (BAP), an existing CCR unit at the Mitchell Power Plant located in Moundsville, West Virginia.

Based on detection monitoring conducted in 2017 and 2018, statistically significant increases (SSIs) over background were concluded for boron, calcium, chloride, and total dissolved solids (TDS and sulfate at the BAP. An alternative source was not identified at the time, so two assessment monitoring events were conducted at the BAP in 2018, in accordance with 40 CFR 257.95. No SSLs were identified and so the unit remained in assessment monitoring. A semi-annual assessment monitoring event was also completed in May 2019, with the results of the May 2019 event documented in this report.

Groundwater data underwent several validation tests, including those for completeness, sample tracking accuracy, transcription errors, and consistent use of measurement units. No data quality issues were identified which would impact the usability of the data.

The monitoring data were submitted to Groundwater Stats Consulting, LLC for statistical analysis. Groundwater protection standards (GWPSs) were re-established for the Appendix IV parameters. Confidence intervals were calculated for Appendix IV parameters at the compliance wells to assess whether Appendix IV parameters were present at a statistically significant level (SSL) above the GWPS. No SSLs were identified, but Appendix III concentrations for boron, calcium, chloride, pH, sulfate, and TDS remained above background. Thus, either the unit will remain in assessment monitoring or an alternative source demonstration (ASD) will be conducted to evaluate if the unit can return to detection monitoring. Certification of the selected statistical methods by a qualified professional engineer is documented in Attachment A.

SECTION 2

BOTTOM ASH POND EVALUATION

2.1 Data Validation & QA/QC

During the assessment monitoring program, one set of samples was collected for analysis from each upgradient and downgradient well to meet the requirements of 40 CFR 257.95(d)(1). Samples from the May 2019 semi-annual sampling event were analyzed for the Appendix III and Appendix IV parameters. A summary of data collected during this assessment monitoring event may be found in Table 1.

Chemical analysis was completed by an analytical laboratory certified by the National Environmental Laboratory Accreditation Program (NELAP). Quality assurance and quality control (QA/QC) samples completed by the analytical laboratory included the use of laboratory reagent blanks (LRBs), continuing calibration verification (CCV) samples, and laboratory fortified blanks (LFBs).

The analytical data were imported into a Microsoft Access database, where checks were completed to assess the accuracy of sample location identification and analyte identification. Where necessary, unit conversions were applied to standardize reported units across all sampling events. Exported data files were created for use with the Sanitas™ v.9.6.14 statistics software. The export file was checked against the analytical data for transcription errors and completeness. No QA/QC issues were noted which would impact data usability.

2.2 Statistical Analysis

Statistical analyses for the BAP were conducted in accordance with the January 2017 *Statistical Analysis Plan* (AEP, 2017), except where noted below. Time series plots and results for all completed statistical tests are provided in Attachment B.

The data obtained to meet the requirements of 40 CFR 257.95(d)(1) were screened for potential outliers. No outliers were identified.

2.2.1 Establishment of GWPSs

A GWPS was established for each Appendix IV parameter in accordance with 40 CFR 257.95(h) and the *Statistical Analysis Plan* (AEP, 2017). The established GWPS was determined to be the greater value of the background concentration and the maximum contaminant level (MCL) or risk-based level specified in 40 CFR 257.95(h)(2) for each Appendix IV parameter. To determine background concentrations, an upper tolerance limit (UTL) was calculated using pooled data from the background wells collected during the background monitoring and assessment monitoring events. Generally, tolerance limits were calculated parametrically with 95% coverage and 95% confidence. Non-parametric tolerance limits were calculated for beryllium, cadmium, fluoride, mercury, and thallium due to apparent non-normal distributions. Tolerance limits and the final GWPSs are summarized in Table 2.

2.2.2 Evaluation of Potential Appendix IV SSLs

A confidence interval was constructed for each Appendix IV parameter at each compliance well. Confidence limits were generally calculated parametrically ($\alpha = 0.01$); however, non-parametric confidence limits were calculated in some cases (e.g., when the data did not appear to be normally distributed or when the non-detect frequency was too high). An SSL was concluded if the lower confidence limit (LCL) exceeded the GWPS (i.e., if the entire confidence interval exceeded the GWPS). Calculated confidence limits are shown in Attachment B.

No SSLs were identified at the Mitchell BAP.

2.2.3 Evaluation of Potential Appendix III SSIs

The CCR rule allows CCR units to move from assessment monitoring to detection monitoring if all Appendix III and Appendix IV parameters were at or below background levels for two consecutive sampling events [40 CFR 257.95(e)]. Since no Appendix IV SSLs were identified, Appendix III results were analyzed to assess whether concentrations of Appendix III parameters at the compliance wells exceeded background concentrations.

Prediction limits were calculated for the Appendix III parameters to represent background values. As described in the January 2018 *Statistical Analysis Summary* report (Geosyntec, 2018), intrawell tests were used to evaluate potential SSIs for fluoride and sulfate, whereas interwell tests were used to evaluate potential SSIs for boron, calcium, chloride, pH, and TDS.

Prediction limits for the interwell tests were recalculated using data collected during the May 2019 assessment monitoring event. Six data points (i.e., one sample from six background wells) were added to the background dataset for each interwell test. New data were tested for outliers prior to being added to the background dataset. The updated prediction limits were calculated for a one-of-two retesting procedure, as during detection monitoring. The values of the updated prediction limits were similar to the values of the prediction limits calculated during detection monitoring. The revised interwell prediction limits were used to evaluate potential SSIs for boron, calcium, chloride, pH, and TDS.

For the intrawell tests, limited data made it possible to add only one data point (i.e., one sample from each compliance well) to each background dataset. Because one sample result is insufficient to compare against the existing background dataset, the prediction limits were not updated for the intrawell tests at this time. The intrawell prediction limits calculated during detection monitoring were used to evaluate potential SSIs for fluoride and sulfate.

Data collected during the August 2018 and May 2019 assessment monitoring events from each compliance well were compared to the prediction limits to evaluate results above background values. The results from this event and the prediction limits are summarized in Table 3. The following exceedances of the upper prediction limits (UPLs) were noted:

- Boron concentrations exceeded the interwell UPL of 1.36 mg/L at MW-1505 (8.00 mg/L and 7.31 mg/L), MW-1506 (5.91 mg/L and 5.24 mg/L), MW-1507 (9.29 mg/L and 8.36 mg/L), MW-1509 (6.97 mg/L and 8.36 mg/L), and MW-1510 (9.13 mg/L and 8.83 mg/L).

- Calcium concentrations exceeded the interwell UPL of 240 mg/L at MW-1505 (274 mg/L and 287 mg/L), MW-1505 (270 mg/L and 280 mg/L), MW-1507 (272 mg/L and 271 mg/L), MW-1509 (279 mg/L and 287 mg/L), and MW-1510 (268 mg/L and 287 mg/L).

- Chloride concentrations exceeded the interwell UPL of 238 mg/L at MW-1505 (284 mg/L and 285 mg/L), MW-1506 (369 mg/L and 331 mg/L), MW 1507 (331 mg/L and 296 mg/L), MW-1509 (323 mg/L and 328 mg/L), and MW-1510 (334 mg/L and 325 mg/L).

- The pH result exceeded the interwell UPL of 8.2 SU at MW-1509 (8.5 SU).

- Sulfate concentrations exceeded the intrawell UPL of 351 mg/L at MW-1505 (383 mg/L and 408 mg/L), the intrawell UPL of 345 mg/L at MW-1506 (349 mg/L and 347 mg/L), the intrawell UPL of 450 mg/L at MW-1509 (465 mg/L), and the intrawell UPL of 399 mg/L at MW-1510 (428 mg/L and 467 mg/L).

- TDS concentrations exceeded the interwell UPL of 1182 mg/L at MW-1505 (1520 mg/L and 1580 mg/L), MW-1506 (1590 mg/L and 1360 mg/L), MW-1507 (1430 mg/L and 1270 mg/L), MW-1509 (1540 mg/L and 1480 mg/L), and MW-1510 (1550 mg/L and 1460 mg/L).

Based on these results, concentrations of Appendix III parameters exceeded background levels at compliance wells at the Mitchell BAP during assessment monitoring. As a result, the Mitchell BAP CCR unit will remain in assessment monitoring.

2.3 Conclusions

A semi-annual assessment monitoring event was conducted in accordance with the CCR Rule. The laboratory and field data were reviewed prior to statistical analysis, with no QA/QC issues identified that impacted data usability. A review of outliers identified no potential outliers in the May 2019 data. GWPSs were re-established for the Appendix IV parameters. A confidence interval was constructed at each compliance well for each Appendix IV parameter; SSLs were concluded if the entire confidence interval exceeded the GWPS. No SSLs were identified.

The Appendix III results were evaluated to assess whether concentrations of Appendix III parameters exceeded background levels. Interwell tests were used to evaluate potential SSIs for boron, calcium, chloride, pH, and TDS, and intrawell tests were used to evaluate potential SSIs for fluoride and sulfate. The prediction limits for the interwell tests were updated with additional data collected from the background wells. Prediction limits were recalculated using a one-of-two retesting procedure. The prediction limits calculated during detection monitoring were used for the intrawell tests. Boron, calcium, chloride, pH, sulfate, and TDS results exceeded background levels.

Based on this evaluation, either the Mitchell BAP CCR unit will remain in assessment monitoring or an ASD will be conducted to evaluate if the unit can return to detection monitoring.

SECTION 3

REFERENCES

American Electric Power (AEP). 2017. Statistical Analysis Plan – Mitchell Plant. January 2017.

Geosyntec Consultants (Geosyntec). 2018. Statistical Analysis Summary – Bottom Ash Pond, Mitchell Plant, Moundsville, West Virginia. January 15, 2018.

TABLES

Table 1 - Groundwater Data Summary
Mitchell Plant - Bottom Ash Pond

Parameter	Unit	MW-1504	MW-1505	MW-1506	MW-1507	MW-1508	MW-1509	MW-1510
		5/1/2019	5/1/2019	5/1/2019	5/1/2019	5/1/2019	5/1/2019	5/1/2019
Antimony	µg/L	0.100 U	0.0300 J	0.0300 J	0.0300 J	0.0300 J	0.0300 J	0.0200 J
Arsenic	µg/L	0.220	0.290	0.340	0.430	0.600	0.330	0.290
Barium	µg/L	36.4	48.7	53.5	53.9	37.4	47.2	41.7
Beryllium	µg/L	0.100 U	0.100 U	0.100 U	0.100 U	0.0200 J	0.100 U	0.100 U
Boron	mg/L	0.0500 J	7.31	5.24	8.36	0.622	8.73	8.83
Cadmium	µg/L	0.0300 J	0.0300 J	0.0200 J	0.0300 J	0.0300 J	0.0100 J	0.0500 U
Calcium	mg/L	220	287	280	271	221	287	287
Chloride	mg/L	81.8	285	331	296	178	328	325
Chromium	µg/L	0.305	0.665	0.752	2.35	0.735	2.28	1.75
Cobalt	µg/L	0.0710	0.199	0.256	0.331	0.637	0.324	0.172
Combined Radium	pCi/L	0.675	0.240	0.188	0.496	0.636	0.408	0.573
Fluoride	mg/L	0.170	0.0600 U	0.0300 J	0.0700	0.0800	0.130	0.100
Lead	µg/L	0.0200 J	0.0700 J	0.135	0.239	0.540	0.114	0.105
Lithium	mg/L	0.0300 U	0.0300 U	0.0200 J	0.0300 U	0.0300 U	0.0300 U	0.0100 J
Mercury	mg/L	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U	0.00500 U
Molybdenum	µg/L	2.00 U	0.600 J	2.00 J	1.00 J	2.00 U	2.00 U	2.00 U
Selenium	µg/L	0.200 U	0.900	0.0700 J	0.0700 J	0.300	0.200 J	0.200 J
Total Dissolved Solids	mg/L	926	1580	1360	1270	978	1480	1460
Sulfate	mg/L	317	408	347	346	287	429	467
Thallium	µg/L	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U	0.500 U
pH	SU	8.01	7.80	7.87	8.04	8.18	8.45	8.11

Notes:
µg/L: micrograms per liter
mg/L: milligrams per liter
pCi/L: picocuries per liter
SU: standard unit
U: Non-detect value. For statistical analysis, parameters which were not detected were replaced with the reporting limit.
J: Estimated value. Parameter was detected in concentrations below the reporting limit.
-: Not sampled

Table 2: Groundwater Protection Standards
Mitchell Plant - Bottom Ash Pond

Constituent Name	MCL	CCR Rule-Specified	Background Limit
Antimony, Total (mg/L)	0.006		0.000068
Arsenic, Total (mg/L)	0.01		0.0017
Barium, Total (mg/L)	2		0.057
Beryllium, Total (mg/L)	0.004		0.0001
Cadmium, Total (mg/L)	0.005		0.00009
Chromium, Total (mg/L)	0.1		0.0023
Cobalt, Total (mg/L)	n/a	0.006	0.0037
Combined Radium, Total (pCi/L)	5		2.26
Fluoride, Total (mg/L)	4		0.25
Lead, Total (mg/L)	n/a	0.015	0.0042
Lithium, Total (mg/L)	n/a	0.04	0.019
Mercury, Total (mg/L)	0.002		0.000008
Molybdenum, Total (mg/L)	n/a	0.1	0.0019
Selenium, Total (mg/L)	0.05		0.0011
Thallium, Total (mg/L)	0.002		0.00025

Notes:
Grey cell indicates calculated UTL is higher than MCL.
MCL = Maximum Contaminant Level
RSL = Regional Screening Level
Calculated UTL (Upper Tolerance Limit) represents site-specific background values.
The higher of the calculated UTL or MCL/Rule-Specified Level is used as the GWPS.

Table 3: Appendix III Data Summary
Mitchell Plant - Bottom Ash Pond

Parameter	Units	Description	MW-1505		MW-1506		MW-1507		MW-1509		MW-1510	
			8/22/2018	5/1/2019	8/22/2018	5/1/2019	8/21/2018	5/1/2019	8/21/2018	5/1/2019	8/21/2018	5/1/2019
Boron	mg/L	Interwell Background Value (UPL)	1.36									
		Detection Monitoring Result	**8.00**	**7.31**	**5.91**	**5.24**	**9.29**	**8.36**	**6.97**	**8.73**	**9.13**	**8.83**
Calcium	mg/L	Interwell Background Value (UPL)	240									
		Detection Monitoring Result	**274**	**287**	**270**	**280**	**272**	**271**	**279**	**287**	**268**	**287**
Chloride	mg/L	Interwell Background Value (UPL)	238									
		Detection Monitoring Result	**284**	**285**	**369**	**331**	**331**	**296**	**323**	**328**	**334**	**325**
Fluoride	mg/L	Intrawell Background Value (UPL)	0.20		0.20		0.11		0.16		0.20	
		Detection Monitoring Result	0.02	0.01	0.05	0.03	0.07	0.07	0.14	0.13	0.09	0.1
pH	SU	Interwell Background Value (UPL)	8.2									
		Interwell Background Value (LPL)	6.9									
		Detection Monitoring Result	7.3	7.8	7.4	7.9	7.2	8.0	7.2	**8.5**	7.3	8.1
Sulfate	mg/L	Intrawell Background Value (UPL)	351		345		377		450		399	
		Detection Monitoring Result	**383**	**408**	**349**	**347**	323	346	**465**	429	**428**	**467**
Total Dissolved Solids	mg/L	Interwell Background Value (UPL)	1182									
		Detection Monitoring Result	**1520**	**1580**	**1590**	**1360**	**1430**	**1270**	**1540**	**1480**	**1550**	**1460**

Notes:
UPL: Upper prediction limit
LPL: Lower prediction limit
Bold values exceed the background value.
Background values are shaded gray.

ATTACHMENT A

Certification by Qualified Professional Engineer

Certification by Qualified Professional Engineer

I certify that the selected and above described statistical method is appropriate for evaluating the groundwater monitoring data for the Mitchell Bottom Ash Pond CCR management area and that the requirements of 40 CFR 257.93(f) have been met.

DAVID ANTHONY MILLER

Printed Name of Licensed Professional Engineer

David Anthony Miller

Signature

DAVID ANTHONY MILLER
REGISTERED
22663
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

22663	WEST VIRGINIA	07.10.19
License Number	Licensing State	Date

ATTACHMENT B

Statistical Analysis Output

GROUNDWATER STATS
CONSULTING

July 10, 2019

Geosyntec Consultants
Attn: Ms. Allison Kreinberg
941 Chatham Lane, #103
Columbus, OH 43221

RE: Mitchell Bottom Ash Pond (BAP) Assessment Event – Spring 2019

Dear Ms. Kreinberg,

Groundwater Stats Consulting, formerly the statistical consulting division of Sanitas Technologies, is pleased to provide the evaluation of groundwater data for the Spring 2019 sample event for American Electric Power Company's Mitchell Bottom Ash Pond. The analysis complies with the federal rule for the Disposal of Coal Combustion Residuals from Electric Utilities (CCR Rule, 2015) as well as with the USEPA Unified Guidance (2009).

Sampling at each of the wells below began at Mitchell Bottom Ash Pond for the CCR program in 2016. The monitoring well network, as provided by Geosyntec Consultants, consists of the following: upgradient wells MW-1504 and MW-1508; and downgradient wells MW-1505, MW-1506, MW-1507, MW-1509 and MW-1510.

Data were sent electronically, and the statistical analysis was conducted according to the Statistical Analysis Plan and screening evaluation prepared by GSC and approved by Dr. Kirk Cameron, PhD Statistician with MacStat Consulting, primary author of the USEPA Unified Guidance, and Senior Advisor to GSC.

The CCR program consists of the following constituents:

- **Appendix III** (Detection Monitoring) **-** boron, calcium, chloride, fluoride, pH, sulfate, and TDS; and

- **Appendix IV** (Assessment Monitoring) – antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, combined radium 226 + 228, fluoride, lead, lithium, mercury, molybdenum, selenium, and thallium.

Time series plots for Appendix III and IV parameters are provided for all wells and constituents; and are used to evaluate concentrations over the entire record (Figure A). Values in background which have previously been flagged as outliers may be seen in a lighter font and disconnected symbol on the graphs. Additionally, a summary of flagged values follows this letter (Figure B).

Evaluation of Appendix III Parameters

Interwell prediction limits combined with a 1-of-2 resample plan were constructed for boron, calcium, chloride, pH, and TDS; and intrawell prediction limits combined with a 1-of-2 resample plan were constructed for fluoride and sulfate (Figures C & D, respectively). The statistical method selected for each parameter was determined based on the results of the evaluation performed in December 2017; and all proposed background data were screened for outliers and trends at that time. The findings of those reports were submitted with that analysis.

Interwell prediction limits utilize all upgradient well data for construction of statistical limits. During each sample event, upgradient well data are screened for any newly suspected outliers or obvious trending patterns using time series plots. All values flagged as outliers may be seen on the Outlier Summary report following this letter. No obvious trending patterns were observed in the upgradient wells.

Intrawell prediction limits utilize the background data set that was originally screened in 2017. As recommended in the EPA Unified Guidance (2009), the background data set will be tested for the purpose of updating statistical limits using the Mann-Whitney two-sample test when an additional four to eight measurements are available.

In the event of an initial exceedance of compliance well data, the 1-of-2 resample plan allows for collection of one additional sample to determine whether the initial exceedance is confirmed. When the resample confirms the initial exceedance, a statistically significant increase (SSI) is identified, and further research would be required to identify the cause of the exceedance (i.e. impact from the site, natural variation, or an off-site source). If the resample falls within the statistical limit, the initial exceedance is considered a false positive result; therefore, no further action is necessary. Prediction limit exceedances were noted for boron, calcium, chloride, pH, sulfate and TDS in at least one downgradient well. The results of those findings may be found in the Prediction Limit Summary tables following this letter.

When a statistically significant increase is identified, the data are further evaluated using the Sen's Slope/Mann Kendall trend test to determine whether data are statistically increasing, decreasing or stable (Figure E). Several statistically significant decreasing trends were noted, but no statistically significant increasing trends were found in any of the downgradient wells. A statistically significant increasing trend was noted for pH in upgradient well MW_1504. When trends are identified in upgradient wells, it typically represents naturally changing groundwater quality unrelated to the site. The Trend Test Summary Table follows this letter.

Evaluation of Appendix IV Parameters

Tolerance limits were used to calculate background limits from all available pooled upgradient well data for Appendix IV parameters with a target of 95% confidence and 95% coverage to determine the Alternate Contaminant Level (ACL) for each constituent (Figure F). Background data are screened for outliers and extreme trending patterns that would lead to artificially elevated statistical limits. Any flagged values may be seen on the Outlier Summary following this letter.

For parametric limits the target is 95% confidence and 95% coverage. The confidence and coverage levels for nonparametric tolerance limits are dependent upon the number of background samples. These limits were compared to the Maximum Contaminant Levels (MCLs) and CCR-Rule specified levels in the Groundwater Protection Standards (GWPS) table following this letter to determine the highest limit for use as the GWPS in the Confidence Interval comparisons (Figure G).

Confidence intervals were then constructed on downgradient wells for each of the Appendix IV parameters using the highest limit of the MCL, CCR-Rule specified levels, or ACL as discussed above (Figure H). Only when the entire confidence interval is above a GWPS is the well/constituent pair considered to exceed its respective standard. No exceedances were noted at any of the downgradient wells. A summary of the confidence interval results follows this letter.

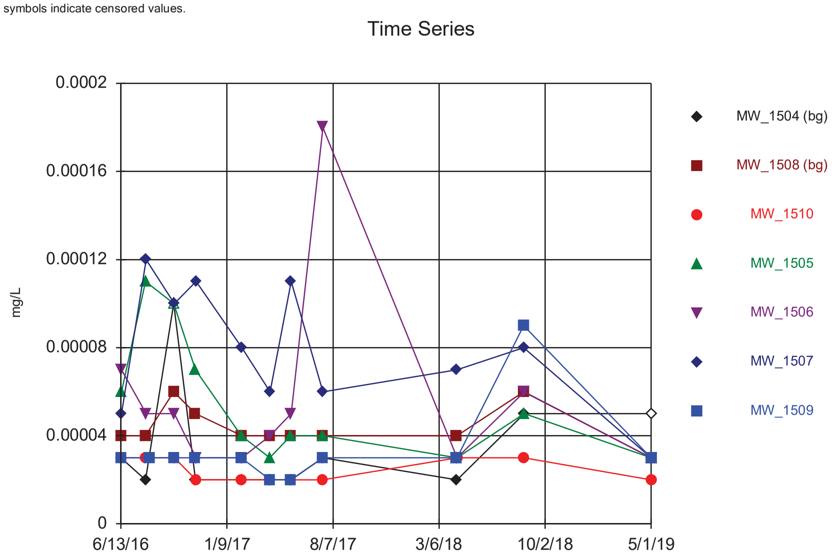
Thank you for the opportunity to assist you in the statistical analysis of groundwater quality for the Mitchell Bottom Ash Pond. If you have any questions or comments, please feel free to contact me.

For Groundwater Stats Consulting,

Kristina Rayner

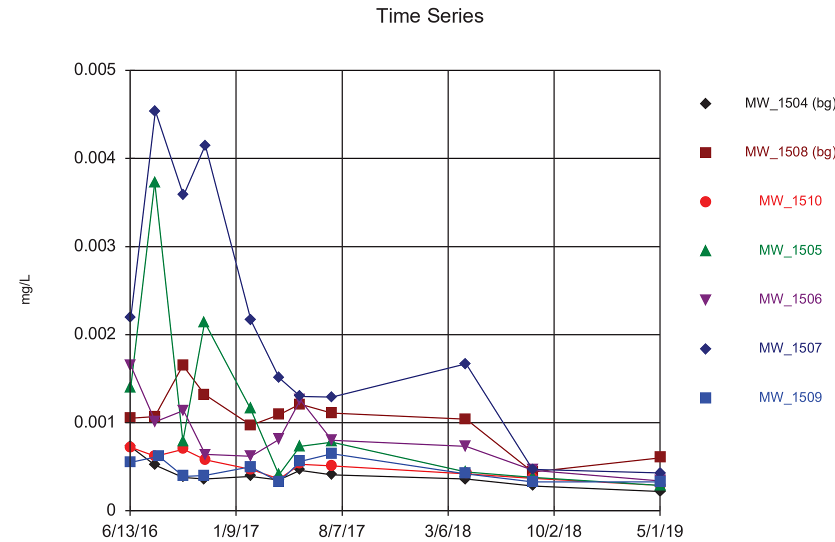
Kristina L. Rayner
Groundwater Statistician

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



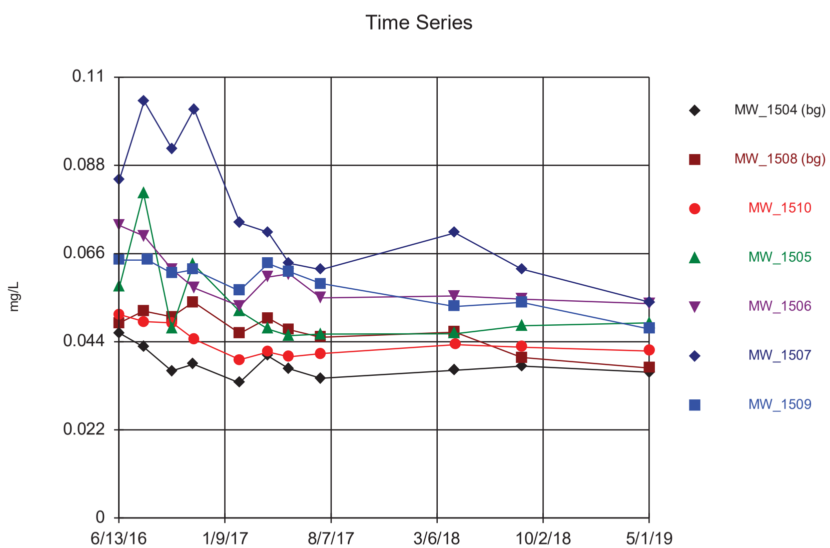
Constituent: Antimony, total Analysis Run 7/10/2019 10:41 AM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG



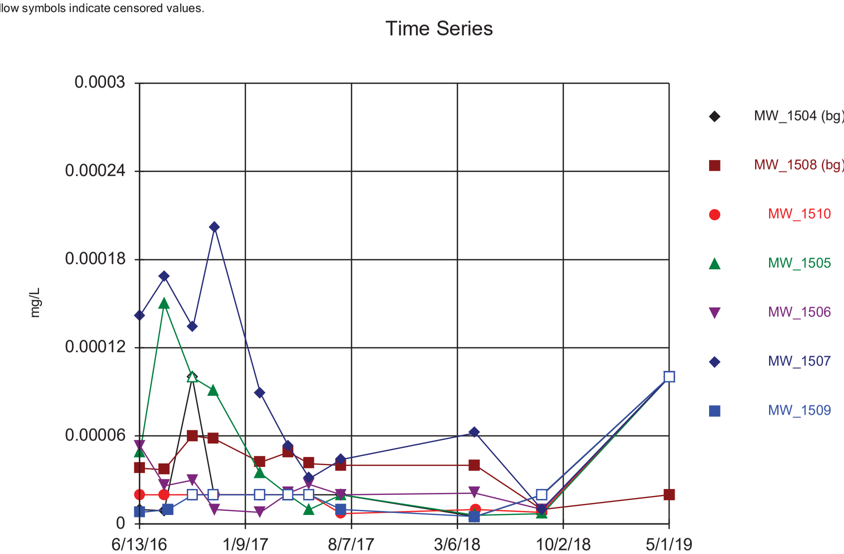
Constituent: Arsenic, Total Analysis Run 7/10/2019 10:41 AM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG



Constituent: Barium, Total Analysis Run 7/10/2019 10:41 AM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

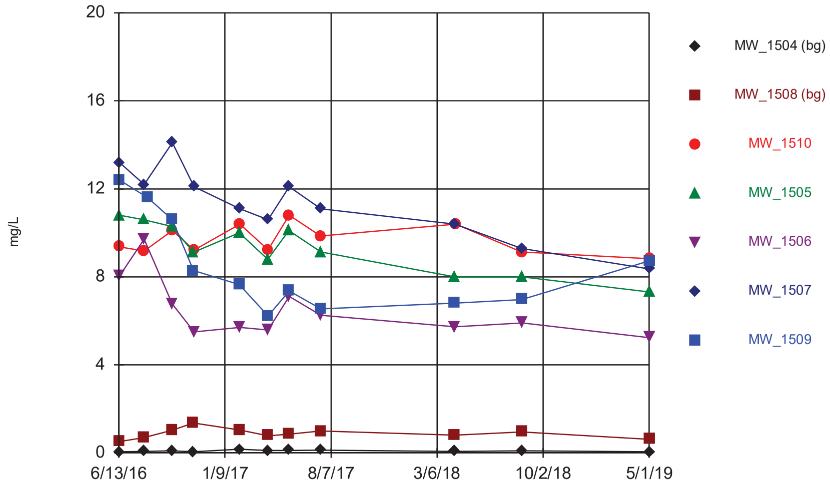
Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



Constituent: Beryllium, total Analysis Run 7/10/2019 10:41 AM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

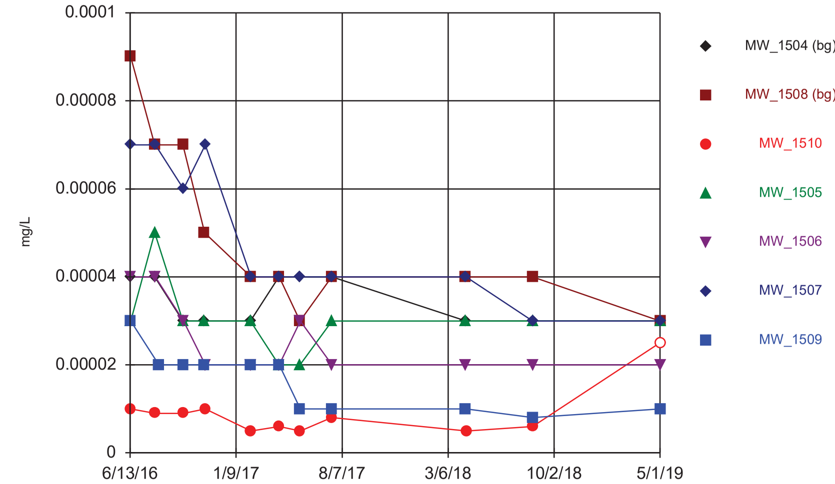
Time Series



Constituent: Boron, total Analysis Run 7/10/2019 10:41 AM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

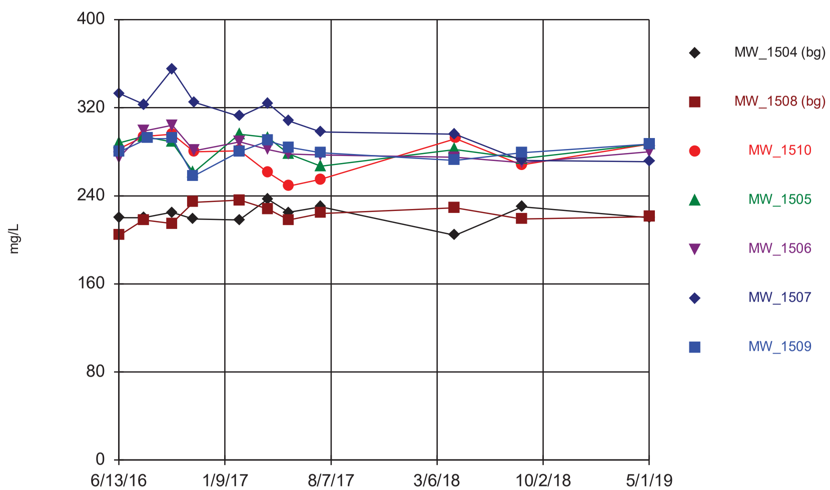
Time Series



Constituent: Cadmium, total Analysis Run 7/10/2019 10:41 AM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

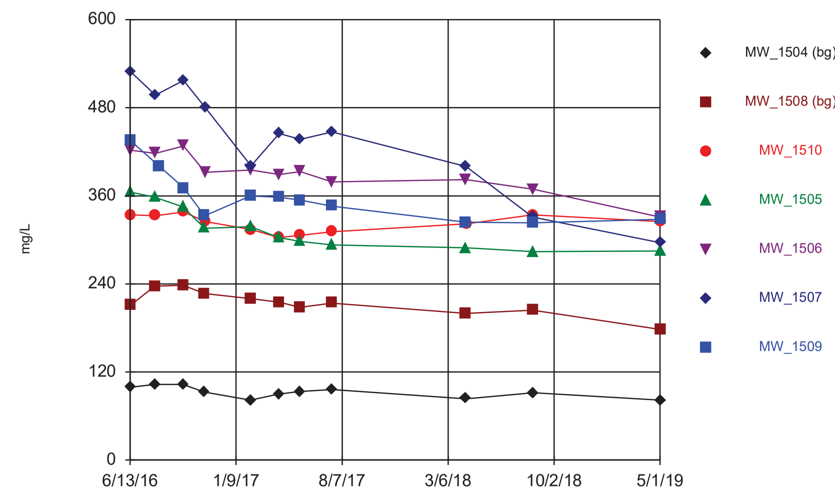
Time Series



Constituent: Calcium, total Analysis Run 7/10/2019 10:41 AM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

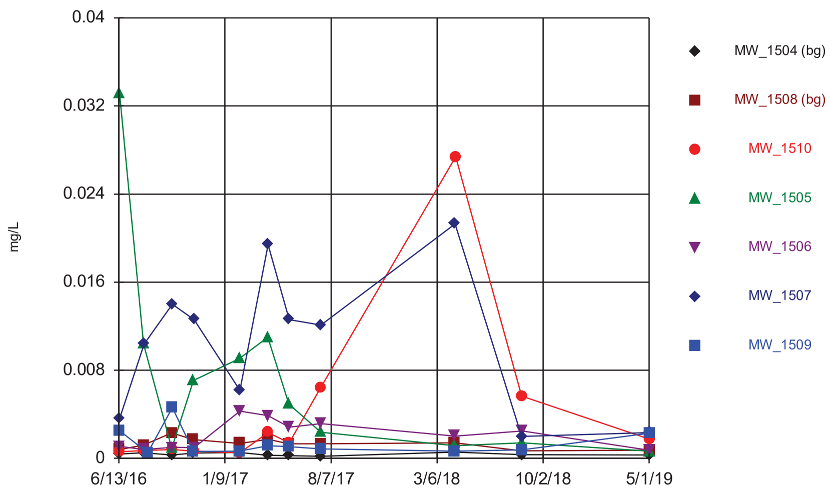
Time Series



Constituent: Chloride, total Analysis Run 7/10/2019 10:42 AM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

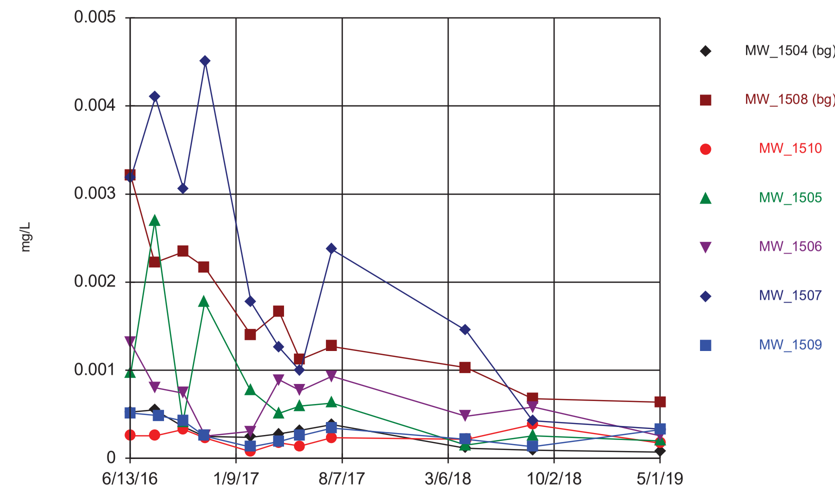
Time Series



Constituent: Chromium, total   Analysis Run 7/10/2019 10:42 AM   View: Time Series - All Wells
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

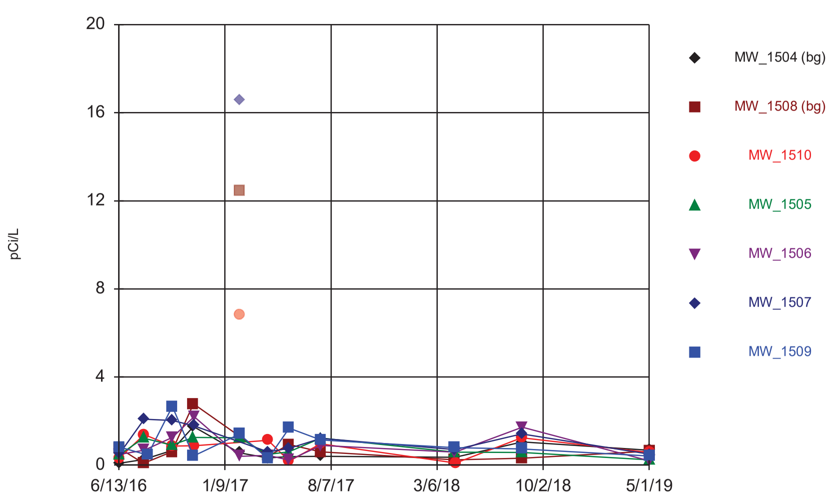
Time Series



Constituent: Cobalt, total   Analysis Run 7/10/2019 10:42 AM   View: Time Series - All Wells
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

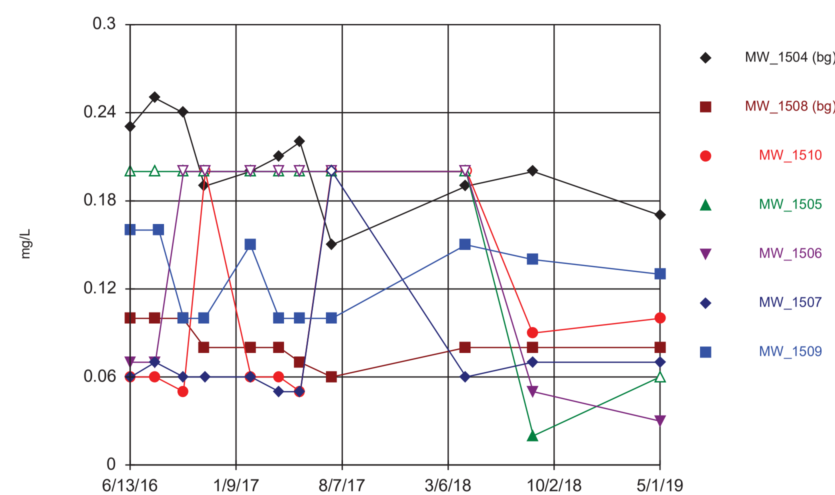
Time Series



Constituent: Combined Radium 226 + 228   Analysis Run 7/10/2019 10:42 AM   View: Time Series - All Well
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

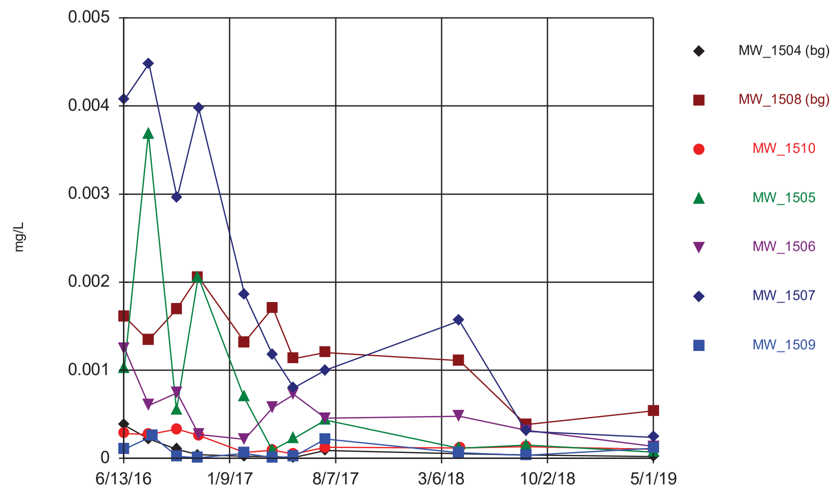
Time Series



Constituent: Fluoride, total   Analysis Run 7/10/2019 10:42 AM   View: Time Series - All Wells
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

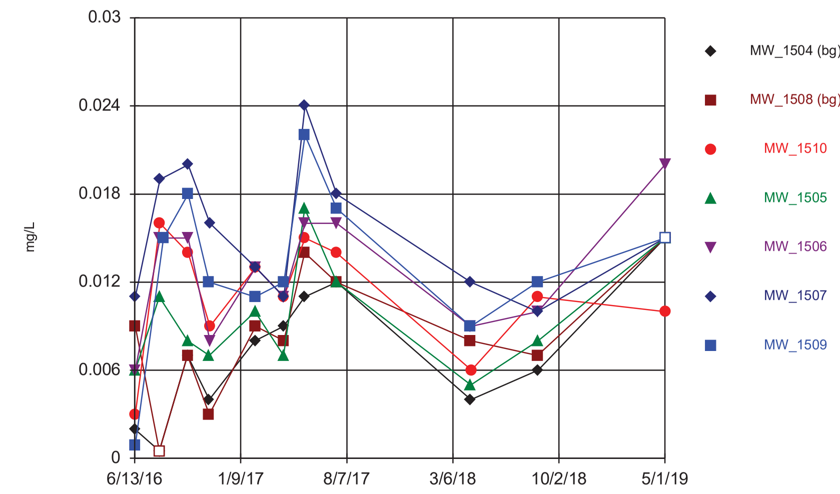
Time Series



Constituent: Lead, total Analysis Run 7/10/2019 10:42 AM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

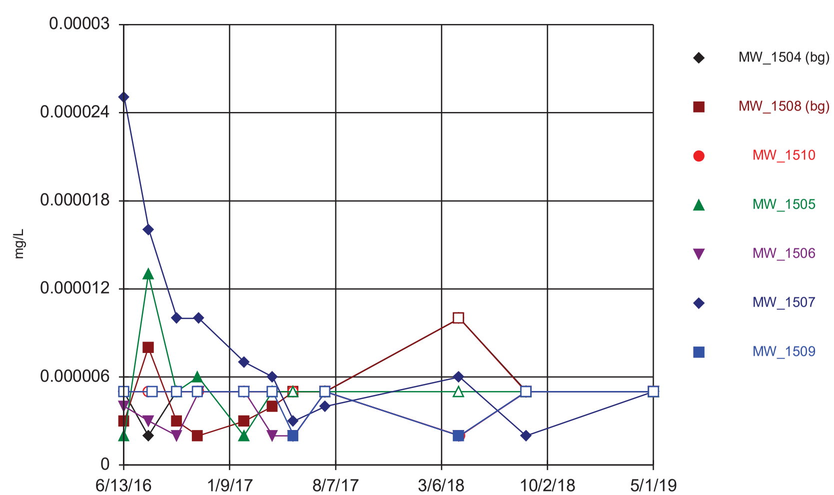
Time Series



Constituent: Lithium, total Analysis Run 7/10/2019 10:42 AM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

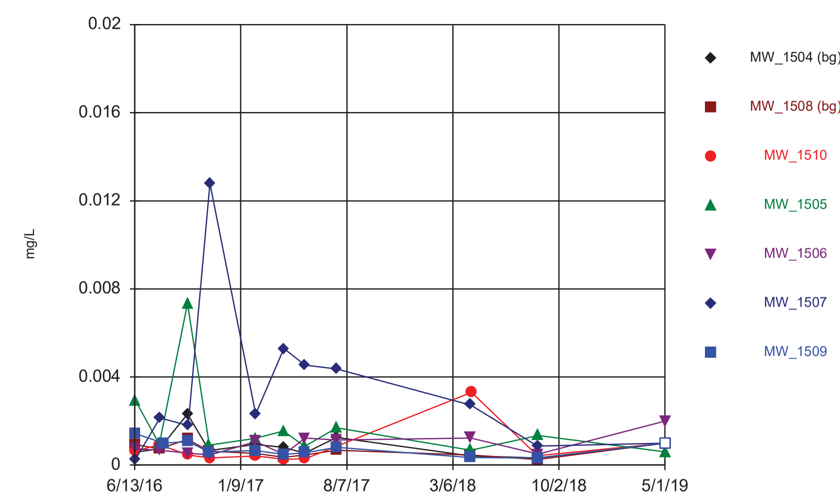
Time Series



Constituent: Mercury, total Analysis Run 7/10/2019 10:42 AM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

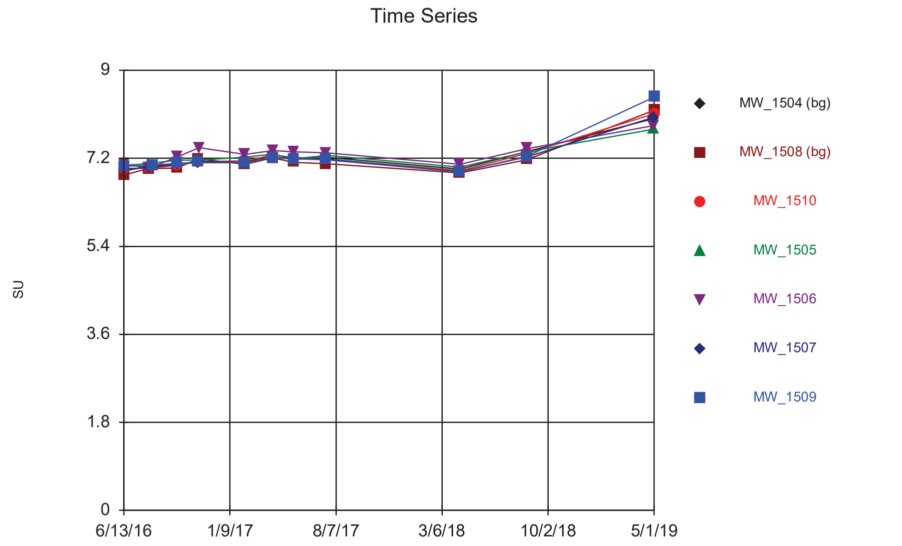
Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Time Series



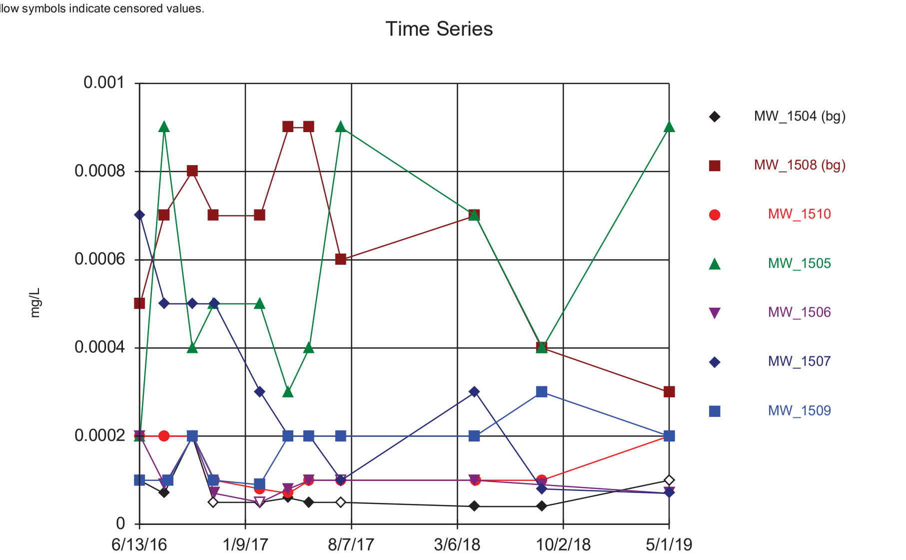
Constituent: Molybdenum, total Analysis Run 7/10/2019 10:42 AM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG



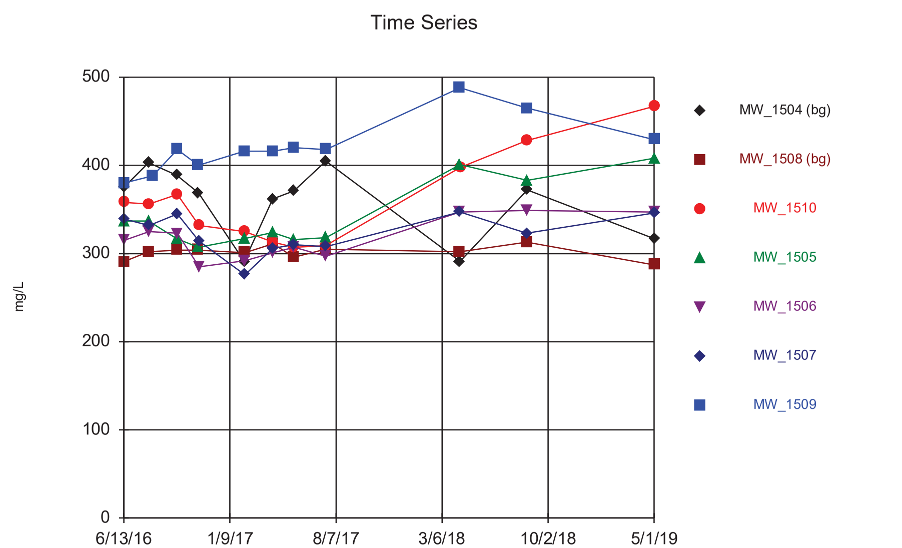
Constituent: pH, field Analysis Run 7/10/2019 10:42 AM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



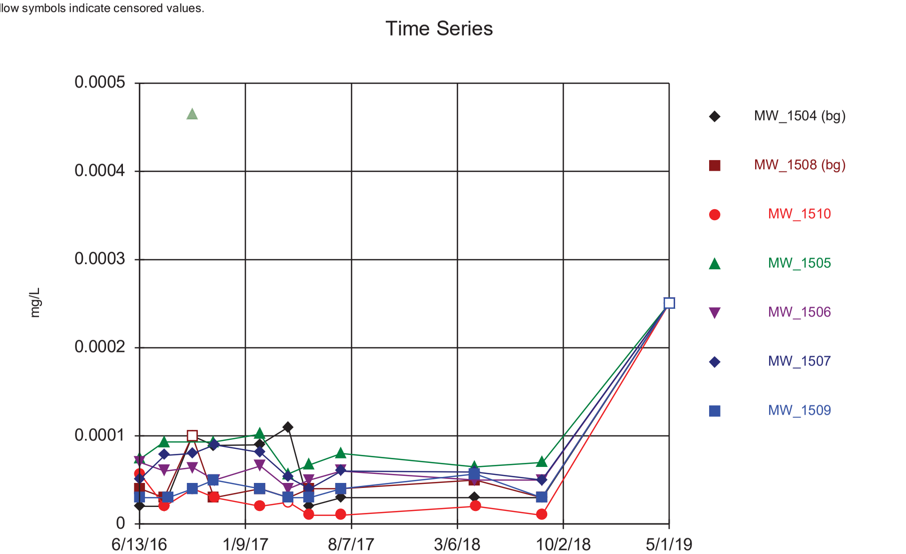
Constituent: Selenium, Total Analysis Run 7/10/2019 10:42 AM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG



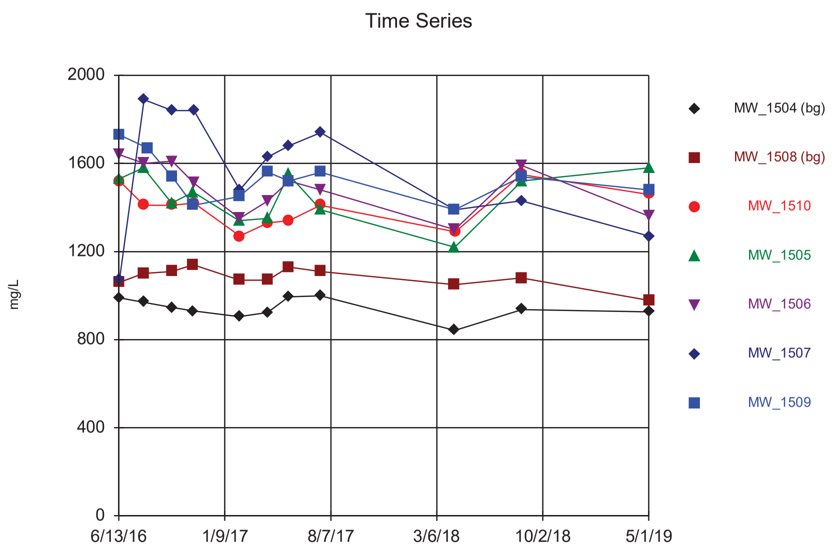
Constituent: Sulfate, total Analysis Run 7/10/2019 10:42 AM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.



Constituent: Thallium, Total Analysis Run 7/10/2019 10:42 AM View: Time Series - All Wells
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG



Constituent: Total Dissolved Solids [TDS]   Analysis Run 7/10/2019 10:42 AM   View: Time Series - All Wells
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Outlier Summary

Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP   Printed 7/10/2019, 10:43 AM

	MW_1508 Combined Radium 226 + 228 (pCi/L)	MW_1510 Combined Radium 226 + 228 (pCi/L)	MW_1507 Combined Radium 226 + 228 (pCi/L)	MW_1505 Thallium, Total (mg/L)
9/26/2016				0.000464 (o)
2/8/2017	12.465 (o)	6.828 (o)	16.587 (o)	

Interwell Prediction Limit Summary - Significant Results

Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP   Printed 7/8/2019, 2:00 PM

Constituent	Well	Upper Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	**MW_1510**	**1.36**	**5/1/2019**	**8.83**	**Yes**	**22**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.003495**	**NP Inter (normality) 1 of 2**
Boron, total (mg/L)	**MW_1505**	**1.36**	**5/1/2019**	**7.31**	**Yes**	**22**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.003495**	**NP Inter (normality) 1 of 2**
Boron, total (mg/L)	**MW_1506**	**1.36**	**5/1/2019**	**5.24**	**Yes**	**22**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.003495**	**NP Inter (normality) 1 of 2**
Boron, total (mg/L)	**MW_1507**	**1.36**	**5/1/2019**	**8.36**	**Yes**	**22**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.003495**	**NP Inter (normality) 1 of 2**
Boron, total (mg/L)	**MW_1509**	**1.36**	**5/1/2019**	**8.73**	**Yes**	**22**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.003495**	**NP Inter (normality) 1 of 2**
Calcium, total (mg/L)	**MW_1510**	**239.9**	**5/1/2019**	**287**	**Yes**	**22**	**222.5**	**8.651**	**0**	**None**	**No**	**0.001504**	**Param Inter 1 of 2**
Calcium, total (mg/L)	**MW_1505**	**239.9**	**5/1/2019**	**287**	**Yes**	**22**	**222.5**	**8.651**	**0**	**None**	**No**	**0.001504**	**Param Inter 1 of 2**
Calcium, total (mg/L)	**MW_1506**	**239.9**	**5/1/2019**	**280**	**Yes**	**22**	**222.5**	**8.651**	**0**	**None**	**No**	**0.001504**	**Param Inter 1 of 2**
Calcium, total (mg/L)	**MW_1507**	**239.9**	**5/1/2019**	**271**	**Yes**	**22**	**222.5**	**8.651**	**0**	**None**	**No**	**0.001504**	**Param Inter 1 of 2**
Calcium, total (mg/L)	**MW_1509**	**239.9**	**5/1/2019**	**287**	**Yes**	**22**	**222.5**	**8.651**	**0**	**None**	**No**	**0.001504**	**Param Inter 1 of 2**
Chloride, total (mg/L)	**MW_1510**	**238**	**5/1/2019**	**325**	**Yes**	**22**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.003495**	**NP Inter (normality) 1 of 2**
Chloride, total (mg/L)	**MW_1505**	**238**	**5/1/2019**	**285**	**Yes**	**22**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.003495**	**NP Inter (normality) 1 of 2**
Chloride, total (mg/L)	**MW_1506**	**238**	**5/1/2019**	**331**	**Yes**	**22**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.003495**	**NP Inter (normality) 1 of 2**
Chloride, total (mg/L)	**MW_1507**	**238**	**5/1/2019**	**296**	**Yes**	**22**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.003495**	**NP Inter (normality) 1 of 2**
Chloride, total (mg/L)	**MW_1509**	**238**	**5/1/2019**	**328**	**Yes**	**22**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.003495**	**NP Inter (normality) 1 of 2**
pH, field (SU)	**MW_1509**	**8.18**	**5/1/2019**	**8.45**	**Yes**	**22**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.006991**	**NP Inter (normality) 1 of 2**
Total Dissolved Solids [TDS] (mg/L)	**MW_1510**	**1182**	**5/1/2019**	**1460**	**Yes**	**22**	**1012**	**84.17**	**0**	**None**	**No**	**0.001504**	**Param Inter 1 of 2**
Total Dissolved Solids [TDS] (mg/L)	**MW_1505**	**1182**	**5/1/2019**	**1580**	**Yes**	**22**	**1012**	**84.17**	**0**	**None**	**No**	**0.001504**	**Param Inter 1 of 2**
Total Dissolved Solids [TDS] (mg/L)	**MW_1506**	**1182**	**5/1/2019**	**1360**	**Yes**	**22**	**1012**	**84.17**	**0**	**None**	**No**	**0.001504**	**Param Inter 1 of 2**
Total Dissolved Solids [TDS] (mg/L)	**MW_1507**	**1182**	**5/1/2019**	**1270**	**Yes**	**22**	**1012**	**84.17**	**0**	**None**	**No**	**0.001504**	**Param Inter 1 of 2**
Total Dissolved Solids [TDS] (mg/L)	**MW_1509**	**1182**	**5/1/2019**	**1480**	**Yes**	**22**	**1012**	**84.17**	**0**	**None**	**No**	**0.001504**	**Param Inter 1 of 2**

Interwell Prediction Limit Summary - All Results

Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP   Printed 7/8/2019, 2:00 PM

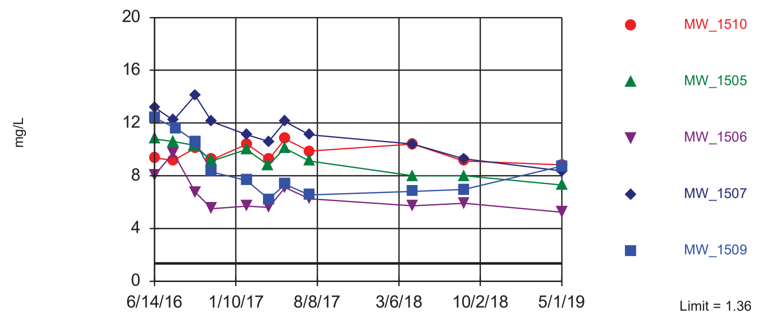
Constituent	Well	Upper Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Boron, total (mg/L)	**MW_1510**	**1.36**	**5/1/2019**	**8.83**	**Yes**	**22**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.003495**	**NP Inter (normality) 1 of 2**
Boron, total (mg/L)	**MW_1505**	**1.36**	**5/1/2019**	**7.31**	**Yes**	**22**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.003495**	**NP Inter (normality) 1 of 2**
Boron, total (mg/L)	**MW_1506**	**1.36**	**5/1/2019**	**5.24**	**Yes**	**22**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.003495**	**NP Inter (normality) 1 of 2**
Boron, total (mg/L)	**MW_1507**	**1.36**	**5/1/2019**	**8.36**	**Yes**	**22**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.003495**	**NP Inter (normality) 1 of 2**
Boron, total (mg/L)	**MW_1509**	**1.36**	**5/1/2019**	**8.73**	**Yes**	**22**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.003495**	**NP Inter (normality) 1 of 2**
Calcium, total (mg/L)	**MW_1510**	**239.9**	**5/1/2019**	**287**	**Yes**	**22**	**222.5**	**8.651**	**0**	**None**	**No**	**0.001504**	**Param Inter 1 of 2**
Calcium, total (mg/L)	**MW_1505**	**239.9**	**5/1/2019**	**287**	**Yes**	**22**	**222.5**	**8.651**	**0**	**None**	**No**	**0.001504**	**Param Inter 1 of 2**
Calcium, total (mg/L)	**MW_1506**	**239.9**	**5/1/2019**	**280**	**Yes**	**22**	**222.5**	**8.651**	**0**	**None**	**No**	**0.001504**	**Param Inter 1 of 2**
Calcium, total (mg/L)	**MW_1507**	**239.9**	**5/1/2019**	**271**	**Yes**	**22**	**222.5**	**8.651**	**0**	**None**	**No**	**0.001504**	**Param Inter 1 of 2**
Calcium, total (mg/L)	**MW_1509**	**239.9**	**5/1/2019**	**287**	**Yes**	**22**	**222.5**	**8.651**	**0**	**None**	**No**	**0.001504**	**Param Inter 1 of 2**
Chloride, total (mg/L)	**MW_1510**	**238**	**5/1/2019**	**325**	**Yes**	**22**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.003495**	**NP Inter (normality) 1 of 2**
Chloride, total (mg/L)	**MW_1505**	**238**	**5/1/2019**	**285**	**Yes**	**22**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.003495**	**NP Inter (normality) 1 of 2**
Chloride, total (mg/L)	**MW_1506**	**238**	**5/1/2019**	**331**	**Yes**	**22**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.003495**	**NP Inter (normality) 1 of 2**
Chloride, total (mg/L)	**MW_1507**	**238**	**5/1/2019**	**296**	**Yes**	**22**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.003495**	**NP Inter (normality) 1 of 2**
Chloride, total (mg/L)	**MW_1509**	**238**	**5/1/2019**	**328**	**Yes**	**22**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.003495**	**NP Inter (normality) 1 of 2**
pH, field (SU)	MW_1510	8.18	5/1/2019	8.11	No	22	n/a	n/a	0	n/a	n/a	0.006991	NP Inter (normality) 1 of 2
pH, field (SU)	MW_1505	8.18	4/30/2019	7.8	No	22	n/a	n/a	0	n/a	n/a	0.006991	NP Inter (normality) 1 of 2
pH, field (SU)	MW_1506	8.18	4/30/2019	7.87	No	22	n/a	n/a	0	n/a	n/a	0.006991	NP Inter (normality) 1 of 2
pH, field (SU)	MW_1507	8.18	4/30/2019	8.04	No	22	n/a	n/a	0	n/a	n/a	0.006991	NP Inter (normality) 1 of 2
pH, field (SU)	**MW_1509**	**8.18**	**5/1/2019**	**8.45**	**Yes**	**22**	**n/a**	**n/a**	**0**	**n/a**	**n/a**	**0.006991**	**NP Inter (normality) 1 of 2**
Total Dissolved Solids [TDS] (mg/L)	**MW_1510**	**1182**	**5/1/2019**	**1460**	**Yes**	**22**	**1012**	**84.17**	**0**	**None**	**No**	**0.001504**	**Param Inter 1 of 2**
Total Dissolved Solids [TDS] (mg/L)	**MW_1505**	**1182**	**5/1/2019**	**1580**	**Yes**	**22**	**1012**	**84.17**	**0**	**None**	**No**	**0.001504**	**Param Inter 1 of 2**
Total Dissolved Solids [TDS] (mg/L)	**MW_1506**	**1182**	**5/1/2019**	**1360**	**Yes**	**22**	**1012**	**84.17**	**0**	**None**	**No**	**0.001504**	**Param Inter 1 of 2**
Total Dissolved Solids [TDS] (mg/L)	**MW_1507**	**1182**	**5/1/2019**	**1270**	**Yes**	**22**	**1012**	**84.17**	**0**	**None**	**No**	**0.001504**	**Param Inter 1 of 2**
Total Dissolved Solids [TDS] (mg/L)	**MW_1509**	**1182**	**5/1/2019**	**1480**	**Yes**	**22**	**1012**	**84.17**	**0**	**None**	**No**	**0.001504**	**Param Inter 1 of 2**

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit: MW_1510, MW_1505, MW_1506, MW_1507, MW_1509

Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 22 background values. Annual per-constituent alpha = 0.03441. Individual comparison alpha = 0.003495 (1 of 2). Comparing 5 points to limit.

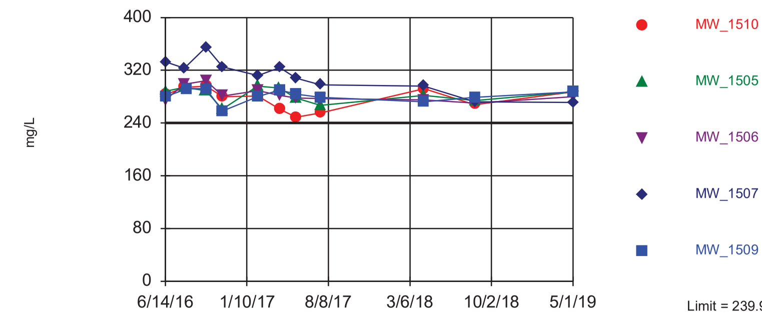
Constituent: Boron, total Analysis Run 7/8/2019 1:58 PM View: PLs - Interwell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit: MW_1510, MW_1505, MW_1506, MW_1507, MW_1509

Prediction Limit

Interwell Parametric



Background Data Summary: Mean=222.5, Std. Dev.=8.651, n=22. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9394, critical = 0.878. Kappa = 2.022 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.001504. Comparing 5 points to limit.

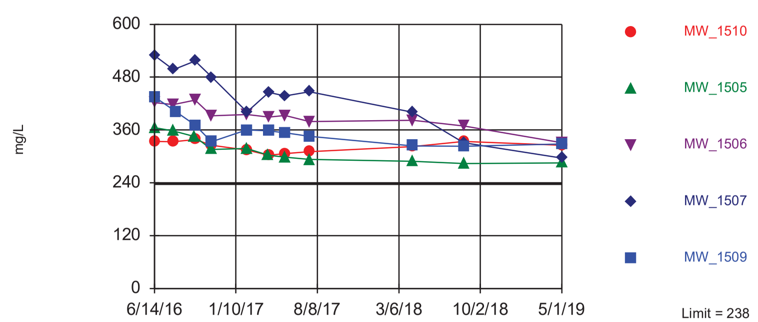
Constituent: Calcium, total Analysis Run 7/8/2019 1:58 PM View: PLs - Interwell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit: MW_1510, MW_1505, MW_1506, MW_1507, MW_1509

Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 22 background values. Annual per-constituent alpha = 0.03441. Individual comparison alpha = 0.003495 (1 of 2). Comparing 5 points to limit.

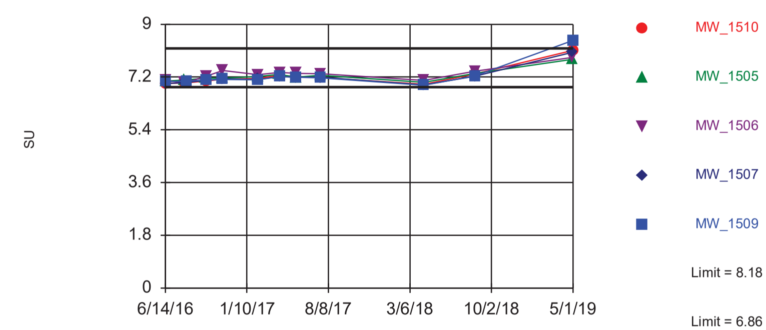
Constituent: Chloride, total Analysis Run 7/8/2019 1:58 PM View: PLs - Interwell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limits: MW_1509

Prediction Limit

Interwell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limits are highest and lowest of 22 background values. Annual per-constituent alpha = 0.06882. Individual comparison alpha = 0.006991 (1 of 2). Comparing 5 points to limit.

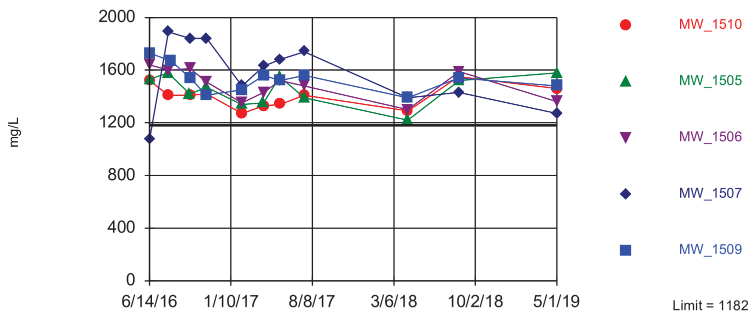
Constituent: pH, field Analysis Run 7/8/2019 1:58 PM View: PLs - Interwell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Exceeds Limit: MW_1510, MW_1505, MW_1506, MW_1507, MW_1509

Prediction Limit

Interwell Parametric



Background Data Summary: Mean=1012, Std. Dev.=84.17, n=22. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9516, critical = 0.878. Kappa = 2.022 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.007498. Individual comparison alpha = 0.001504. Comparing 5 points to limit.

Constituent: Total Dissolved Solids [TDS] Analysis Run 7/8/2019 1:58 PM View: PLs - Interwell

Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Intrawell Prediction Limit Summary - Significant Results

Mitchell BAP Client: Geosyntec Data: Mitchell BAP Printed 7/8/2019, 2:10 PM

Constituent	Well	Upper Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Sulfate, total (mg/L)	**MW_1510**	**399.1**	**5/1/2019**	**467**	**Yes**	**8**	**333.4**	**23.98**	**0**	**None**	**No**	**0.001504**	Param 1 of 2
Sulfate, total (mg/L)	**MW_1505**	**350.5**	**5/1/2019**	**408**	**Yes**	**8**	**321.6**	**10.56**	**0**	**None**	**No**	**0.001504**	Param 1 of 2
Sulfate, total (mg/L)	**MW_1506**	**345.4**	**5/1/2019**	**347**	**Yes**	**8**	**305.6**	**14.51**	**0**	**None**	**No**	**0.001504**	Param 1 of 2

Intrawell Prediction Limit Summary - All Results

Mitchell BAP Client: Geosyntec Data: Mitchell BAP Printed 7/8/2019, 2:10 PM

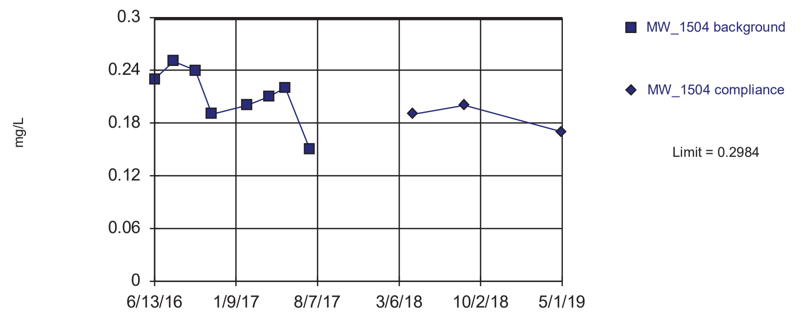
Constituent	Well	Upper Lim.	Date	Observ.	Sig.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Fluoride, total (mg/L)	MW_1504	0.2984	5/1/2019	0.17	No	8	0.2113	0.03182	0	None	No	0.001504	Param 1 of 2
Fluoride, total (mg/L)	MW_1508	0.125	5/1/2019	0.08	No	8	0.08375	0.01506	0	None	No	0.001504	Param 1 of 2
Fluoride, total (mg/L)	MW_1510	0.2	5/1/2019	0.1	No	8	n/a	n/a	25	n/a	n/a	0.02144	NP (normality) 1 of 2
Fluoride, total (mg/L)	MW_1505	0.2	5/1/2019	0.06ND	No	8	n/a	n/a	100	n/a	n/a	0.02144	NP (NDs) 1 of 2
Fluoride, total (mg/L)	MW_1506	0.2	5/1/2019	0.03	No	8	n/a	n/a	75	n/a	n/a	0.02144	NP (NDs) 1 of 2
Fluoride, total (mg/L)	MW_1507	0.2	5/1/2019	0.07	No	8	n/a	n/a	12.5	n/a	n/a	0.02144	NP (normality) 1 of 2
Fluoride, total (mg/L)	MW_1509	0.16	5/1/2019	0.13	No	8	n/a	n/a	0	n/a	n/a	0.02144	NP (normality) 1 of 2
Sulfate, total (mg/L)	MW_1504	468.9	5/1/2019	317	No	8	370.6	35.86	0	None	No	0.001504	Param 1 of 2
Sulfate, total (mg/L)	MW_1508	318.3	5/1/2019	287	No	8	301.8	6.042	0	None	No	0.001504	Param 1 of 2
Sulfate, total (mg/L)	**MW_1510**	**399.1**	**5/1/2019**	**467**	**Yes**	**8**	**333.4**	**23.98**	**0**	**None**	**No**	**0.001504**	Param 1 of 2
Sulfate, total (mg/L)	**MW_1505**	**350.5**	**5/1/2019**	**408**	**Yes**	**8**	**321.6**	**10.56**	**0**	**None**	**No**	**0.001504**	Param 1 of 2
Sulfate, total (mg/L)	**MW_1506**	**345.4**	**5/1/2019**	**347**	**Yes**	**8**	**305.6**	**14.51**	**0**	**None**	**No**	**0.001504**	Param 1 of 2
Sulfate, total (mg/L)	MW_1507	376.9	5/1/2019	346	No	8	316.3	22.13	0	None	No	0.001504	Param 1 of 2
Sulfate, total (mg/L)	MW_1509	449.9	5/1/2019	429	No	8	407	15.64	0	None	No	0.001504	Param 1 of 2

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=0.2113, Std. Dev.=0.03182, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9517, critical = 0.749. Kappa = 2.74 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

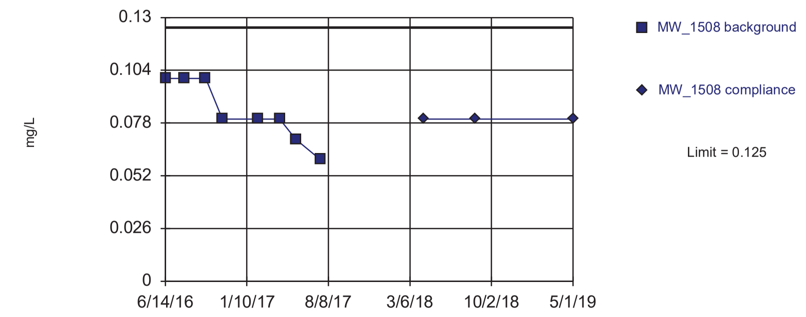
Constituent: Fluoride, total Analysis Run 7/8/2019 2:08 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=0.08375, Std. Dev.=0.01506, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8711, critical = 0.749. Kappa = 2.74 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

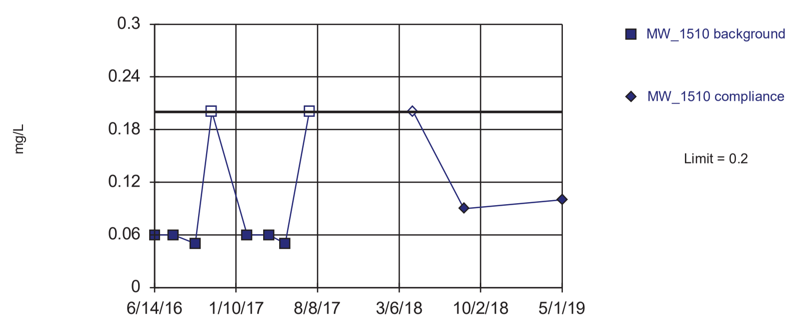
Constituent: Fluoride, total Analysis Run 7/8/2019 2:08 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 8 background values. 25% NDs. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

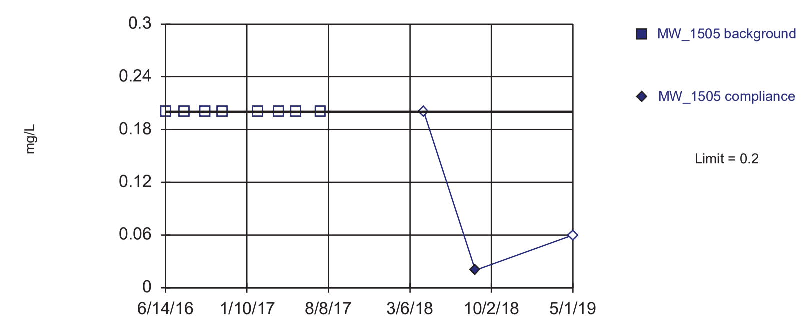
Constituent: Fluoride, total Analysis Run 7/8/2019 2:08 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. All background values (n = 8) were censored; limit is most recent reporting limit. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

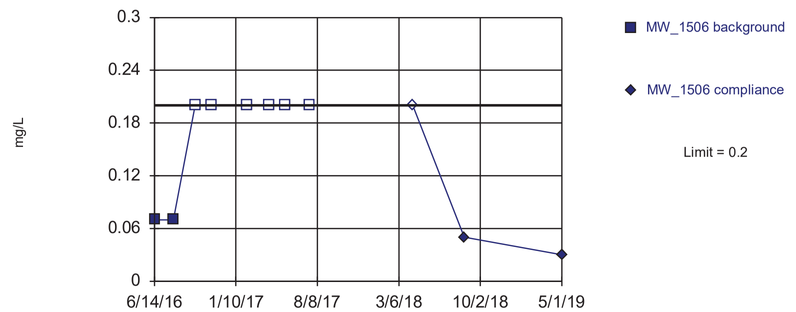
Constituent: Fluoride, total Analysis Run 7/8/2019 2:08 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because censored data exceeded 50%. Limit is highest of 8 background values. 75% NDs. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

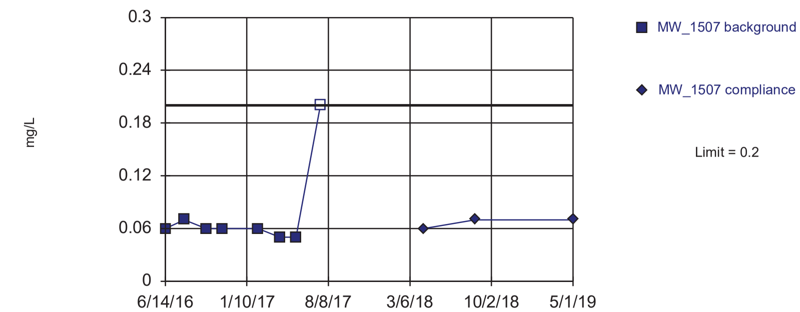
Constituent: Fluoride, total Analysis Run 7/8/2019 2:08 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG
Hollow symbols indicate censored values.

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 8 background values. 12.5% NDs. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

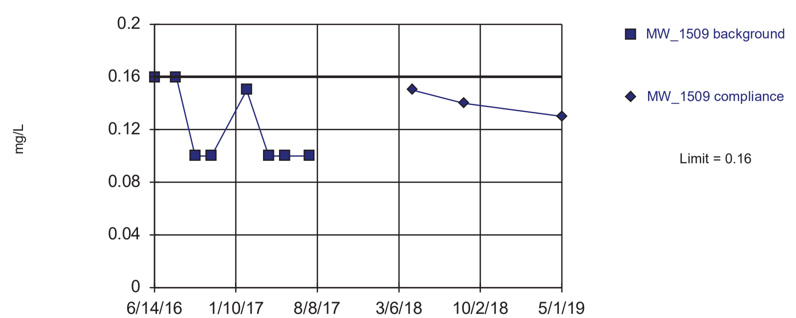
Constituent: Fluoride, total Analysis Run 7/8/2019 2:08 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Non-parametric



Non-parametric test used in lieu of parametric prediction limit because the Shapiro Wilk normality test showed the data to be non-normal at the 0.01 alpha level. Limit is highest of 8 background values. Well-constituent pair annual alpha = 0.04242. Individual comparison alpha = 0.02144 (1 of 2).

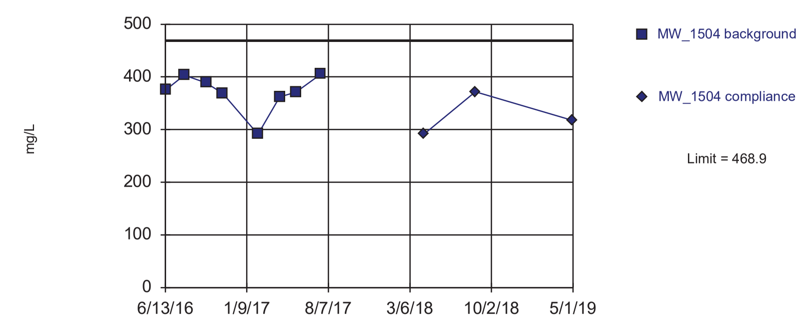
Constituent: Fluoride, total Analysis Run 7/8/2019 2:08 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Within Limit

Prediction Limit

Intrawell Parametric



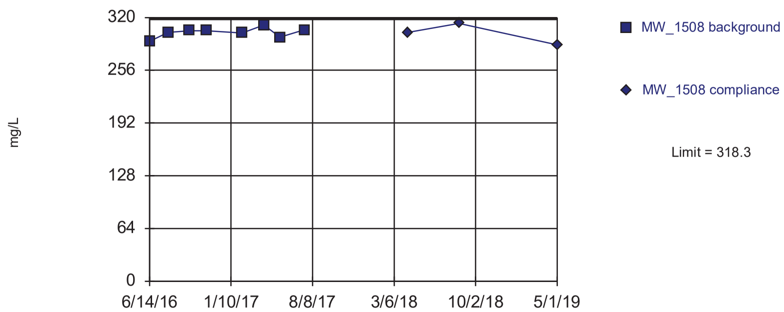
Background Data Summary: Mean=370.6, Std. Dev.=35.86, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8152, critical = 0.749. Kappa = 2.74 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

Constituent: Sulfate, total Analysis Run 7/8/2019 2:08 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Within Limit

Prediction Limit

Intrawell Parametric



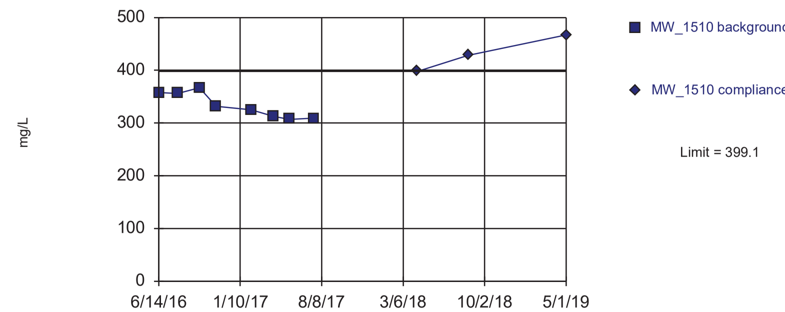
Background Data Summary: Mean=301.8, Std. Dev.=6.042, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9509, critical = 0.749. Kappa = 2.74 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

Constituent: Sulfate, total Analysis Run 7/8/2019 2:08 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Exceeds Limit

Prediction Limit

Intrawell Parametric



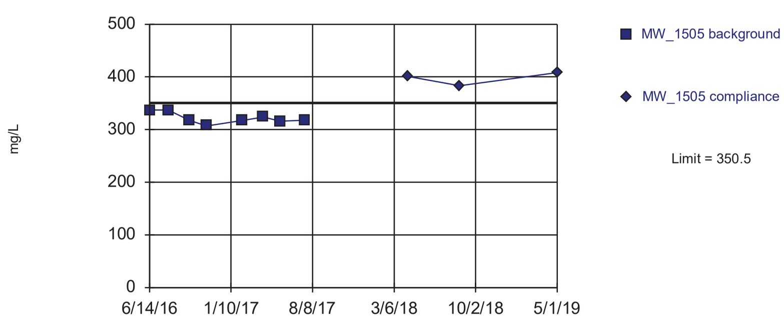
Background Data Summary: Mean=333.4, Std. Dev.=23.98, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8854, critical = 0.749. Kappa = 2.74 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

Constituent: Sulfate, total Analysis Run 7/8/2019 2:08 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Exceeds Limit

Prediction Limit

Intrawell Parametric



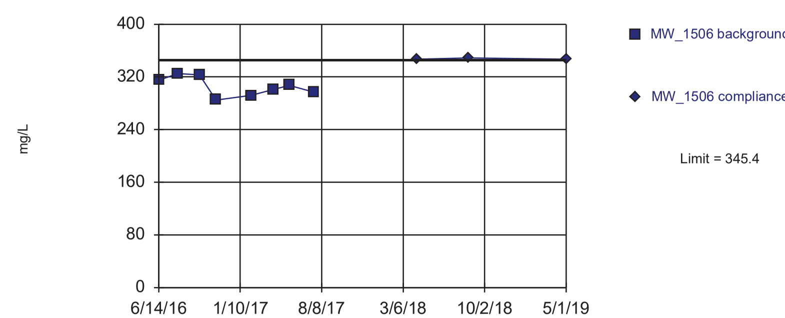
Background Data Summary: Mean=321.6, Std. Dev.=10.56, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.8719, critical = 0.749. Kappa = 2.74 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

Constituent: Sulfate, total Analysis Run 7/8/2019 2:08 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Exceeds Limit

Prediction Limit

Intrawell Parametric



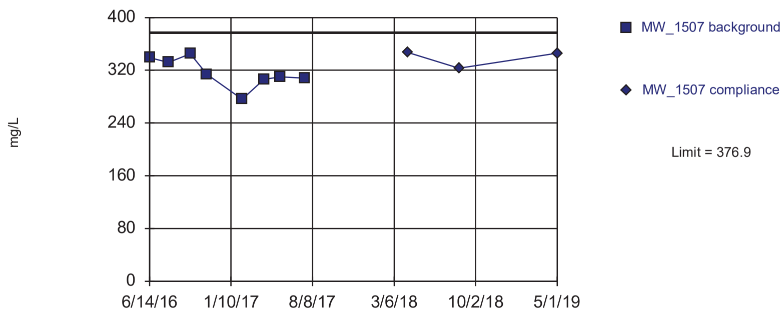
Background Data Summary: Mean=305.6, Std. Dev.=14.51, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9536, critical = 0.749. Kappa = 2.74 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

Constituent: Sulfate, total Analysis Run 7/8/2019 2:08 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Within Limit

Prediction Limit

Intrawell Parametric



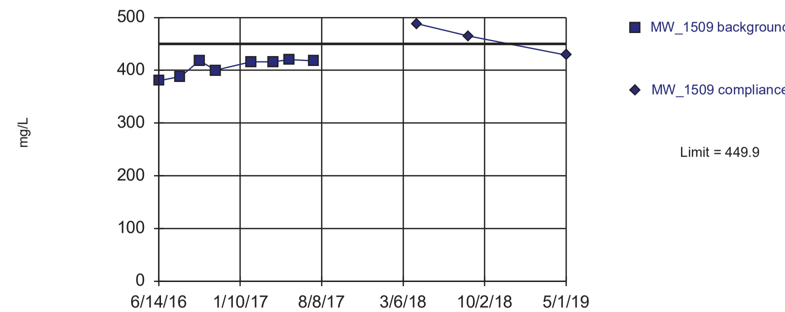
Background Data Summary: Mean=316.3, Std. Dev.=22.13, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.9344, critical = 0.749. Kappa = 2.74 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

Constituent: Sulfate, total Analysis Run 7/8/2019 2:08 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Within Limit

Prediction Limit

Intrawell Parametric



Background Data Summary: Mean=407, Std. Dev.=15.64, n=8. Normality test: Shapiro Wilk @alpha = 0.01, calculated = 0.7926, critical = 0.749. Kappa = 2.74 (c=7, w=5, 1 of 2, event alpha = 0.05132). Report alpha = 0.001504.

Constituent: Sulfate, total Analysis Run 7/8/2019 2:08 PM View: PLs - Intrawell
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Trend Test Summary Table - Significant Results

Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP   Printed 7/8/2019, 2:27 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron, total (mg/L)	**MW_1505**	**-1.212**	**-42**	**-34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Boron, total (mg/L)	**MW_1507**	**-1.578**	**-43**	**-34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Calcium, total (mg/L)	**MW_1507**	**-25.59**	**-45**	**-34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	**MW_1508 (bg)**	**-18.83**	**-37**	**-34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	**MW_1505**	**-34.76**	**-51**	**-34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	**MW_1506**	**-29.93**	**-43**	**-34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	**MW_1507**	**-76.12**	**-43**	**-34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	**MW_1509**	**-30.58**	**-43**	**-34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
pH, field (SU)	**MW_1504 (bg)**	**0.1866**	**36**	**34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**

Trend Test Summary Table - All Results

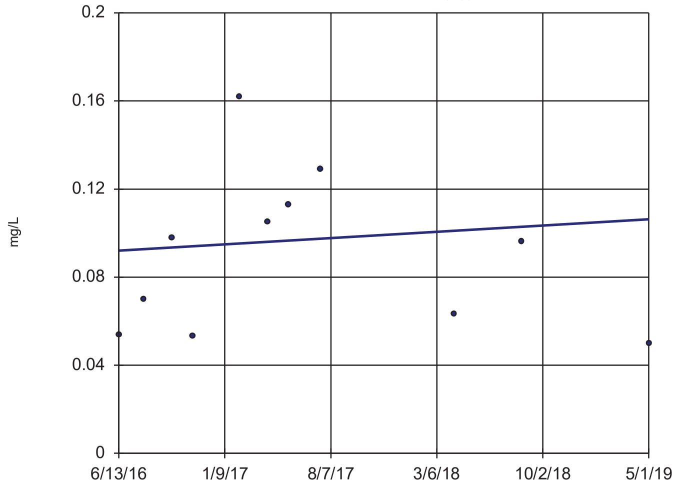
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP   Printed 7/8/2019, 2:27 PM

Constituent	Well	Slope	Calc.	Critical	Sig.	N	%NDs	Normality	Xform	Alpha	Method
Boron, total (mg/L)	MW_1504 (bg)	0.004925	1	34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW_1508 (bg)	-0.02475	-1	-34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	MW_1510	-0.05054	-4	-34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	**MW_1505**	**-1.212**	**-42**	**-34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Boron, total (mg/L)	MW_1506	-0.717	-21	-34	No	11	0	n/a	n/a	0.01	NP
Boron, total (mg/L)	**MW_1507**	**-1.578**	**-43**	**-34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Boron, total (mg/L)	MW_1509	-2.466	-27	-34	No	11	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW_1504 (bg)	0	4	34	No	11	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW_1508 (bg)	2.104	12	34	No	11	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW_1510	-6.738	-13	-34	No	11	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW_1505	-3.288	-13	-34	No	11	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	MW_1506	-6.32	-24	-34	No	11	0	n/a	n/a	0.01	NP
Calcium, total (mg/L)	**MW_1507**	**-25.59**	**-45**	**-34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Calcium, total (mg/L)	MW_1509	-1.834	-12	-34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	MW_1504 (bg)	-6.002	-24	-34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	**MW_1508 (bg)**	**-18.83**	**-37**	**-34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	MW_1510	-5.016	-11	-34	No	11	0	n/a	n/a	0.01	NP
Chloride, total (mg/L)	**MW_1505**	**-34.76**	**-51**	**-34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	**MW_1506**	**-29.93**	**-43**	**-34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	**MW_1507**	**-76.12**	**-43**	**-34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
Chloride, total (mg/L)	**MW_1509**	**-30.58**	**-43**	**-34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
pH, field (SU)	**MW_1504 (bg)**	**0.1866**	**36**	**34**	**Yes**	**11**	**0**	**n/a**	**n/a**	**0.01**	**NP**
pH, field (SU)	MW_1508 (bg)	0.1505	25	34	No	11	0	n/a	n/a	0.01	NP
pH, field (SU)	MW_1509	0.1304	31	34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW_1504 (bg)	-17.38	-14	-34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW_1508 (bg)	1.448	7	34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW_1510	21.89	5	34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW_1505	21.01	17	34	No	11	0	n/a	n/a	0.01	NP
Sulfate, total (mg/L)	MW_1506	13.67	16	34	No	11	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW_1504 (bg)	-16.52	-13	-34	No	11	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW_1508 (bg)	-19.31	-11	-34	No	11	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW_1510	0	0	34	No	11	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW_1505	-23.65	-4	-34	No	11	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW_1506	-101.4	-25	-34	No	11	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW_1507	-184.3	-20	-34	No	11	0	n/a	n/a	0.01	NP
Total Dissolved Solids [TDS] (mg/L)	MW_1509	-51.17	-19	-34	No	11	0	n/a	n/a	0.01	NP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1504 (bg)



n = 11

Slope = 0.004925 units per year.

Mann-Kendall statistic = 1 critical = 34

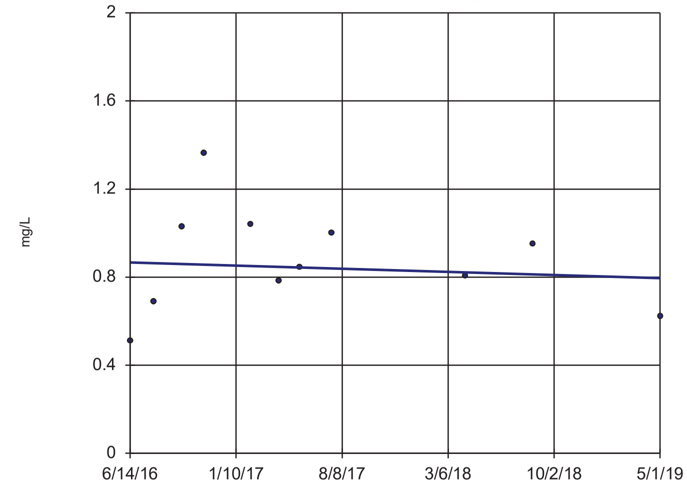
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 7/8/2019 2:26 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1508 (bg)



n = 11

Slope = -0.02475 units per year.

Mann-Kendall statistic = -1 critical = -34

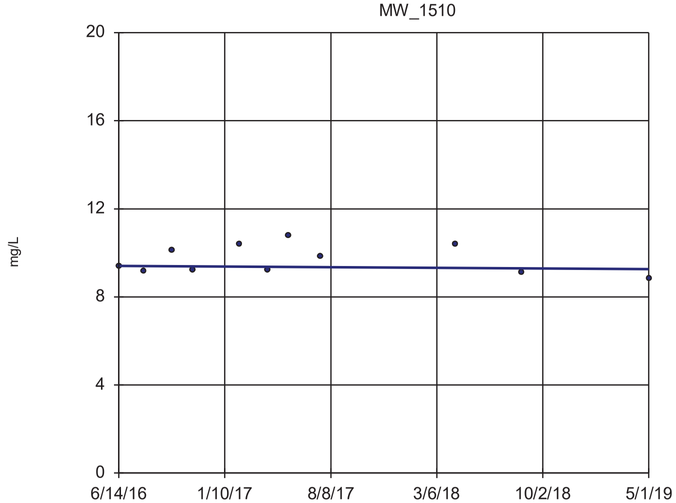
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 7/8/2019 2:26 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1510



n = 11

Slope = -0.05054 units per year.

Mann-Kendall statistic = -4 critical = -34

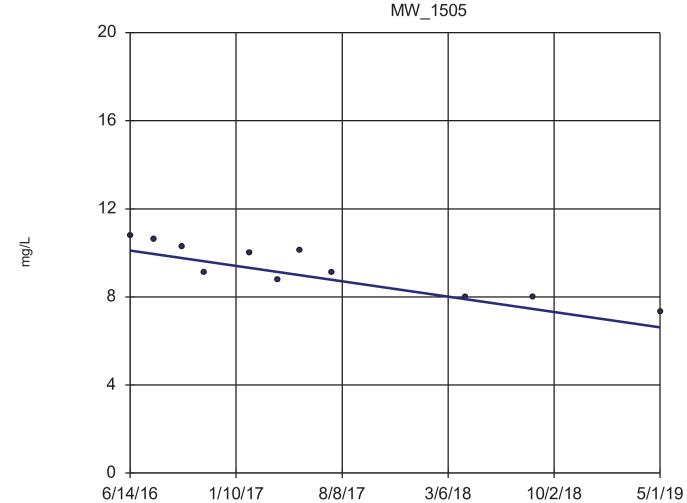
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 7/8/2019 2:26 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1505



n = 11

Slope = -1.212 units per year.

Mann-Kendall statistic = -42 critical = -34

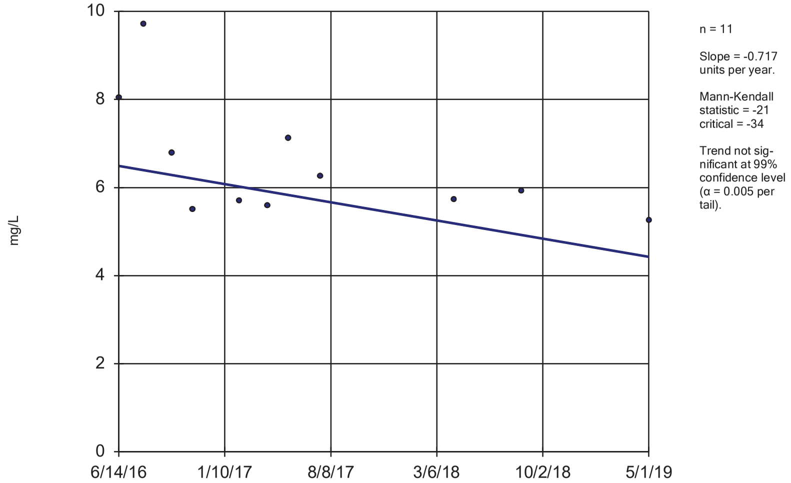
Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Boron, total Analysis Run 7/8/2019 2:26 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1506



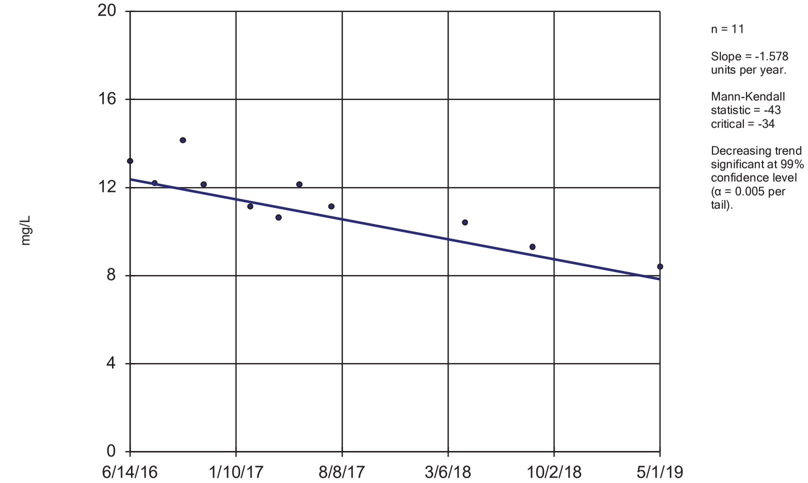
Constituent: Boron, total   Analysis Run 7/8/2019 2:26 PM   View: Trend Testing

Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1507



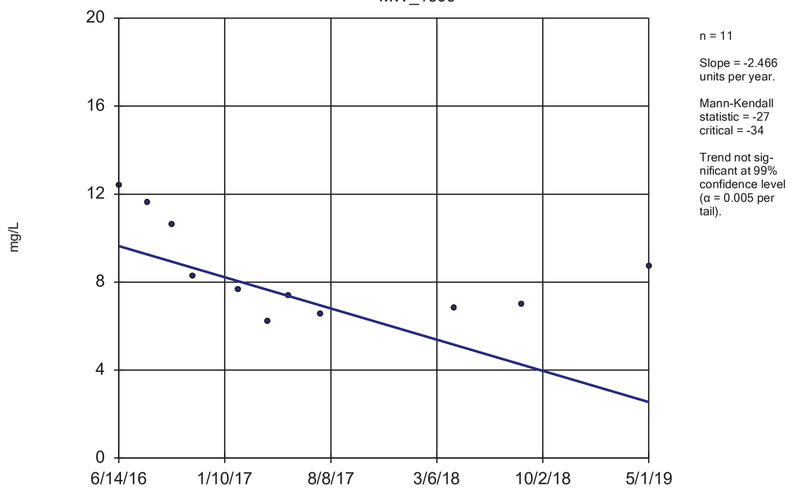
Constituent: Boron, total   Analysis Run 7/8/2019 2:26 PM   View: Trend Testing

Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1509



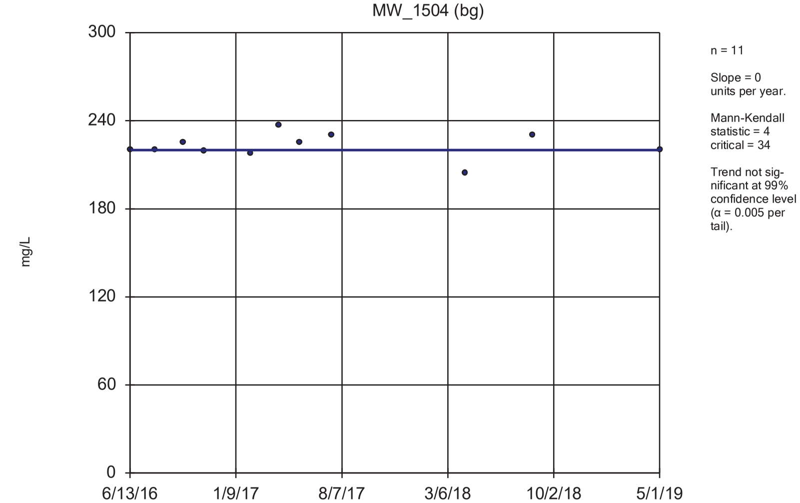
Constituent: Boron, total   Analysis Run 7/8/2019 2:26 PM   View: Trend Testing

Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1504 (bg)



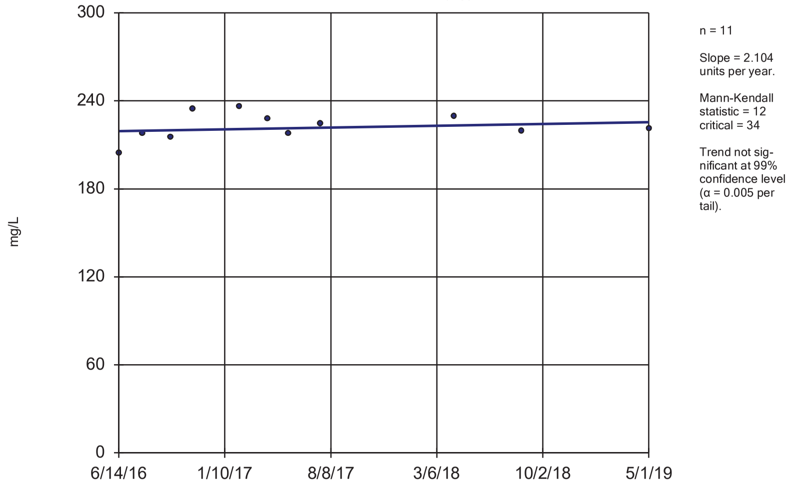
Constituent: Calcium, total   Analysis Run 7/8/2019 2:26 PM   View: Trend Testing

Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1508 (bg)

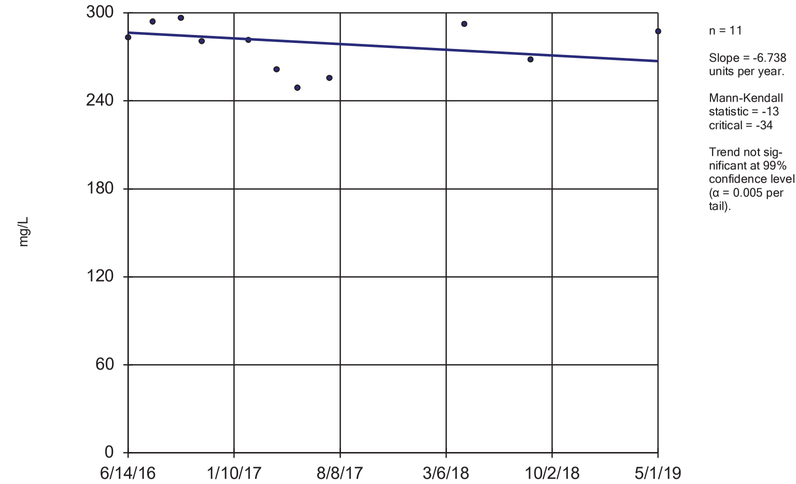


Constituent: Calcium, total Analysis Run 7/8/2019 2:26 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1510

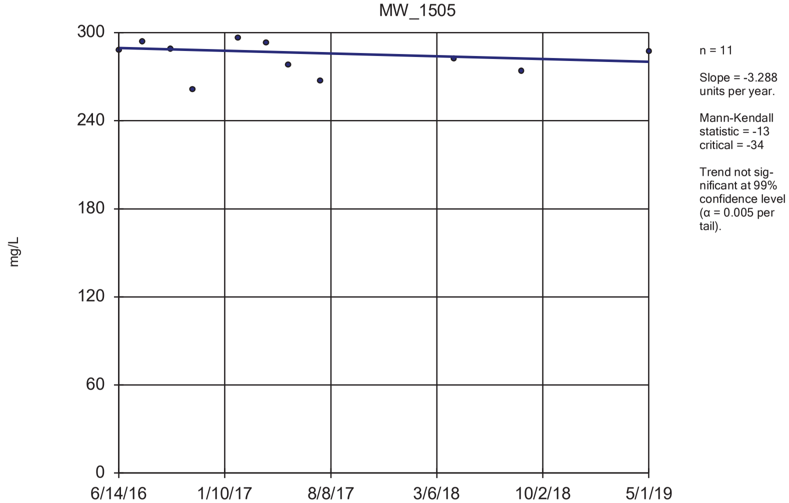


Constituent: Calcium, total Analysis Run 7/8/2019 2:26 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1505

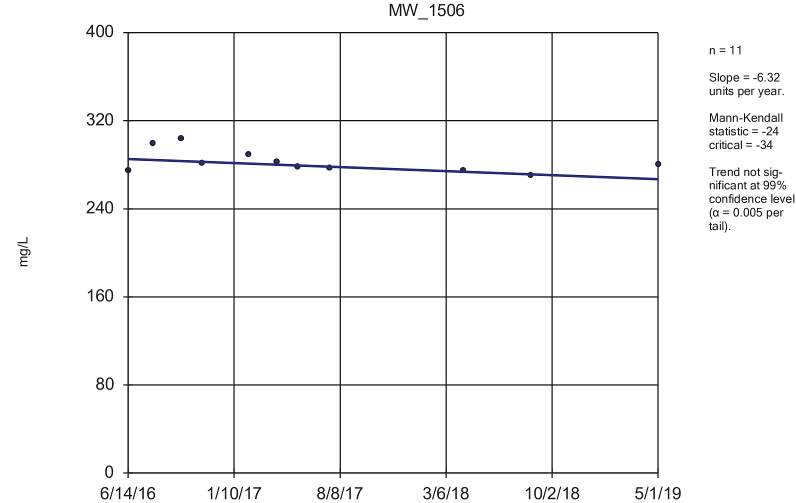


Constituent: Calcium, total Analysis Run 7/8/2019 2:26 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1506

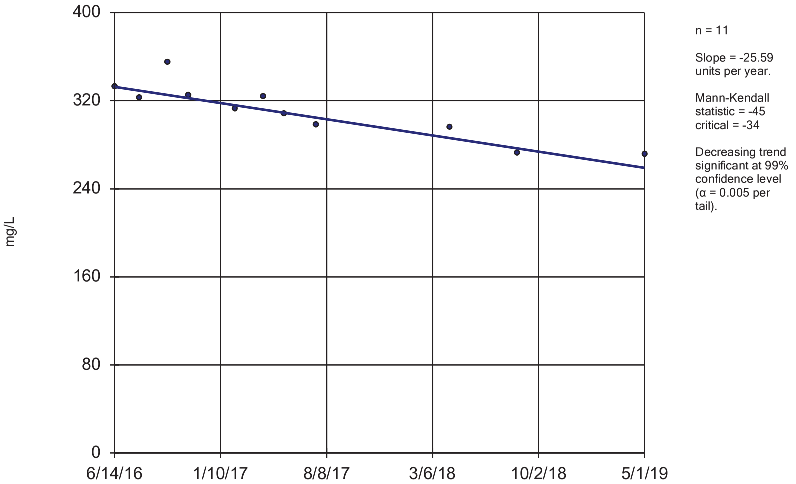


Constituent: Calcium, total Analysis Run 7/8/2019 2:26 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1507

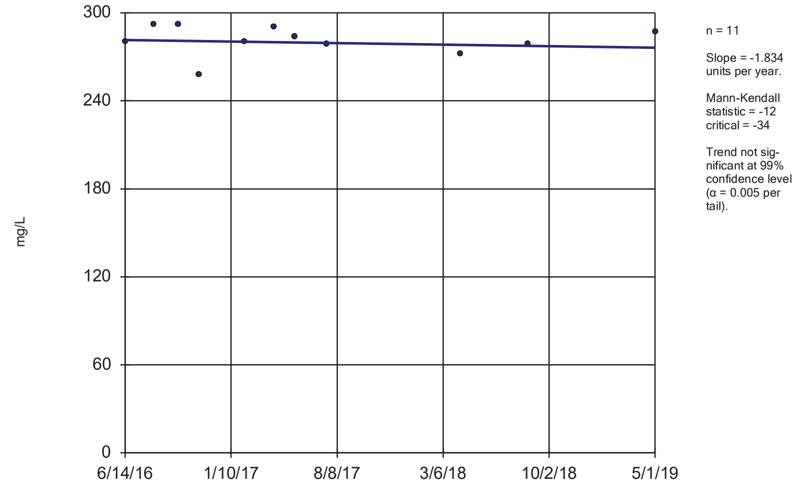


Constituent: Calcium, total Analysis Run 7/8/2019 2:26 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1509

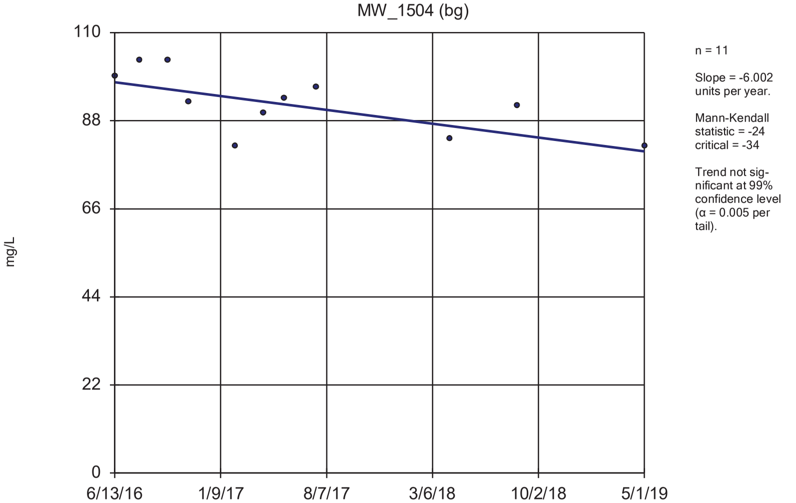


Constituent: Calcium, total Analysis Run 7/8/2019 2:26 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1504 (bg)

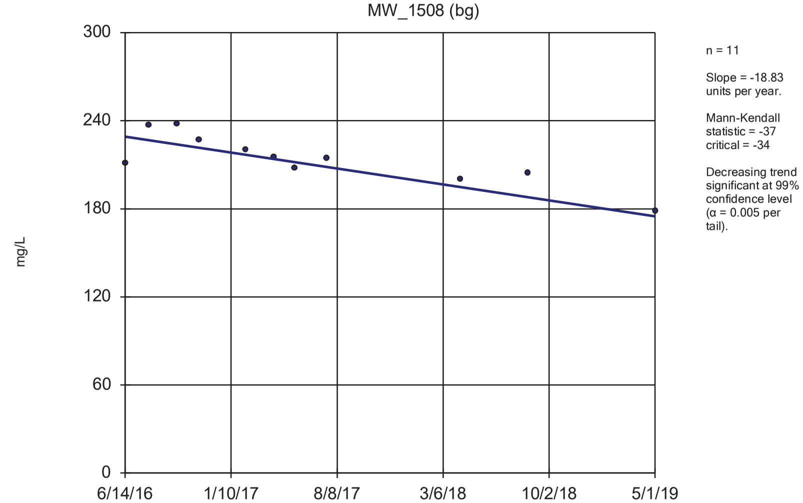


Constituent: Chloride, total Analysis Run 7/8/2019 2:26 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1508 (bg)

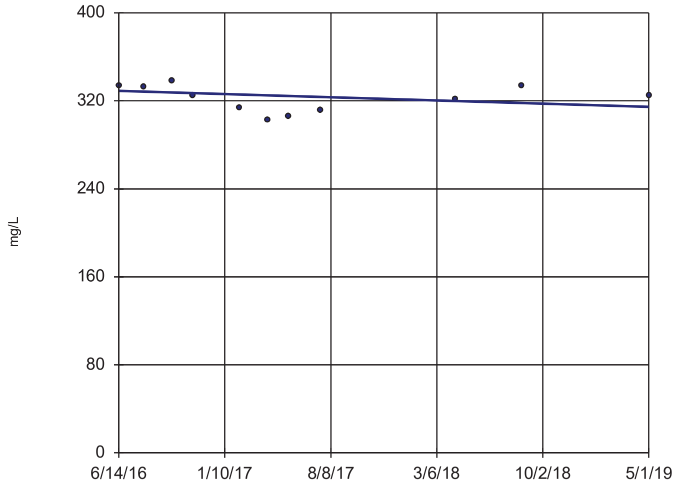


Constituent: Chloride, total Analysis Run 7/8/2019 2:26 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1510



n = 11

Slope = -5.016 units per year.

Mann-Kendall statistic = -11 critical = -34

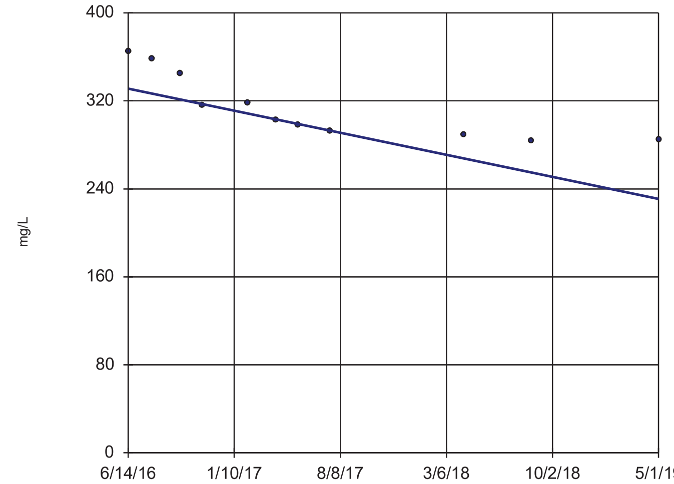
Trend not significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 7/8/2019 2:26 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1505



n = 11

Slope = -34.76 units per year.

Mann-Kendall statistic = -51 critical = -34

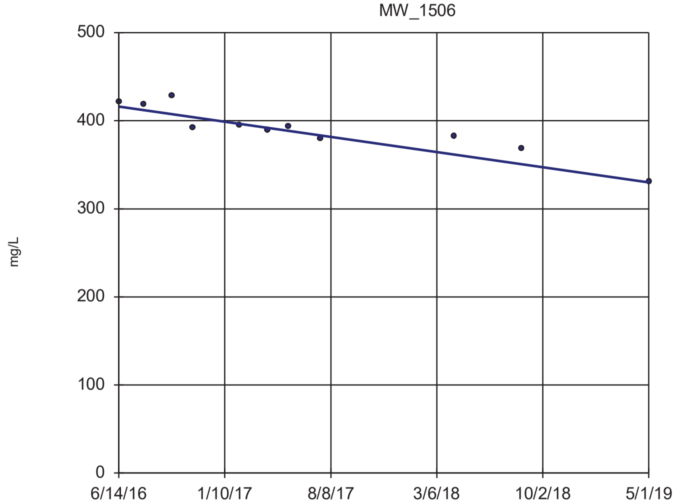
Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 7/8/2019 2:26 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1506



n = 11

Slope = -29.93 units per year.

Mann-Kendall statistic = -43 critical = -34

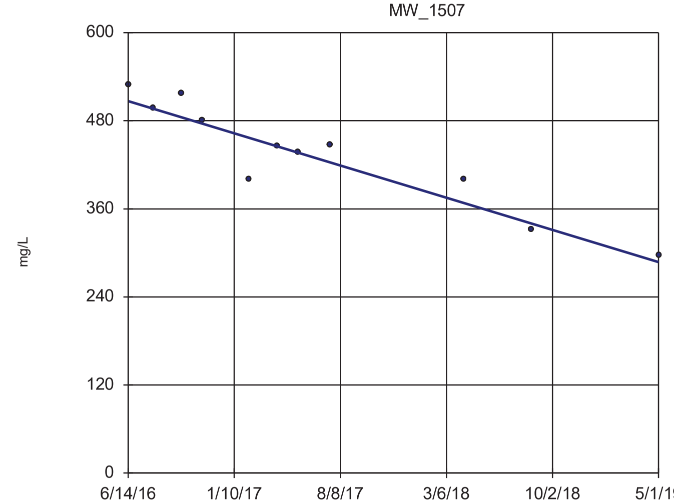
Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 7/8/2019 2:26 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1507



n = 11

Slope = -76.12 units per year.

Mann-Kendall statistic = -43 critical = -34

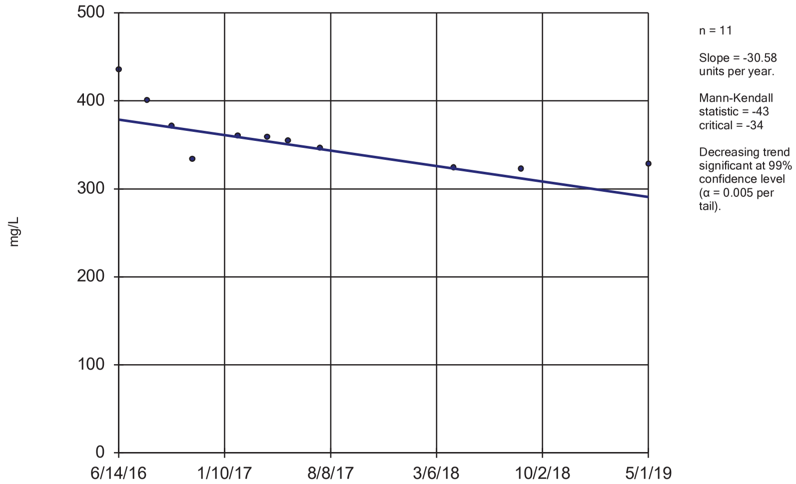
Decreasing trend significant at 99% confidence level (α = 0.005 per tail).

Constituent: Chloride, total Analysis Run 7/8/2019 2:26 PM View: Trend Testing
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1509

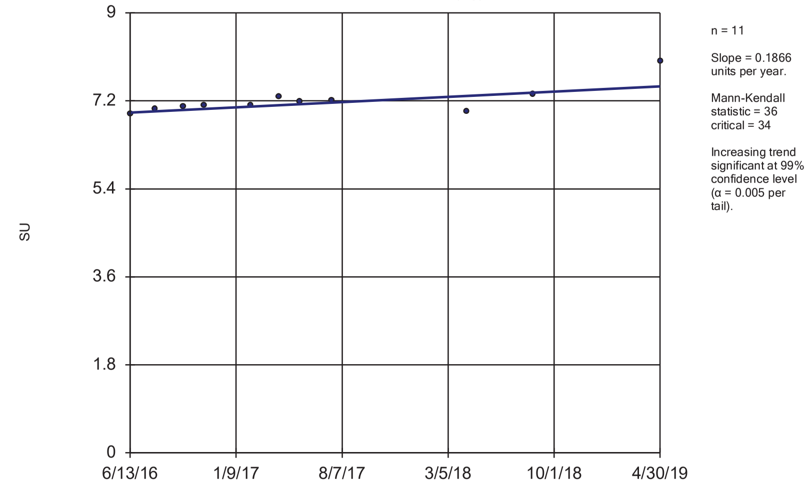


Constituent: Chloride, total   Analysis Run 7/8/2019 2:26 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1504 (bg)

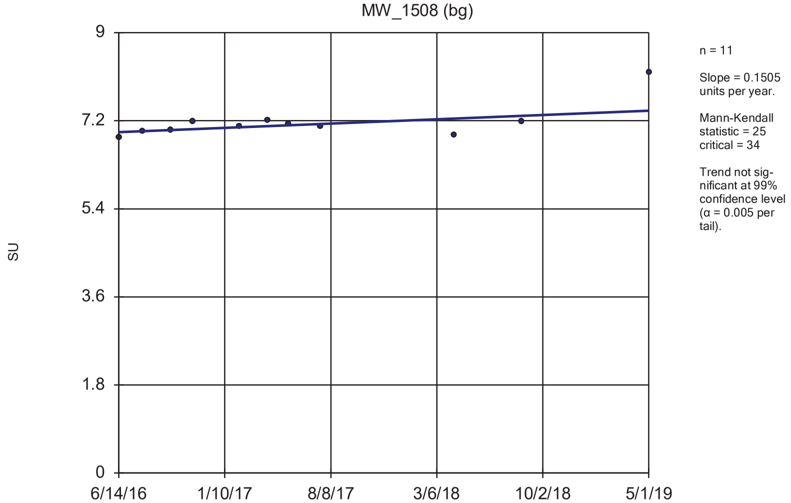


Constituent: pH, field   Analysis Run 7/8/2019 2:26 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1508 (bg)

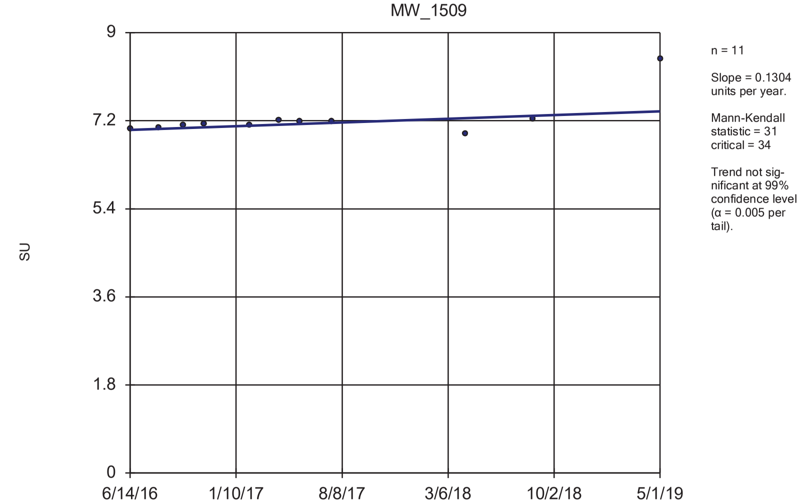


Constituent: pH, field   Analysis Run 7/8/2019 2:26 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

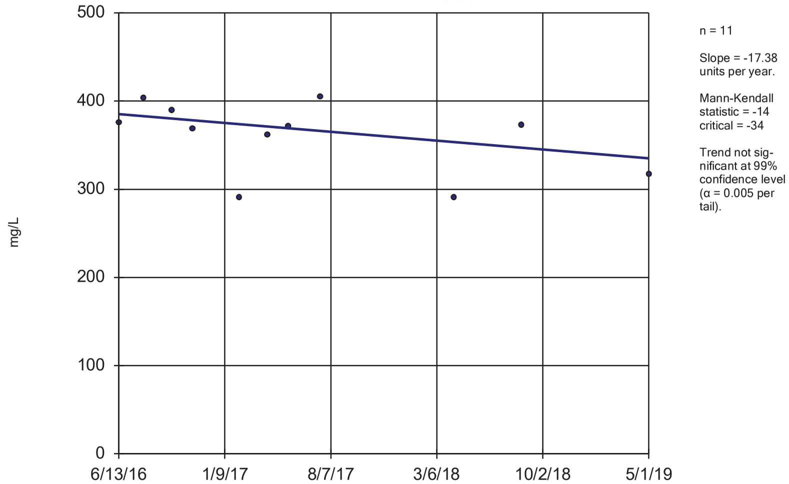
MW_1509



Constituent: pH, field   Analysis Run 7/8/2019 2:26 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sen's Slope Estimator

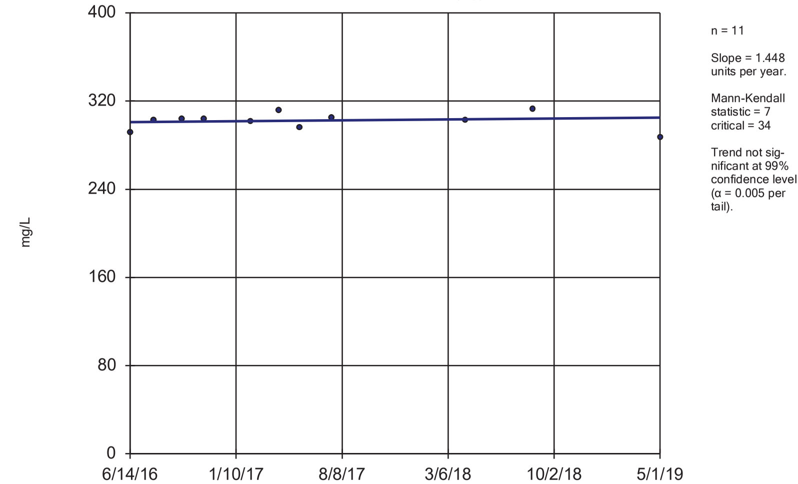
MW_1504 (bg)



Constituent: Sulfate, total   Analysis Run 7/8/2019 2:26 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sen's Slope Estimator

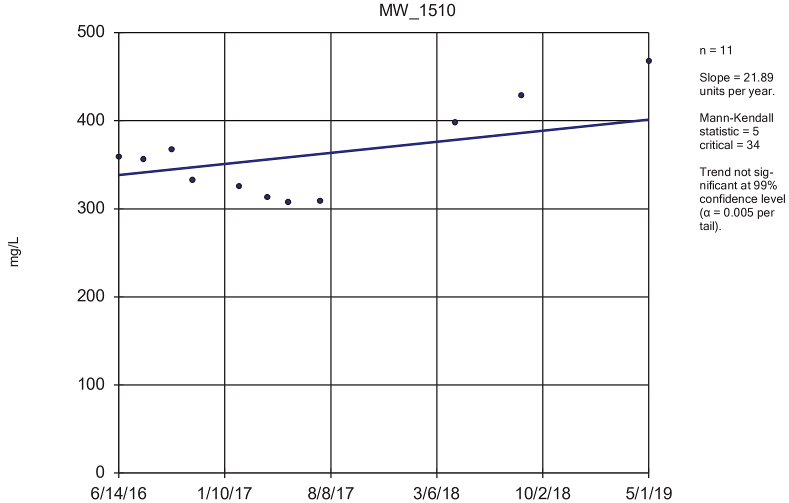
MW_1508 (bg)



Constituent: Sulfate, total   Analysis Run 7/8/2019 2:26 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sen's Slope Estimator

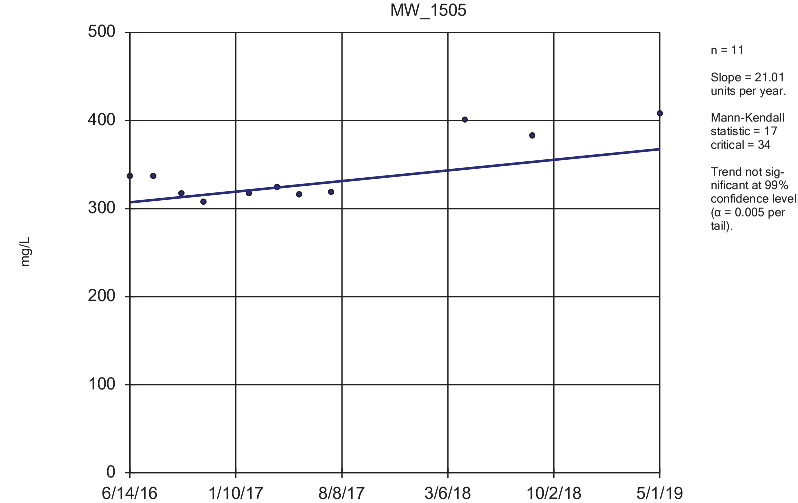
MW_1510



Constituent: Sulfate, total   Analysis Run 7/8/2019 2:26 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sen's Slope Estimator

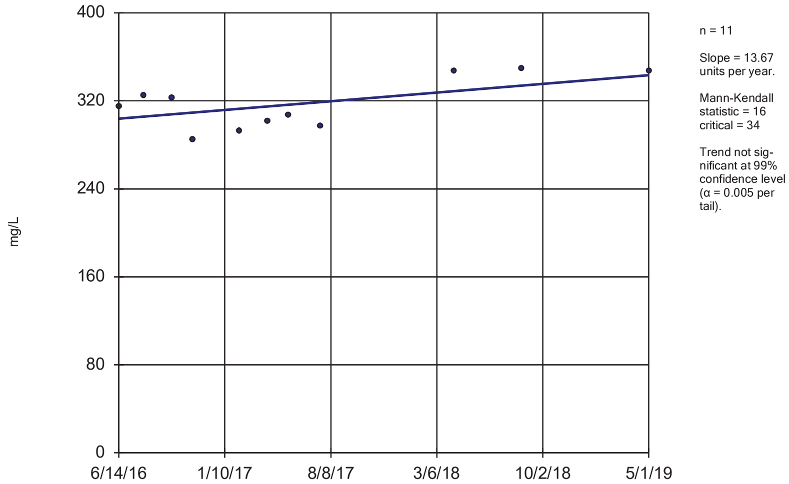
MW_1505



Constituent: Sulfate, total   Analysis Run 7/8/2019 2:26 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sen's Slope Estimator

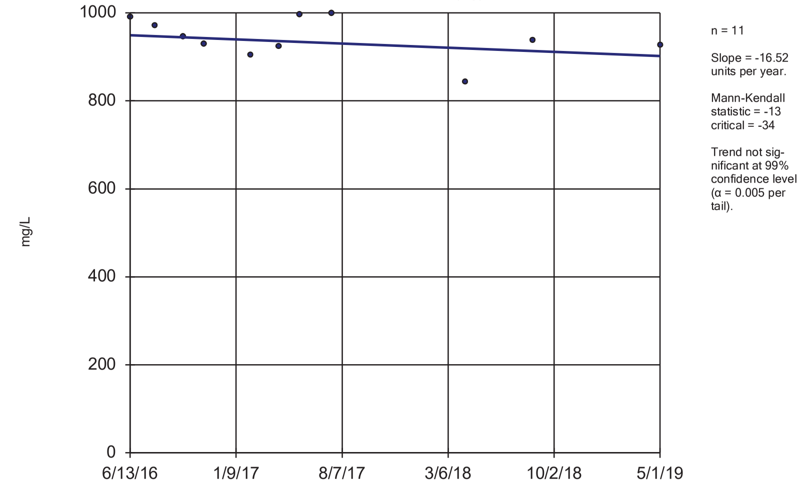
MW_1506



Constituent: Sulfate, total   Analysis Run 7/8/2019 2:26 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sen's Slope Estimator

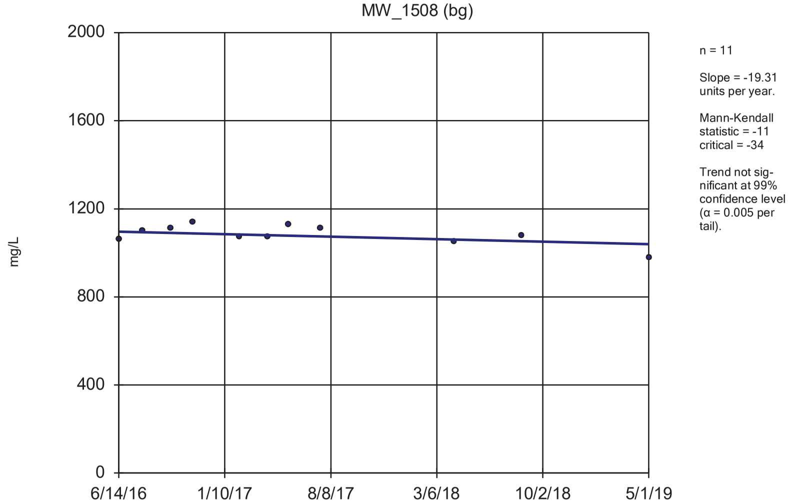
MW_1504 (bg)



Constituent: Total Dissolved Solids [TDS]   Analysis Run 7/8/2019 2:26 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sen's Slope Estimator

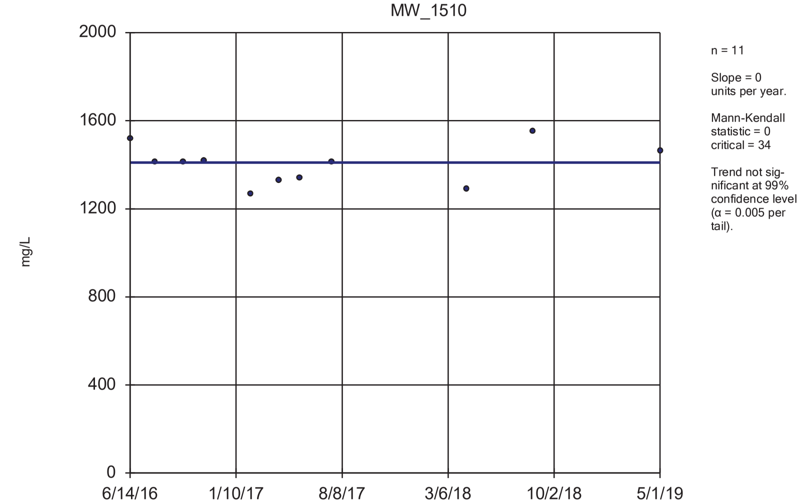
MW_1508 (bg)



Constituent: Total Dissolved Solids [TDS]   Analysis Run 7/8/2019 2:26 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sen's Slope Estimator

MW_1510

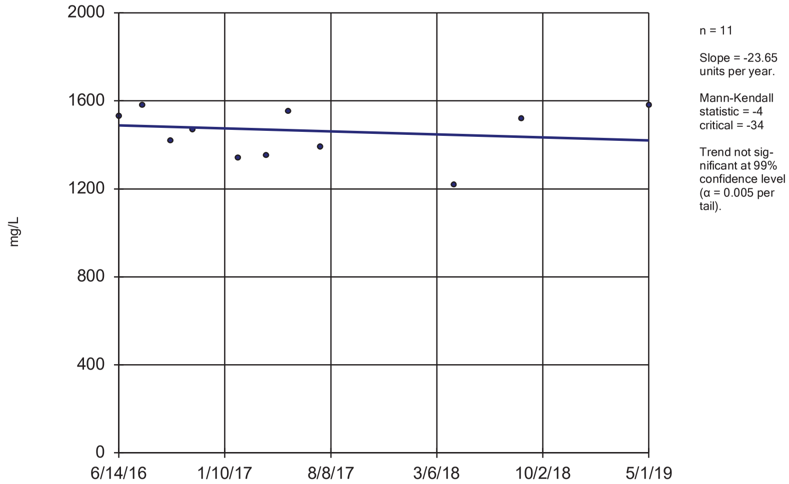


Constituent: Total Dissolved Solids [TDS]   Analysis Run 7/8/2019 2:26 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1505

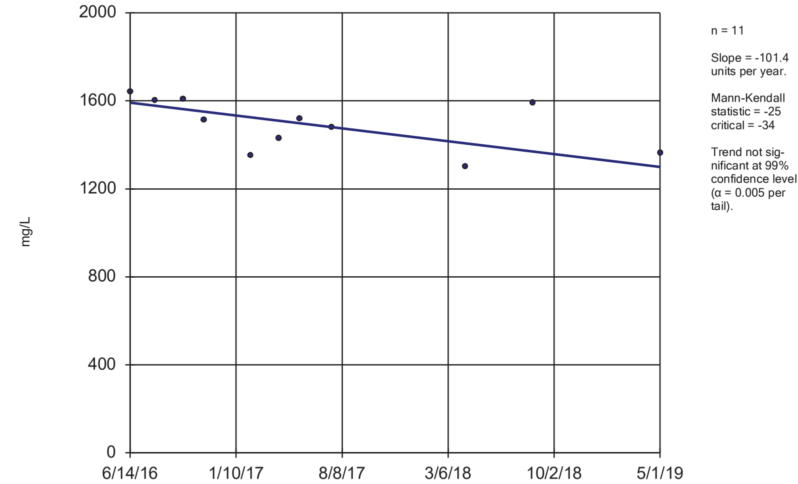


Constituent: Total Dissolved Solids [TDS]   Analysis Run 7/8/2019 2:26 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1506

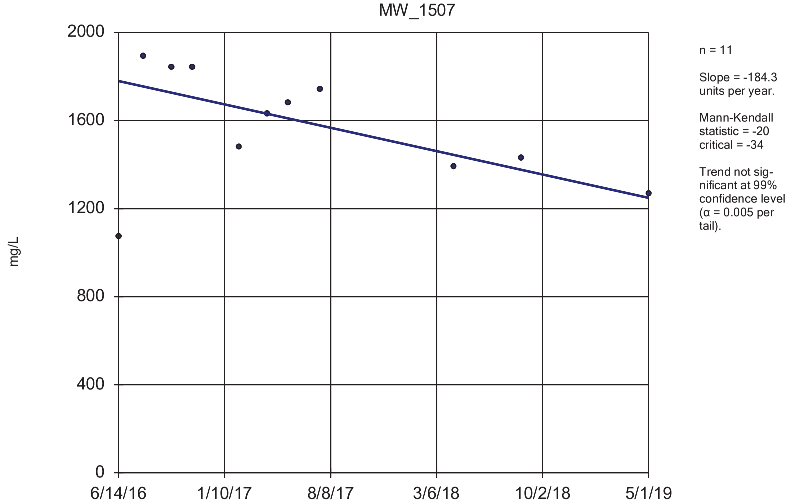


Constituent: Total Dissolved Solids [TDS]   Analysis Run 7/8/2019 2:26 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1507

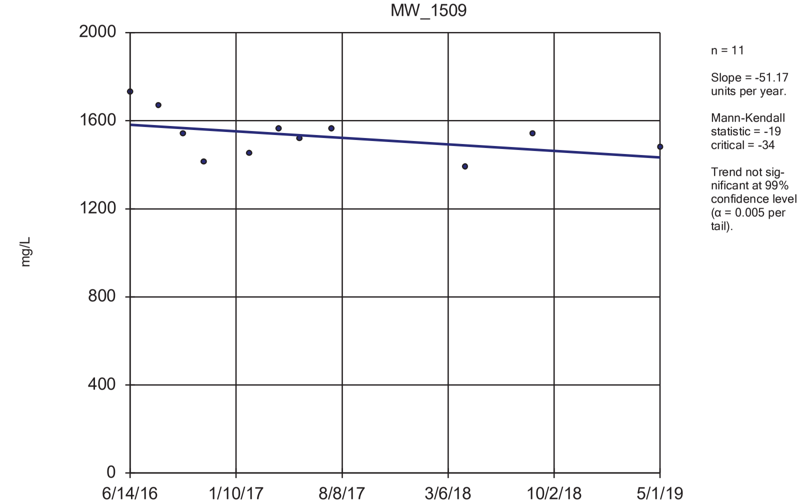


Constituent: Total Dissolved Solids [TDS]   Analysis Run 7/8/2019 2:26 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.18 Sanitas software utilized by Groundwater Stats Consulting. UG

Sen's Slope Estimator

MW_1509



Constituent: Total Dissolved Solids [TDS]   Analysis Run 7/8/2019 2:26 PM   View: Trend Testing
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Tolerance Limit Summary Table

Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP   Printed 7/10/2019, 9:44 AM

Constituent	Well	Upper Lim.	Bg N	Bg Mean	Std. Dev.	%NDs	ND Adj.	Transform	Alpha	Method
Antimony, total (mg/L)	n/a	0.00006792	22	0.00003682	0.00001323	9.091	None	No	0.05	Inter
Arsenic, Total (mg/L)	n/a	0.001688	22	0.0007277	0.0004088	0	None	No	0.05	Inter
Barium, Total (mg/L)	n/a	0.05689	22	0.04265	0.006063	0	None	No	0.05	Inter
Beryllium, total (mg/L)	n/a	0.0001	22	n/a	n/a	36.36	n/a	n/a	0.3235	NP Inter(normality)
Cadmium, total (mg/L)	n/a	0.00009	22	n/a	n/a	0	n/a	n/a	0.3235	NP Inter(normality)
Chromium, total (mg/L)	n/a	0.002247	22	0.0008482	0.0005951	0	None	No	0.05	Inter
Cobalt, total (mg/L)	n/a	0.003646	22	0.02767	0.01392	0	None	sqrt(x)	0.05	Inter
Combined Radium 226 + 228 (pCi/L)	n/a	2.259	21	0.7496	0.3178	0	None	sqrt(x)	0.05	Inter
Fluoride, total (mg/L)	n/a	0.25	22	n/a	n/a	0	n/a	n/a	0.3235	NP Inter(normality)
Lead, total (mg/L)	n/a	0.004213	22	0.07295	0.03769	0	None	x^(1/3)	0.05	Inter
Lithium, total (mg/L)	n/a	0.0193	22	0.16	0.04606	18.18	Kaplan-Meier	x^(1/3)	0.05	Inter
Mercury, total (mg/L)	n/a	0.000008	22	n/a	n/a	68.18	n/a	n/a	0.3235	NP Inter(normality)
Molybdenum, total (mg/L)	n/a	0.001885	22	0.02673	0.007099	9.091	None	sqrt(x)	0.05	Inter
Selenium, Total (mg/L)	n/a	0.001096	22	0.01389	0.008179	18.18	Kaplan-Meier	sqrt(x)	0.05	Inter
Thallium, Total (mg/L)	n/a	0.00025	22	n/a	n/a	13.64	n/a	n/a	0.3235	NP Inter(normality)

Confidence Interval Summary Table - All Results (No Significant)

Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP   Printed 7/10/2019, 10:24 AM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Lower Compl.	Sig.	N	%NDs	Transform	Alpha	Method
Antimony, total (mg/L)	MW_1510	0.00003	0.00002	0.006	n/a	No	11	0	No	0.006	NP (normality)
Antimony, total (mg/L)	MW_1505	0.00007514	0.00003259	0.006	n/a	No	11	9.091	sqrt(x)	0.01	Param.
Antimony, total (mg/L)	MW_1506	0.00007	0.00003	0.006	n/a	No	11	0	No	0.006	NP (normality)
Antimony, total (mg/L)	MW_1507	0.0001028	0.00005539	0.006	n/a	No	11	0	No	0.01	Param.
Antimony, total (mg/L)	MW_1509	0.00003	0.00002	0.006	n/a	No	11	0	No	0.006	NP (normality)
Arsenic, Total (mg/L)	MW_1510	0.0006235	0.0003892	0.01	n/a	No	11	0	No	0.01	Param.
Arsenic, Total (mg/L)	MW_1505	0.001759	0.0003922	0.01	n/a	No	11	0	sqrt(x)	0.01	Param.
Arsenic, Total (mg/L)	MW_1506	0.001177	0.0005433	0.01	n/a	No	11	0	No	0.01	Param.
Arsenic, Total (mg/L)	MW_1507	0.003285	0.0009498	0.01	n/a	No	11	0	No	0.01	Param.
Arsenic, Total (mg/L)	MW_1509	0.0005612	0.0003625	0.01	n/a	No	11	0	No	0.01	Param.
Barium, Total (mg/L)	MW_1510	0.04714	0.04064	2	n/a	No	11	0	No	0.01	Param.
Barium, Total (mg/L)	MW_1505	0.0633	0.0459	2	n/a	No	11	0	No	0.006	NP (normality)
Barium, Total (mg/L)	MW_1506	0.06518	0.05393	2	n/a	No	11	0	No	0.01	Param.
Barium, Total (mg/L)	MW_1507	0.0905	0.06227	2	n/a	No	11	0	No	0.01	Param.
Barium, Total (mg/L)	MW_1509	0.06333	0.05409	2	n/a	No	11	0	No	0.01	Param.
Beryllium, total (mg/L)	MW_1510	0.00002	0.000008	0.004	n/a	No	11	36.36	No	0.006	NP (normality)
Beryllium, total (mg/L)	MW_1505	0.0001247	0.00001946	0.004	n/a	No	11	27.27	No	0.01	Param.
Beryllium, total (mg/L)	MW_1506	0.00004617	0.00001128	0.004	n/a	No	11	9.091	sqrt(x)	0.01	Param.
Beryllium, total (mg/L)	MW_1507	0.000145	0.00004317	0.004	n/a	No	11	9.091	No	0.01	Param.
Beryllium, total (mg/L)	MW_1509	0.00002	0.000008	0.004	n/a	No	11	63.64	No	0.006	NP (normality)
Cadmium, total (mg/L)	MW_1510	0.00001	0.000005	0.005	n/a	No	11	9.091	No	0.006	NP (normality)
Cadmium, total (mg/L)	MW_1505	0.00003	0.00002	0.005	n/a	No	11	0	No	0.006	NP (normality)
Cadmium, total (mg/L)	MW_1506	0.00004	0.00002	0.005	n/a	No	11	0	No	0.006	NP (normality)
Cadmium, total (mg/L)	MW_1507	0.00007	0.00003	0.005	n/a	No	11	0	No	0.006	NP (normality)
Cadmium, total (mg/L)	MW_1509	0.00002	0.00001	0.005	n/a	No	11	0	No	0.006	NP (normality)
Chromium, total (mg/L)	MW_1510	0.005133	0.0006327	0.1	n/a	No	11	0	ln(x)	0.01	Param.
Chromium, total (mg/L)	MW_1505	0.01277	0.001233	0.1	n/a	No	11	0	sqrt(x)	0.01	Param.
Chromium, total (mg/L)	MW_1506	0.003187	0.001035	0.1	n/a	No	11	0	No	0.01	Param.
Chromium, total (mg/L)	MW_1507	0.01602	0.005162	0.1	n/a	No	11	0	No	0.01	Param.
Chromium, total (mg/L)	MW_1509	0.001972	0.0006125	0.1	n/a	No	11	0	ln(x)	0.01	Param.
Cobalt, total (mg/L)	MW_1510	0.0002956	0.0001524	0.006	n/a	No	11	0	No	0.01	Param.
Cobalt, total (mg/L)	MW_1505	0.001303	0.0002604	0.006	n/a	No	11	0	sqrt(x)	0.01	Param.
Cobalt, total (mg/L)	MW_1506	0.0009387	0.0003901	0.006	n/a	No	11	0	No	0.01	Param.
Cobalt, total (mg/L)	MW_1507	0.003318	0.000943	0.006	n/a	No	11	0	No	0.01	Param.
Cobalt, total (mg/L)	MW_1509	0.000408	0.0001854	0.006	n/a	No	11	0	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW_1510	1.166	0.362	5	n/a	No	10	0	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW_1505	1.117	0.4851	5	n/a	No	11	0	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW_1506	1.362	0.287	5	n/a	No	11	0	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW_1507	1.727	0.5974	5	n/a	No	10	0	No	0.01	Param.
Combined Radium 226 + 228 (pCi/L)	MW_1509	1.572	0.3911	5	n/a	No	11	0	No	0.01	Param.
Fluoride, total (mg/L)	MW_1510	0.2	0.05	4	n/a	No	11	27.27	No	0.006	NP (normality)
Fluoride, total (mg/L)	MW_1505	0.2	0.06	4	n/a	No	11	90.91	No	0.006	NP (NDs)
Fluoride, total (mg/L)	MW_1506	0.2	0.05	4	n/a	No	11	63.64	No	0.006	NP (normality)
Fluoride, total (mg/L)	MW_1507	0.07	0.05	4	n/a	No	11	9.091	No	0.006	NP (normality)
Fluoride, total (mg/L)	MW_1509	0.16	0.1	4	n/a	No	11	0	No	0.006	NP (normality)
Lead, total (mg/L)	MW_1510	0.0002496	0.00008419	0.015	n/a	No	11	0	No	0.01	Param.
Lead, total (mg/L)	MW_1505	0.001431	0.0001055	0.015	n/a	No	11	0	sqrt(x)	0.01	Param.
Lead, total (mg/L)	MW_1506	0.0007859	0.0002635	0.015	n/a	No	11	0	No	0.01	Param.
Lead, total (mg/L)	MW_1507	0.003343	0.0007325	0.015	n/a	No	11	0	No	0.01	Param.
Lead, total (mg/L)	MW_1509	0.000137	0.00001798	0.015	n/a	No	11	0	sqrt(x)	0.01	Param.
Lithium, total (mg/L)	MW_1510	0.01439	0.00779	0.04	n/a	No	11	0	No	0.01	Param.
Lithium, total (mg/L)	MW_1505	0.0128	0.006468	0.04	n/a	No	11	9.091	No	0.01	Param.
Lithium, total (mg/L)	MW_1506	0.01614	0.009135	0.04	n/a	No	11	0	No	0.01	Param.
Lithium, total (mg/L)	MW_1507	0.0191	0.01163	0.04	n/a	No	11	9.091	No	0.01	Param.
Lithium, total (mg/L)	MW_1509	0.01764	0.008523	0.04	n/a	No	11	9.091	No	0.01	Param.

Confidence Interval Summary Table - All Results (No Significant)

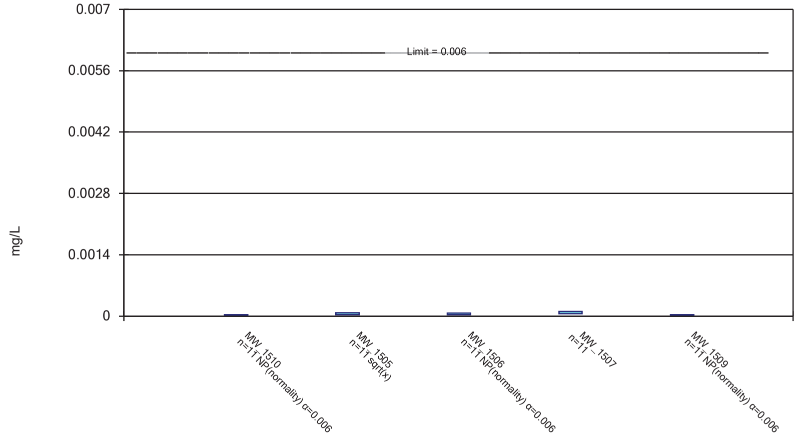
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP   Printed 7/10/2019, 10:24 AM

Constituent	Well	Upper Lim.	Lower Lim.	Compliance	Lower Compl.	Sig.	N	%NDs	Transform	Alpha	Method
Mercury, total (mg/L)	MW_1510	0.000005	0.000005	0.002	n/a	No	11	90.91	No	0.006	NP (NDs)
Mercury, total (mg/L)	MW_1505	0.000006	0.000002	0.002	n/a	No	11	63.64	No	0.006	NP (normality)
Mercury, total (mg/L)	MW_1506	0.000005	0.000002	0.002	n/a	No	11	45.45	No	0.006	NP (normality)
Mercury, total (mg/L)	MW_1507	0.00001308	0.000003549	0.002	n/a	No	11	9.091	sqrt(x)	0.01	Param.
Mercury, total (mg/L)	MW_1509	0.000005	0.000002	0.002	n/a	No	11	81.82	No	0.006	NP (NDs)
Molybdenum, total (mg/L)	MW_1510	0.001099	0.0003238	0.1	n/a	No	11	9.091	ln(x)	0.01	Param.
Molybdenum, total (mg/L)	MW_1505	0.002461	0.0007391	0.1	n/a	No	11	0	ln(x)	0.01	Param.
Molybdenum, total (mg/L)	MW_1506	0.001309	0.0005217	0.1	n/a	No	11	0	No	0.01	Param.
Molybdenum, total (mg/L)	MW_1507	0.005653	0.000975	0.1	n/a	No	11	0	sqrt(x)	0.01	Param.
Molybdenum, total (mg/L)	MW_1509	0.001037	0.0004628	0.1	n/a	No	11	9.091	No	0.01	Param.
Selenium, Total (mg/L)	MW_1510	0.0002	0.00008	0.05	n/a	No	11	0	No	0.006	NP (normality)
Selenium, Total (mg/L)	MW_1505	0.0007666	0.0003425	0.05	n/a	No	11	0	No	0.01	Param.
Selenium, Total (mg/L)	MW_1506	0.0002	0.00007	0.05	n/a	No	11	18.18	No	0.006	NP (Cohens/xfrm)
Selenium, Total (mg/L)	MW_1507	0.0004883	0.000139	0.05	n/a	No	11	0	No	0.01	Param.
Selenium, Total (mg/L)	MW_1509	0.0002	0.0001	0.05	n/a	No	11	0	No	0.006	NP (normality)
Thallium, Total (mg/L)	MW_1510	0.000057	0.00001	0.002	n/a	No	11	18.18	No	0.006	NP (Cohens/xfrm)
Thallium, Total (mg/L)	MW_1505	0.000102	0.000065	0.002	n/a	No	10	10	No	0.011	NP (normality)
Thallium, Total (mg/L)	MW_1506	0.00007	0.00005	0.002	n/a	No	11	9.091	No	0.006	NP (normality)
Thallium, Total (mg/L)	MW_1507	0.00009	0.00005	0.002	n/a	No	11	9.091	No	0.006	NP (normality)
Thallium, Total (mg/L)	MW_1509	0.000057	0.00003	0.002	n/a	No	11	9.091	No	0.006	NP (normality)

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

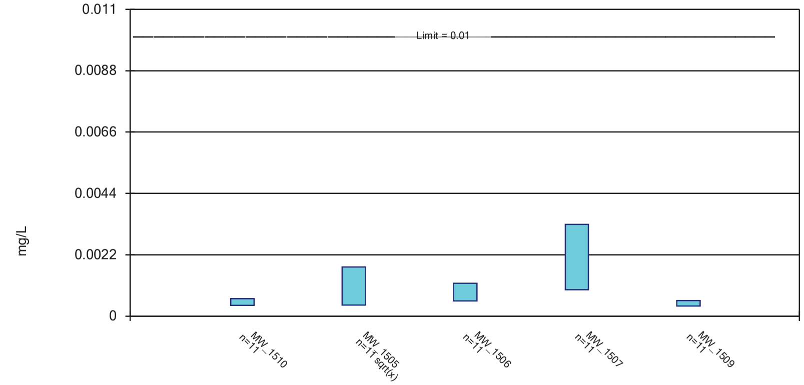


Constituent: Antimony, total   Analysis Run 7/10/2019 10:22 AM   View: Confidence Intervals - Appendix IV
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

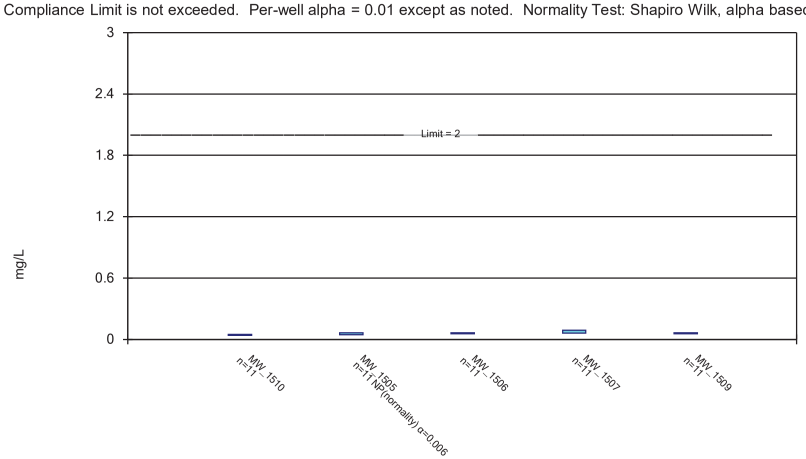


Constituent: Arsenic, Total   Analysis Run 7/10/2019 10:22 AM   View: Confidence Intervals - Appendix IV
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

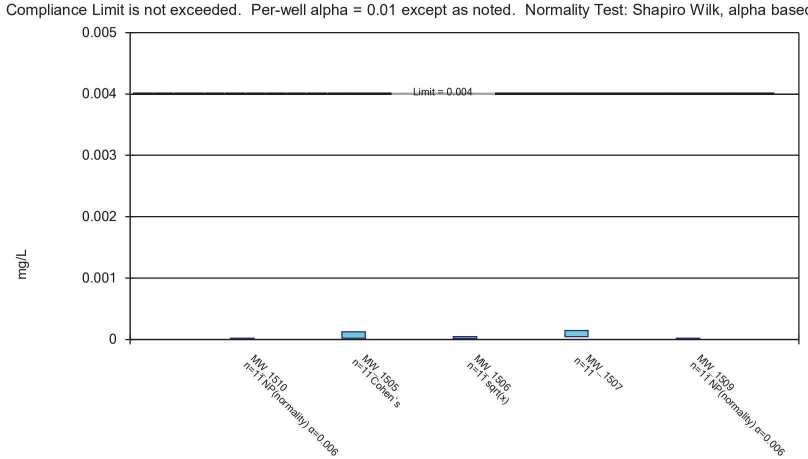


Constituent: Barium, Total   Analysis Run 7/10/2019 10:22 AM   View: Confidence Intervals - Appendix IV
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

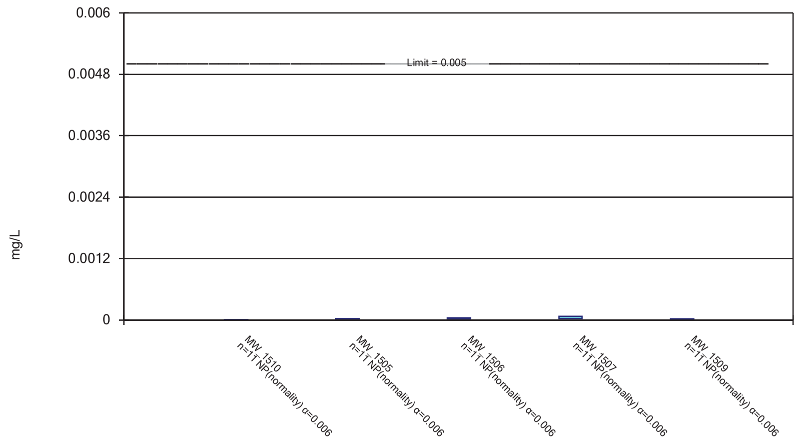


Constituent: Beryllium, total   Analysis Run 7/10/2019 10:22 AM   View: Confidence Intervals - Appendix IV
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.

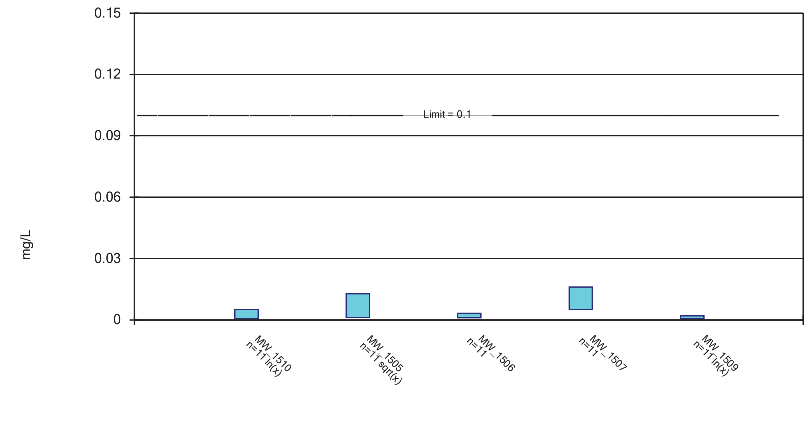


Constituent: Cadmium, total   Analysis Run 7/10/2019 10:22 AM   View: Confidence Intervals - Appendix IV
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

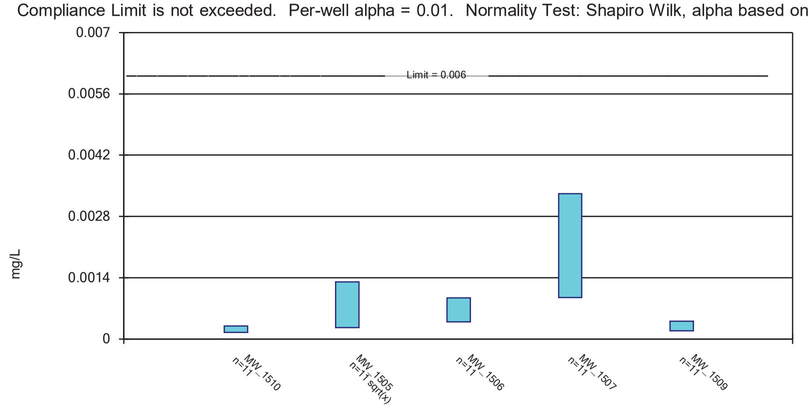


Constituent: Chromium, total   Analysis Run 7/10/2019 10:22 AM   View: Confidence Intervals - Appendix IV
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

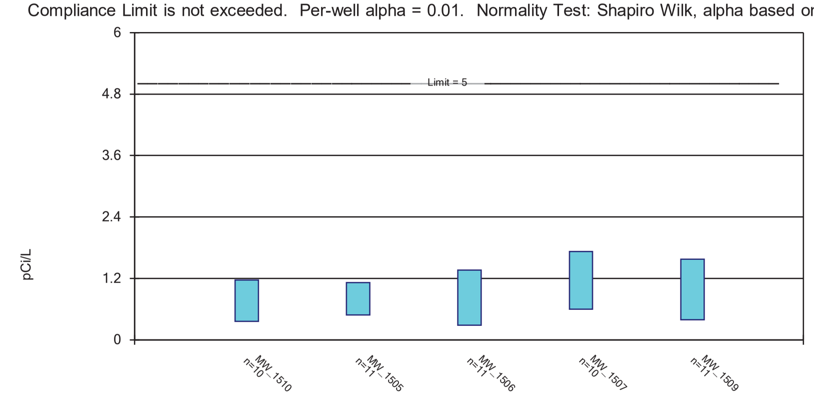


Constituent: Cobalt, total   Analysis Run 7/10/2019 10:22 AM   View: Confidence Intervals - Appendix IV
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

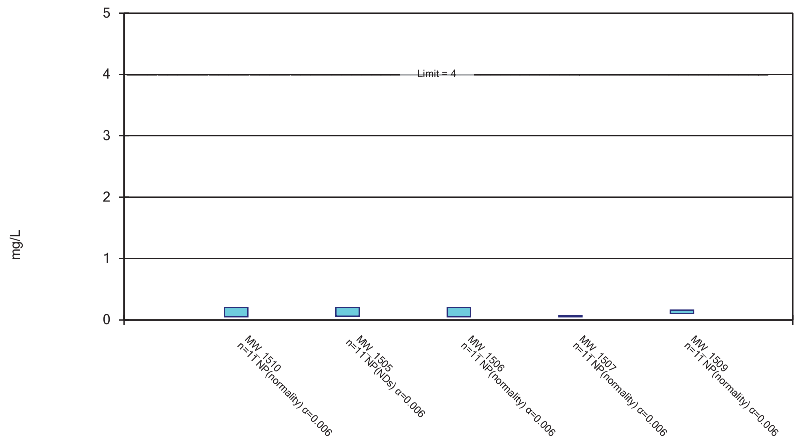


Constituent: Combined Radium 226 + 228   Analysis Run 7/10/2019 10:22 AM   View: Confidence Intervals -
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.

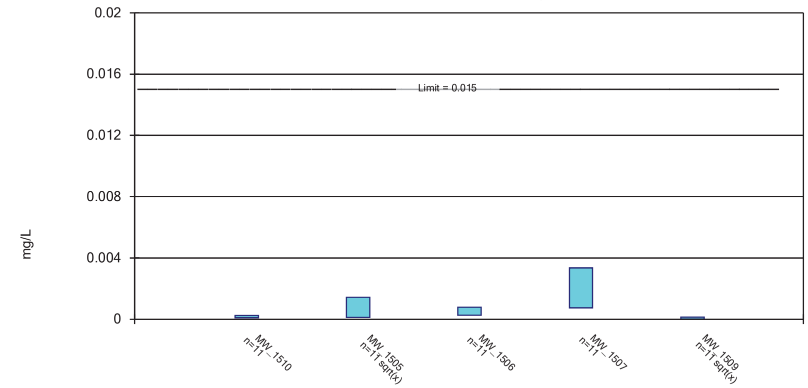


Constituent: Fluoride, total   Analysis Run 7/10/2019 10:22 AM   View: Confidence Intervals - Appendix IV
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

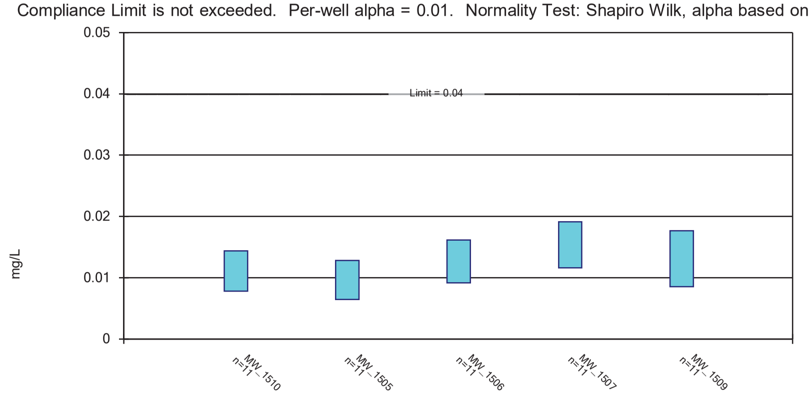


Constituent: Lead, total   Analysis Run 7/10/2019 10:22 AM   View: Confidence Intervals - Appendix IV
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

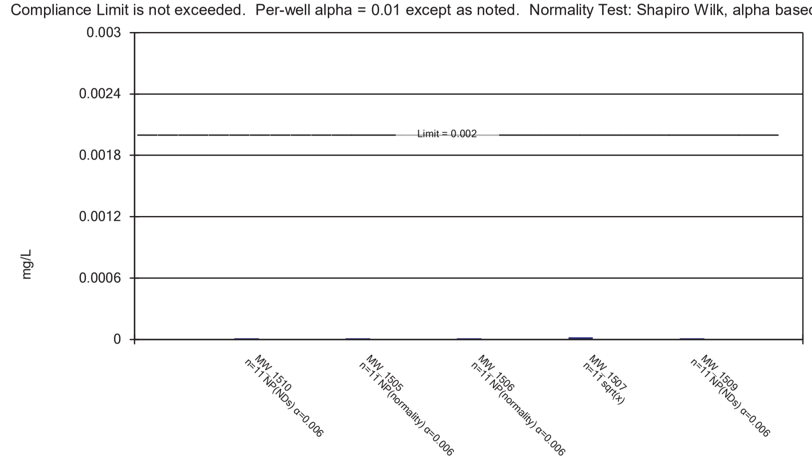


Constituent: Lithium, total   Analysis Run 7/10/2019 10:22 AM   View: Confidence Intervals - Appendix IV
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

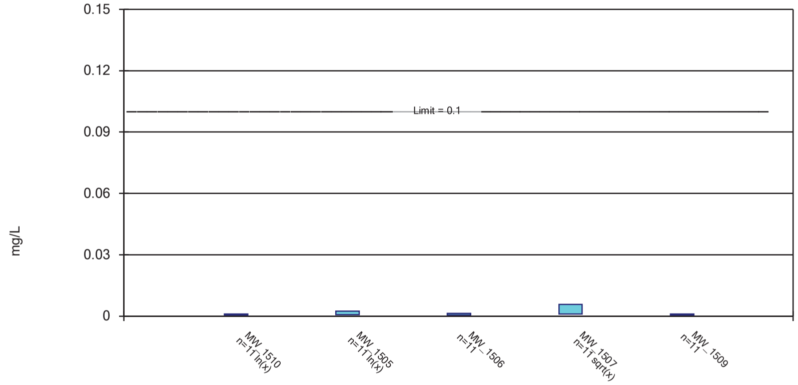


Constituent: Mercury, total   Analysis Run 7/10/2019 10:22 AM   View: Confidence Intervals - Appendix IV
Mitchell BAP   Client: Geosyntec   Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01. Normality Test: Shapiro Wilk, alpha based on n.

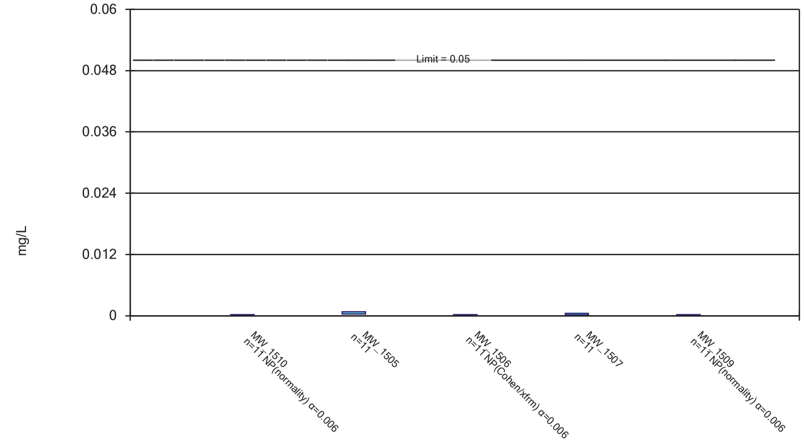


Constituent: Molybdenum, total Analysis Run 7/10/2019 10:22 AM View: Confidence Intervals - Appendix I
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Parametric and Non-Parametric (NP) Confidence Interval

Compliance Limit is not exceeded. Per-well alpha = 0.01 except as noted. Normality Test: Shapiro Wilk, alpha based on n.

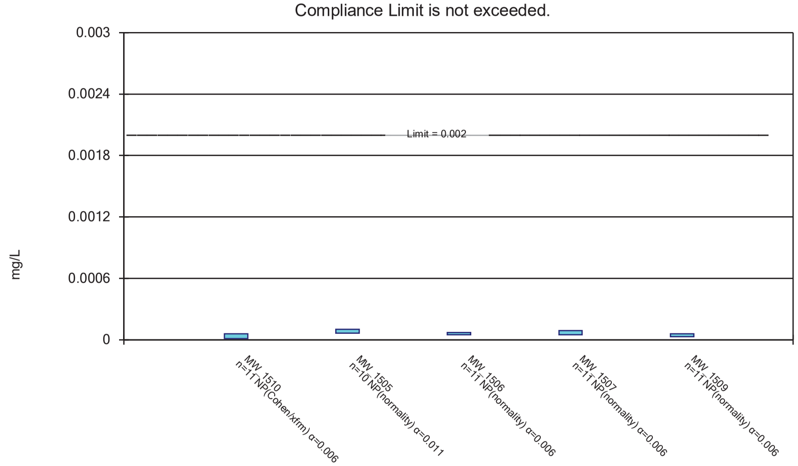


Constituent: Selenium, Total Analysis Run 7/10/2019 10:22 AM View: Confidence Intervals - Appendix IV
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

Sanitas™ v.9.6.19d Sanitas software utilized by Groundwater Stats Consulting. UG

Non-Parametric Confidence Interval

Compliance Limit is not exceeded.



Constituent: Thallium, Total Analysis Run 7/10/2019 10:22 AM View: Confidence Intervals - Appendix IV
Mitchell BAP Client: Geosyntec Data: Mitchell BAP

APPENDIX 3 – Alternative Source Demonstrations

Alternative source demonstrations relative to Appendix IV SSLs above the groundwater protection standard were not necessary because no SSLs above the groundwater protection standards were identified in 2019. Alternative source demonstrations are not applicable at this time.

APPENDIX 4 - Notices for Monitoring Program Transitions

No transition between monitoring requirements occurred in 2019; the CCR unit remained in assessment monitoring over the entire year. Notices for monitoring program transitions are not applicable at this time.

APPENDIX 5 - Well Installation/Decommissioning Logs

No monitoring wells installed or decommissioned in 2019. Well installation/decommissioning logs are not applicable at this time.

Annual Groundwater Monitoring Report

Kentucky Power Company

Mitchell Plant

Landfill

Moundsville, WV

January 2020

Prepared by:
American Electric Power Service Corporation
1 Riverside Plaza
Columbus, Ohio 43215

KENTUCKY POWER℠

An AEP Company

BOUNDLESS ENERGY℠

Table of Contents

I. Overview

This *Annual Groundwater Monitoring Report* (Report) has been prepared to report the status of activities for the preceding year for the landfill at Kentucky Power Company's, a wholly owned subsidiary of American Electric Power Company (AEP), Mitchell Power Plant. The USEPA's CCR rules require that the Annual Groundwater Monitoring Report be posted to the operating record for the preceding year no later than January 31st.

In general, the following activities were completed in 2019:

- Groundwater samples were collected and analyzed in June 2019 for Appendix III constituents, as specified in 40 CFR 257.94 and AEP's *Groundwater Sampling and Analysis Plan (2016)*;
- Groundwater data underwent various validation tests, including tests for completeness, valid values, transcription errors, and consistent units;
- Appendix III parameters were compared to prediction limits (intervals for pH) established from background data established previously;
- The statistical evaluation concluded that there were statistically significant increases (SSIs) over background of two Appendix III parameters;
- Because SSIs over background of Appendix III parameters were detected, an alternative source demonstration (ASD) study was conducted resulting in a November 2019 ASD report, as discussed further in Section VI of this report.
- As required by 40 CFR 257.94, groundwater samples were collected and analyzed for all Appendix III constituents during a second semiannual sampling event in October 2019.

The major components of this annual report, to the extent applicable at this time, are presented in sections that follow:

- A map, aerial photograph or a drawing showing the CCR management unit(s), all groundwater monitoring wells and monitoring well identification numbers;
- All of the monitoring data collected, including the rate and direction of groundwater flow, plus a summary showing the number of samples collected per monitoring well, the dates the samples were collected and whether the sample was collected as part of detection monitoring or assessment monitoring programs (Attached as **Appendix 1**);
- Statistical comparison of monitoring data to determine if there have been one or more SSIs over background levels (Attached as **Appendix 2**, where applicable);
- A discussion of whether any alternate source demonstration were performed, and the conclusions (Attached as **Appendix 3**, where applicable);

- A summary of any transition between monitoring programs, for example the date and circumstances for transitioning from detection monitoring to assessment monitoring (Notices attached as **Appendix 4**, where applicable);
- Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a statement as to why that happened (Attached as **Appendix 5**, where applicable); and
- Other information required to be included in the annual report such as an alternate monitoring frequency, or assessment of corrective measures, if applicable.

In addition, this report summarizes key actions completed, and where applicable, describes any problems encountered and actions taken to resolve those problems. The report includes a projection of key activities for the upcoming year.

II. Groundwater Monitoring Well Locations and Identification Numbers

A figure that depicts the PE-certified groundwater monitoring network, the monitoring well locations, and their corresponding identification is provided in Appendix 1.

III. Monitoring Wells Installed or Decommissioned

There were no monitoring wells installed or decommissioned in 2019. The network design, as summarized in the *Groundwater Monitoring Network Design Report* (2016) and as posted at the CCR web site for Mitchell Plant, did not change. That design report, viewable on the AEP CCR web site, discusses the facility location, the hydrogeological setting, the hydrostratigraphic units, the uppermost aquifer, downgradient monitoring well locations and the upgradient monitoring well locations.

IV. Groundwater Quality Data and Static Water Elevation Data, With Flow Rate and Direction and Discussion

Appendix 1 contains tables showing the groundwater quality data collected during the establishment of background quality and detection monitoring. Static water elevation data from each monitoring event also are shown in Appendix 1, along with the groundwater velocities, groundwater flow direction, and potentiometric maps developed after each sampling event.

V. Groundwater Quality Data Statistical Analysis

Statistical analysis of the detection monitoring samples taken in June 2019 was completed on September 4, 2019. The evaluation concluded that SSIs of chloride and total dissolved solids over background levels were detected in one monitoring well. A memorandum with the results of the statistical evaluation is provided in Appendix 2.

As required by 40 CFR 257.94, groundwater samples were collected and analyzed for all Appendix III constituents during a second semiannual sampling event in October 2019. A statistical evaluation of these results will be completed in 2020.

VI. Alternative Source Demonstrations

Because SSIs over background of Appendix III parameters were detected at Mitchell Plant's landfill, an ASD study was conducted resulting in a November 2019 ASD report. The report concluded that the SSIs are not due to a release from the Mitchell Landfill, but were instead attributed to natural variation in groundwater quality. The report is provided in Appendix 3.

VII. Discussion About Transition Between Monitoring Requirements or Alternate Monitoring Frequency

No transition between monitoring requirements occurred in 2019; the CCR unit remained in detection monitoring over the entire year. A statement to this effect is provided in Appendix 4. The sampling frequency of twice per year will be maintained for the Appendix III parameters (boron, calcium, chloride, fluoride, pH, sulfate and total dissolved solids).

Regarding defining an alternate monitoring frequency, the groundwater velocity and monitoring well production is high enough at this facility that no modification of the semiannual detection monitoring effort is needed.

VIII. Other Information Required

The Mitchell landfill has remained in its current status of detection monitoring. All required information has been included in this annual groundwater monitoring report.

IX. Description of Any Problems Encountered in 2019 and Actions Taken

No significant problems were encountered. The low flow sampling effort went smoothly and the schedule was met to support this annual groundwater report preparation. There were, however, dry wells encountered during sampling, but this did not affect the statistical evaluation or monitoring network at the landfill. The minimum requirement of one upgradient and three downgradient wells was still met.

X. A Projection of Key Activities for the Upcoming Year

Key activities for 2020 include:

- Detection monitoring on a semiannual schedule;
- Evaluation of the detection monitoring results from a statistical analysis viewpoint, looking for any SSIs (or decreases with respect to pH);
- Responding to any new data received in light of what the CCR rule requires;
- Preparation of the next annual groundwater report.

APPENDIX 1 - Groundwater Data Tables and Figures

Tables follow showing the groundwater monitoring data collected, the rate of groundwater flow each time groundwater was sampled, the number of samples collected per monitoring well, dates that the samples were collected, and whether each sample was collected as part of a detection monitoring or an assessment monitoring program. Figures follow showing the PE-certified groundwater monitoring network with the corresponding well identifications along with static water elevation data and groundwater flow directions each time groundwater was sampled in the form of annotated satellite images.

Table 1 - Groundwater Data Summary: MW-1101F
Mitchell - LF
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
6/15/2016	Background	0.042	88.3	3.87	0.22	7.4	395	64.3
8/3/2016	Background	0.380	91.0	3.30	0.21	7.4	425	62.1
9/28/2016	Background	0.054	88.6	3.73	0.26	8.7	466	58.1

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1101F
Mitchell - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/15/2016	Background	0.21	1.64	159	0.023	0.08	0.6	0.294	0.304	0.22	0.525	0.012	<0.002 U	3.87	0.2	0.02 J
8/3/2016	Background	0.14	1.46	155	0.033	0.08	0.6	0.244	1.494	0.21	0.673	0.017	<0.002 U	4.04	0.2	<0.01 U
9/28/2016	Background	0.18	1.79	142	0.029	0.12	0.8	0.231	1.561	0.26	0.511	0.016	<0.002 U	3.39	0.3	0.02 J

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1101R
Mitchell - LF
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
6/15/2016	Background	0.287	6.91	8.41	1.20	8.2	741	76.4
8/3/2016	Background	0.518	5.00	10.3	1.56	8.4	750	76.4
9/28/2016	Background	0.382	6.12	13.3	1.83	8.5	43.0	43.5
11/16/2016	Background	1.80	19.4	15.2	2.29	8.6	801	32.2
2/14/2017	Background	0.501	2.23	15.4	2.40	8.6	806	32.0
4/12/2017	Background	0.360	4.02	14.4	2.17	8.7	798	39.2
5/24/2017	Background	0.380	1.91	15.1	2.41	8.7	793	28.6
7/25/2017	Background	0.415	1.76	15.8	2.61	8.7	788	28.7
10/11/2017	Detection	0.394	1.87	16.9	2.59	8.7	784	29.1
1/11/2018	Detection	- -	1.75	- -	- -	8.4	- -	28.8
4/10/2018	Detection	0.344	1.75	16.5	2.62	8.5	790	29.0
8/29/2018	Detection	0.371	2.42	16.3	2.45	9.0	783	29.7
5/1/2019	Detection	0.376	1.90	16.9	2.62	10.5	809	28.7
6/12/2019	Detection	0.371	2.03	16.2	2.38	8.8	822	27.4

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1101R
Mitchell - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/15/2016	Background	0.82	8.11	185	0.031	0.03	1.1	0.650	0.493	1.20	1.22	0.002	0.003 J	31.8	0.5	0.05 J
8/3/2016	Background	1.10	10.8	149	0.023	0.03	1.0	0.363	0.4776	1.56	0.674	0.012	<0.002 U	32.9	0.5	0.02 J
9/28/2016	Background	0.92	11.1	149	0.01 J	0.02	0.7	0.301	0.565	1.83	0.550	0.009	<0.002 U	26.2	0.5	0.01 J
11/16/2016	Background	0.67	14.2	125	0.01 J	0.02 J	0.595	0.143	1.808	2.29	0.292	0.026	<0.002 U	20.6	0.4	<0.01 U
2/14/2017	Background	0.69	15.3	102	0.01 J	0.02 J	0.512	0.160	1.661	2.40	0.327	0.012	<0.002 U	34.0	0.4	0.02 J
4/12/2017	Background	0.84	12.4	117	0.02 J	0.02 J	0.824	0.333	0.190	2.17	0.634	0.010	0.002 J	16.7	0.5	<0.01 U
5/24/2017	Background	0.66	15.7	102	0.01 J	0.01 J	0.526	0.299	0.759	2.41	0.298	<0.0002 U	<0.002 U	14.8	0.3	<0.01 U
7/25/2017	Background	0.62	14.5	91.3	0.01 J	0.01 J	0.377	0.126	0.977	2.61	0.235	0.009	<0.002 U	18.3	0.3	0.02 J

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1102F
Mitchell - LF
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
6/15/2016	Background	0.109	4.34	12.4	0.56	8.0	523	37.2
8/3/2016	Background	0.280	5.48	11.9	0.58	8.2	535	35.9
10/3/2016	Background	0.160	5.45	11.8	0.60	8.1	519	29.5
11/15/2016	Background	0.117	4.87	11.7	0.56	8.1	551	27.4
2/14/2017	Background	0.109	5.04	11.3	0.53	8.2	521	29.9
4/12/2017	Background	0.109	4.67	11.3	0.53	8.3	530	30.6
5/24/2017	Background	0.118	5.31	13.7	0.56	8.3	521	31.8
7/26/2017	Background	0.202	5.41	11.4	0.57	8.3	519	31.5
10/10/2017	Detection	0.278	4.79	12.4	0.57	8.4	526	32.3
1/11/2018	Detection	- -	4.47	- -	- -	7.9	- -	32.1
4/10/2018	Detection	0.109	4.40	13.4	0.63	8.2	539	33.2
8/28/2018	Detection	0.247	4.48	14.1	0.64	8.6	549	33.8
5/1/2019	Detection	0.126	4.69	15.2	0.66	9.5	577	37.6
6/12/2019	Detection	0.110	4.36	14.9	0.74	8.2	574	38.0

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1102F
Mitchell - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/15/2016	Background	0.71	9.37	214	<0.005 U	0.04	0.4	0.096	0.352	0.56	0.335	0.003	<0.002 U	28.1	0.3	<0.01 U
8/3/2016	Background	0.69	8.16	212	<0.005 U	0.02 J	0.4	0.090	0.881	0.58	0.183	0.006	<0.002 U	25.8	0.3	0.01 J
10/3/2016	Background	0.64	8.45	194	0.005 J	0.01 J	0.5	0.286	0.972	0.60	0.298	0.002	<0.002 U	23.9	0.3	<0.01 U
11/15/2016	Background	0.63	8.49	212	0.005 J	0.008 J	0.435	0.074	1.859	0.56	0.141	0.003	<0.002 U	22.9	0.3	<0.01 U
2/14/2017	Background	0.62	8.66	197	0.006 J	0.006 J	0.411	0.049	1.015	0.53	0.131	0.004	<0.002 U	21.4	0.3	0.02 J
4/12/2017	Background	0.56	7.68	191	0.005 J	0.01 J	0.399	0.079	0.1825	0.53	0.135	0.005	<0.002 U	19.3	0.3	0.01 J
5/24/2017	Background	0.60	8.76	229	0.01 J	0.02	0.807	0.203	0.3252	0.56	0.335	<0.0002 U	<0.002 U	20.0	0.4	0.01 J
7/26/2017	Background	0.54	7.58	205	<0.004 U	0.01 J	0.323	0.072	0.942	0.57	0.121	0.007	<0.002 U	34.7	0.3	0.03 J

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1102R
Mitchell - LF
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
6/15/2016	Background	0.339	3.49	219	2.97	8.2	1470	47.8
8/3/2016	Background	0.467	4.05	217	2.98	8.3	1450	44.9
10/3/2016	Background	0.332	5.33	213	2.96	8.3	1530	35.1

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1102R
Mitchell - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/15/2016	Background	2.01	2.64	292	0.02 J	0.35	0.5	0.799	0.710	2.97	0.558	0.015	<0.002 U	68.7	0.9	0.01 J
8/3/2016	Background	1.71	3.57	356	0.128	0.14	3.0	1.75	1.217	2.98	2.82	0.021	0.007 J	66.0	1.2	0.03 J
10/3/2016	Background	1.73	3.37	441	0.307	0.17	3.9	3.01	2.828	2.96	7.24	0.028	0.007	51.4	1.9	0.03 J

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1103F
Mitchell - LF
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
6/15/2016	Background	0.355	3.01	243	3.11	8.3	1390	0.5
8/2/2016	Background	0.402	2.99	247	3.20	8.3	1420	0.3
10/3/2016	Background	0.321	3.12	242	3.34	8.4	1380	<0.04 U
11/16/2016	Background	0.323	2.97	240	2.96	8.4	1370	0.2
2/15/2017	Background	0.303	2.82	240	3.07	8.5	1400	0.2
4/11/2017	Background	0.304	2.57	234	3.05	8.6	1400	0.4
5/23/2017	Background	0.346	2.88	237	3.23	8.5	1370	0.4
7/26/2017	Background	0.343	2.76	240	3.24	8.5	1370	0.3
10/11/2017	Detection	0.328	3.09	247	3.17	8.6	1390	0.5
4/10/2018	Detection	0.286	2.58	239	3.16	8.3	1390	0.5
8/29/2018	Detection	0.332	2.76	244	3.03	8.6	1380	0.4
5/2/2019	Detection	0.342	2.95	245	3.13	9.1	1360	0.8
6/12/2019	Detection	0.329	2.96	233	3.55	8.3	1410	0.9

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1103F
Mitchell - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/15/2016	Background	0.16	8.03	639	0.029	0.02	1.0	0.351	1.10	3.11	0.674	0.012	<0.002 U	10.1	0.2	0.01 J
8/2/2016	Background	0.14	7.01	704	0.026	0.01 J	0.9	0.299	0.899	3.20	0.479	0.016	<0.002 U	2.61	0.2	<0.01 U
10/3/2016	Background	0.04 J	5.80	558	0.01 J	0.03	0.4	0.180	1.026	3.34	0.313	0.016	<0.004 U	2.66	0.1 J	0.01 J
11/16/2016	Background	0.10	7.71	723	0.01 J	0.009 J	0.471	0.159	1.57	2.96	0.218	0.015	<0.002 U	2.57	0.1	<0.01 U
2/15/2017	Background	0.03 J	7.67	631	0.009 J	0.008 J	0.336	0.147	1.416	3.07	0.213	0.016	<0.002 U	2.81	0.09 J	0.03 J
4/11/2017	Background	0.07	8.46	618	0.006 J	0.006 J	0.262	0.102	2.183	3.05	0.088	0.015	<0.002 U	3.19	0.1	<0.01 U
5/23/2017	Background	0.03 J	7.85	688	0.006 J	0.007 J	0.26	0.149	1.214	3.23	0.194	0.006	<0.002 U	2.80	0.06 J	<0.01 U
7/26/2017	Background	0.02 J	6.81	562	<0.004 U	0.007 J	0.112	0.136	1.798	3.24	0.103	0.015	<0.002 U	5.46	0.07 J	0.02 J

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1104R
Mitchell - LF
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
6/21/2016	Background	0.431	39.4	485	1.18	7.87	2390	162

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1104R
Mitchell - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/21/2016	Background	0.66	4.35	182	0.57	0.18	3.4	4.36	0.153	1.18	9.41	0.014	<0.09 U	42.3	2.3	0.133

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1 - Groundwater Data Summary: MW-1502R
Mitchell - LF
Appendix III Constituents

Collection Date	Monitoring Program	Boron	Calcium	Chloride	Fluoride	pH	Total Dissolved Solids	Sulfate
		mg/L	mg/L	mg/L	mg/L	SU	mg/L	mg/L
6/20/2016	Background	0.268	71.5	33.4	0.18	7.3	474	155
8/9/2016	Background	0.160	95.4	34.0	0.17	7.3	547	187
9/27/2016	Background	0.376	103	39.7	0.1 J	7.4	560	183
11/9/2016	Background	0.214	87.3	25.4	0.1 J	7.4	551	186
2/15/2017	Background	0.069	90.0	167	0.16	7.5	564	90.1
4/12/2017	Background	0.075	72.2	79.5	0.16	7.6	507	102
5/23/2017	Background	0.100	73.9	52.4	0.17	7.6	466	118
7/25/2017	Background	0.158	61.7	18.8	0.20	7.3	358	88.6
10/11/2017	Detection	0.132	91.0	24.5	0.1 J	7.3	535	159
1/11/2018	Detection	- -	240	- -	- -	7.0	- -	149
4/10/2018	Detection	0.051	78.3	196	0.19	7.4	616	87.6
8/29/2018	Detection	0.150	95.7	99.3	0.17	7.7	650	167
5/2/2019	Detection	0.1 J	93.6	245	0.17	8.5	702	105
6/12/2019	Detection	0.127	80.7	155	0.23	7.3	661	114

Notes:
mg/L: milligrams per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed

Table 1 - Groundwater Data Summary: MW-1502R
Mitchell - LF
Appendix IV Constituents

Collection Date	Monitoring Program	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Combined Radium	Fluoride	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	pCi/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
6/20/2016	Background	0.22	0.28	30.6	<0.005 U	0.005 J	0.3	0.082	0.143	0.18	0.064	0.002	<0.09 U	3.48	8.2	0.01 J
8/9/2016	Background	0.20	0.26	34.1	<0.005 U	0.006 J	0.3	0.068	1.029	0.17	0.089	0.010	<0.002 U	8.71	7.4	<0.01 U
9/27/2016	Background	0.16	0.27	38.2	<0.005 U	0.004 J	0.4	0.076	0.429	0.1 J	0.064	0.012	<0.002 U	8.40	8.8	<0.01 U
11/9/2016	Background	0.20	0.84	44.2	0.062	0.009 J	1.44	0.507	2.497	0.1 J	0.764	0.006	<0.002 U	3.19	5.3	0.03 J
2/15/2017	Background	0.13	0.24	27.7	0.006 J	<0.004 U	1.90	0.069	2.61	0.16	0.061	0.009	<0.002 U	1.84	4.3	0.03 J
4/12/2017	Background	0.13	0.69	29.2	0.053	0.008 J	1.20	0.426	0.613	0.16	0.630	0.015	0.002 J	1.91	4.8	0.02 J
5/23/2017	Background	0.15	0.53	32.2	0.033	<0.005 U	0.918	0.238	0.647	0.17	0.364	0.002	<0.002 U	2.46	4.7	0.01 J
7/25/2017	Background	0.21	0.30	19.0	0.008 J	<0.005 U	0.196	0.082	0.6323	0.20	0.088	0.009	<0.002 U	2.47	3.2	0.03 J

Notes:
µg/L: micrograms per liter
SU: standard unit
<: Non-detect value. Parameters which were not detected are shown as less than the method detection limit (MDL) followed by a 'U' flag.
J: Estimated value. Parameter was detected at concentration below the reporting limit
- -: Not analyzed
pCi/L: picocuries per liter

Table 1: Residence Time Calculation Summary
Mitchell Landfill

			2019-05		2019-06	
CCR Management Unit	Monitoring Well Pair	Well Diameter (inches)	Vertical Groundwater Velocity (ft/year)	Groundwater Residence Time (days)	Vertical Groundwater Velocity (ft/year)	Groundwater Residence Time (days)
Landfill	MW1101F/R [1]	2.0	2.4	26	2.4	25
	MW1102F/R [1]	2.0	1.4	43	1.4	45
	MW1103F/R [2]	2.0	1.8	35	1.7	35
	MW1104F/R [2]	2.0	0.8	80	0.8	76
	MW1501F/R [3]	4.0	2.2	56	2.2	56
	MW1502R [3]	4.0	NC	NC	NC	NC
	MW1503F/R [3]	4.0	1.3	93	1.3	93

Notes:
[1] - Sidegradient Well
[2] - Background Well
[3] - Downgradient Well
NC - No calculation can be generated

Legend

- Compliance Sampling Location
- Upgradient Sampling Location
- CCR Landfill (Approximate Limits of Waste)

Notes

- Monitoring well coordinates provided by AEP.
-Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.

Site Layout
Landfill - Fish Creek Aquifer

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2018/01/26

Figure **1a**

C:\Users\mmuenich\Documents\local_projects\AEP_GIS\Mitchell\MXDs\Landfill-FC\AEP-Mitchell_LF-Fish-Creek_Site_Layout.mxd. MMuenich. 1/26/2018. Project/Phase/Task.

Legend

- Compliance Sampling Location
- Upgradient Sampling Location

CCR Landfill (Approximate Limits of Waste)

Notes

- Monitoring well coordinates provided by AEP.
-Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.

Site Layout
Landfill - Rush Run Aquifer

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2018/01/26

Figure **1b**

C:\Users\mmuenich\Documents\local_projects\AEP_GIS\Mitchell\MXDs\AEP-Mitchell_LF-Rush-Run_Site_Layout.mxd. MMuenich. 1/26/2018. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contours (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on May 1-2, 2019) provided by AEP.
-Site features based on information available in the Groundwater Monitoring Network Evaluation (AMEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

500 250 0 500 Feet

Potentiometric Surface Map - Fish Creek
May 2019

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2019/12/13

Figure 2

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-FC\2019\AEP-Mitchell_Landfill-FC_GW_May2019.mxd. ARevezzo. 12/13/2019. Project/Phase/Task.

Legend
- Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes
- Monitoring well coordinates and water level data (collected on May 1-2, 2019) provided by AEP.
-Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

Potentiometric Surface Map - Rush Run May 2019

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Clumbus, Ohio | 2019/12/13

Figure 3

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-RR\2019\AEP-Mitchell_Landfill-RR_GW_May2019.mxd. ARevezzo. 12/13/2019. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contours (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on June 12, 2019) provided by AEP.
-Site features based on information available in the Groundwater Monitoring Network Evaluation (AMEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

500 250 0 500 Feet

Potentiometric Surface Map - Fish Creek
June 2019

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Columbus, Ohio | 2020/01/29

Figure 4

P:\Projects\AEP\Groundwater Statistical Evaluation - CHA8423\Groundwater Mapping\GIS Files\MXD\Mitchell\Landfill-FC\2019\AEP-Mitchell_Landfill-FC_GW_June2019.mxd. ARevezzo. 1/29/2020. Project/Phase/Task.

Legend

- Groundwater Monitoring Well
- Groundwater Flow Direction
- Groundwater Elevation Contour
- Groundwater Elevation Contour (Inferred)

Notes

- Monitoring well coordinates and water level data (collected on June 12, 2019) provided by AEP.
-Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.
- Groundwater elevation units are feet above mean sea level (NAVD 88).

Potentiometric Surface Map - Rush Run
June 2019

Mitchell Power Generation Plant
Marshall County, West Virginia

Geosyntec consultants

Clumbus, Ohio | 2020/01/29

Figure **5**

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APPENDIX 2 - Statistical Analyses

The memorandum summarizing the September 2019 statistical evaluation follows.

Geosyntec consultants

941 Chatham Lane, Suite 103
Columbus, Ohio 43212
PH 614.468.0415
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Memorandum

Date:	September 4, 2019
To:	David Miller (AEP)
Copies to:	Justin Jent (AEP)
From:	Allison Kreinberg and Bruce Sass, Ph.D. (Geosyntec)
Subject:	Evaluation of Detection Monitoring Data at Mitchell Plant's Landfill (LF)

In accordance with the United States Environmental Protection Agency's (USEPA's) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments (40 CFR 257 Subpart D, "CCR rule"), the first semi-annual detection monitoring event at the Landfill (LF), an existing CCR unit at the Mitchell Power Plant located in Moundsville, West Virginia was completed on May 1-2, 2019. Based on the results, verification sampling was completed on June 12, 2019.

Eight background monitoring events were conducted at the Mitchell LF prior to these detection monitoring events, and upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. Lower prediction limits (LPLs) were also calculated for pH. Details on the calculation of these background values are described in Geosyntec's *Statistical Analysis Summary* report, dated January 15, 2018.

To achieve an acceptably high statistical power while maintaining a site-wide false-positive rate (SWFPR) of 10% per year or less, prediction limits were calculated based on a one-of-two retesting procedure. With this procedure, a statistically significant increase (SSI) is only concluded if both samples in a series of two exceeds the UPL (or are below the LPL for pH). In practice, if the initial result did not exceed the UPL, a second sample was not collected or analyzed.

Detection monitoring results and the relevant background values are compared in Table 1 and noted exceedances are described in the list below.

- Chloride concentrations exceeded the intrawell UPL of 14.1 mg/L in both the initial (15.2 mg/L) and second (14.9 mg/L) samples collected at MW-1102F. Therefore, an SSI over background is concluded for chloride at MW-1102F.

- Total Dissolved Solids (TDS) concentrations exceeded the intrawell UPL of 551 mg/L in both the initial (577 mg/L) and second (574 mg/L) samples collected at MW-1102F. Therefore, an SSI over background is concluded for TDS at MW-1102F.

In response to the exceedances noted above, the Mitchell LF CCR unit will either transition to assessment monitoring or an alternative source demonstration (ASD) for chloride and TDS will be conducted in accordance with 40 CFR 257.94(e)(2). If the ASD is successful, the Mitchell LF will remain in detection monitoring.

The statistical analysis was conducted within 90 days of completion of sampling and analysis in accordance with 40 CFR 257.93(h)(2). A certification of these statistics by a qualified professional engineer is provided in Attachment A.

Table 1: Detection Monitoring Data Evaluation
Mitchell Plant - Landfill

Parameter	Units	Description	MW-1101R		MW-1102F		MW-1502R	
			5/1/2019	6/12/2019	5/1/2019	6/12/2019	5/2/2019	6/12/2019
Boron	mg/L	Intrawell Background Value (UPL)	0.651		0.320		0.467	
		Detection Monitoring Data	0.376	--	0.126	--	0.100	--
Calcium	mg/L	Intrawell Background Value (UPL)	25.0		6.22		121	
		Detection Monitoring Data	1.9	--	4.69	--	93.6	
Chloride	mg/L	Intrawell Background Value (UPL)	18.6		14.1		213	
		Detection Monitoring Data	16.9	--	**15.2**	**14.9**	**245**	155
Fluoride	mg/L	Intrawell Background Value (UPL)	3.49		0.67		0.25	
		Detection Monitoring Data	2.62	--	0.66	--	0.17	--
pH	SU	Intrawell Background Value (UPL)	9.1		8.6		7.7	
		Intrawell Background Value (LPL)	7.8		7.5		7.1	
		Detection Monitoring Data	**10.5**	8.8	**9.5**	8.2	**8.5**	7.4
Sulfate	mg/L	Intrawell Background Value (UPL)	67.3		47.1		259	
		Detection Monitoring Data	28.7	--	37.6	--	105	--
TDS	mg/L	Intrawell Background Value (UPL)	1600		551		696	
		Detection Monitoring Data	809	--	**577**	**574**	**702**	661

Notes
UPL: Upper prediction limit
LPL: Lower prediction limit
TDS: Total dissolved solids
Bold values exceed the background value.
Background values are shaded gray.

ATTACHMENT A

Certification by Qualified Professional Engineer

CERTIFICATION BY QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected statistical method, described above and in the January 15, 2018 *Statistical Analysis Summary* report, is appropriate for evaluating the groundwater monitoring data for the Mitchell LF CCR management area and that the requirements of 40 CFR 257.93(f) have been met.

DAVID ANTHONY MILLER

Printed Name of Licensed Professional Engineer

David Anthony Miller

Signature

22663	WEST VIRGINIA	09.06.2019
License Number	Licensing State	Date

APPENDIX 3 – Alternative Source Demonstrations

The November 2019 ASD report follows.

ALTERNATIVE SOURCE DEMONSTRATION REPORT FEDERAL CCR RULE

Mitchell Plant Landfill
Marshall County, West Virginia

Submitted to

AMERICAN ELECTRIC POWER

1 Riverside Plaza
Columbus, Ohio 43215-2372

Submitted by

Geosyntec consultants

engineers | scientists | innovators

941 Chatham Lane, Suite 103
Columbus, Ohio 43221

November 26, 2019

CHA8462

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

LIST OF ACRONYMS AND ABBREVIATIONS

AEP	American Electric Power
ASD	Alternative Source Demonstration
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
EPA	Environmental Protection Agency
LPL	Lower Prediction Limit
QC	Quality Control
SSI	Statistically Significant Increase
TDS	Total Dissolved Solids
UPL	Upper Prediction Limit
USEPA	United States Environmental Protection Agency

SECTION 1

INTRODUCTION AND SUMMARY

Statistically significant increases (SSIs) in groundwater were identified for chloride and total dissolved solids (TDS) at MW-1102F during the first semi-annual detection monitoring event of 2019. This report presents an alternative source demonstration (ASD) which documents that the SSIs should not be attributed to the Mitchell Plant Landfill.

Following completion of eight background monitoring events at the Mitchell Landfill, upper prediction limits (UPLs) were calculated for each Appendix III parameter to represent background values. A lower prediction limit (LPL) was also calculated for pH. Prediction limits were calculated based on a one-of-two retesting procedure. With this procedure, an SSI is concluded only if both samples in a series of two exceeds the UPL, or in the case of pH is above the LPL. In practice, if the initial result did not result in an exceedance, a second sample was not collected or analyzed.

The first semi-annual detection monitoring event of 2019 at the Landfill was performed in May 2019 (initial sampling event) and June 2019 (verification sampling event) and the results were compared to the calculated prediction limits., A summary of the detection monitoring analytical results for all constituents listed in 40 CFR Part 257 Appendix III and the calculated prediction limits to which they were compared is provided in Table 1.

1.1 <u>CCR Rule Requirements</u>

In accordance with the United States Environmental Protection Agency (USEPA) regulations regarding the disposal of coal combustion residuals (CCR) in landfills and surface impoundments, Rule 40 CFR 257.94(e)(2) states the following:

> *The owner or operator may demonstrate that a source other than the CCR unit caused the statistically significant increase over background levels for a constituent or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. The owner or operator must complete the written demonstration within 90 days of detecting a statistically significant increase over background levels to include obtaining a certification from a qualified professional engineer verifying the accuracy of the information in the report.*

The first semi-annual detection monitoring event for 2019 was completed in May and June 2019 at the Mitchell Plant Landfill. Pursuant to 40 CFR 257.94(e)(2), Geosyntec Consultants, Inc. (Geosyntec) has prepared this ASD report, which documents that the SSIs cited above should not be attributed to the Landfill.

1.2 Demonstration of Alternative Sources

An evaluation was completed to assess possible alternative sources to which identified SSIs could be attributed. Alternative sources were identified amongst five types:

- ASD Type I: Sampling Causes;
- ASD Type II: Laboratory Causes;
- ASD Type III: Statistical Evaluation Causes;
- ASD Type IV: Natural Variation; and
- ASD Type V: Alternative Sources.

A demonstration was conducted to show that the increases in constituent concentrations were based on Type IV causes and not by a release from the Landfill.

SECTION 2

ALTERNATIVE SOURCE DEMONSTRATION

The Federal CCR Rule (40 CFR 257) allows the owner or operator 90 days from the determination of an SSI to demonstrate that a source other than the CCR unit caused the SSI. A brief description of the site geology, ASD evaluation methodology, and the proposed alternative source are described below.

2.1 Site Geology

According to the monitoring well network report, the local geology consists of sandstone units separated by sharp contacts with shale or coal seams (CEC, 2016). From top to bottom, the named sandstone units underlying the Landfill include: the Burton Sandstone, the Fish Creek Sandstone, the Rush Run Sandstone, the Jollytown Sandstone, and the Hundred Sandstone. The Burton Sandstone was not identified as a hydrostatic unit that required monitoring because the unit is not water-bearing upgradient of the Landfill.

2.2 Groundwater Monitoring History

Groundwater at the Landfill has been monitored under the West Virginia Solid Waste Management Rule (33CSR1) since 2012, which is prior to construction of the Landfill in 2013 and the initial waste placement in 2014 (CEC, 2016). Background monitoring under the Federal CCR Rule began in 2016. Wells set within both the Fish Creek Sandstone and Rush Run Sandstone are included in the monitoring network for the Federal program (CEC, 2016). The well of concern (MW-1102F) is set within the Fish Creek Formation. While there are two background wells set within the Fish Creek Formation (MW-1103F and MW-1104F), only MW-1103F consistently produced water during sampling completed under the Federal program. A site map showing the location of Fish Creek Formation monitoring wells is provided in Figure 1.

2.3 Proposed Alternative Source

An initial review of sampling and laboratory data did not identify any Type I (sampling) errors. A review of the laboratory and statistical analyses did not identify any Type II or III issues. An initial review of site geochemistry identified natural variation (Type IV) as the source of the observed chloride and TDS SSIs at well MW-1102F.

2.3.1 Comparison to Background Concentrations

Chloride and TDS at the Landfill are both monitored using intrawell prediction limits. However, a comparison of the reported concentrations for both parameters between MW-1102F and background well MW-1103F shows that concentrations at the background location have consistently been higher (Figure 2). While chloride concentrations are consistently around 250 mg/L at background well MW-1103F, chloride concentrations at downgradient well MW-1102F have not exceeded 20 mg/L. Similarly, TDS concentrations at MW-1102F are consistently several hundred milligrams per liter lower than the concentrations observed at the background location. Thus, the changes in chloride and TDS concentrations at MW-1102F likely represent natural variation in the dilution of ion-rich groundwater as it moves through the aquifer.

2.3.2 Comparison of Groundwater Chemistry to Landfill Leachate

The average concentrations of all major cations and anions are higher in the Landfill leachate than in the groundwater at MW-1102F (Table 2). These data are also shown graphically in Figure 3. Boron and sulfate concentrations are both several orders of magnitude higher in the leachate compared to the average concentration at MW-1102F, whereas the difference in chloride concentrations is less than two orders of magnitude.

A mixing model was created to illustrate how concentrations at MW-1102F would be expected to change if there were a release from the Landfill. Groundwater data at MW-1102F collected under the state program in February 2012, which is prior to waste placement, was used to represent initial conditions at the monitoring location. The sample was mixed with leachate data at varying ratios, and the output was compared to the actual groundwater concentrations at MW-1102F in July 2017, which was the last sample collected under the Federal program where data for all major cations and anions were available.

A slight increase in chloride would be expected if leachate were mixing with groundwater as shown in Figure 4. However, a greater increase in sulfate and boron would be expected, based on the multiple order of magnitude difference in initial concentrations between the leachate and the groundwater. Additionally, both boron and sulfate are conservative species that are not readily attenuated. Time series graphs for boron and sulfate at MW-1102F are provided in Figure 5. While there may be seasonal effects on boron concentrations at MW-1102F, the concentrations remain below the Federal intrawell UPL and do not appear to be consistently trending upwards as would be expected if there were a release from the Landfill. Concentrations of sulfate at MW-1102F remain below both those reported for initial sampling prior to waste placement and the Federal intrawell UPL.

Additionally, if leachate were mixing with groundwater at MW-1102F, then the concentrations of calcium and magnesium would also have increased (Figure 4). Results of the mixing calculation show that the opposite occurred: calcium and magnesium concentrations decreased between February 2012 and July 2017 (Figure 4). The relatively stable and low concentrations of boron and sulfate at MW-1102F and the lack of increases in other cations suggest that the well is not impacted by a release from the Landfill.

2.4 Sampling Requirements

As the ASD described above supports the position that the identified SSIs are not due to a release from the Mitchell Landfill, the unit will remain in the detection monitoring program. Groundwater at the unit will be sampled for Appendix III parameters on a semi-annual basis.

SECTION 3

CONCLUSIONS

This ASD has been prepared in accordance with 40 CFR 257.94(e)(2) and supports the conclusion that the SSIs for chloride and TDS observed during the first semiannual sampling event of 2019 are not due to a release from the Mitchell Landfill. The observed chloride and TDS SSIs were instead attributed to natural variation. Therefore, no further action is warranted and the Mitchell Landfill will remain in the detection monitoring program. Certification of this ASD by a qualified professional engineer is provided in Attachment A.

SECTION 4

REFERENCES

Civil & Environmental Consultants, Inc. (CEC). 2016. CCR Groundwater Monitoring System Demonstration. Mitchell Landfill – Mitchell Power Generation Plant. March.

U.S. EPA, 2015. Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities (Final Rule). Fed. Reg. 80 FR 21301, pp. 21301-21501, 40 CFR Parts 257 and 261, April.

TABLES

Table 1: Detection Monitoring Data Evaluation
Mitchell Plant - Landfill

Parameter	Units	Description	MW-1101R		MW-1102F		MW-1502R	
			5/1/2019	6/12/2019	5/1/2019	6/12/2019	5/2/2019	6/12/2019
Boron	mg/L	Intrawell Background Value (UPL)	0.651		0.320		0.467	
		Detection Monitoring Data	0.376	--	0.126	--	0.100	--
Calcium	mg/L	Intrawell Background Value (UPL)	25.0		6.22		121	
		Detection Monitoring Data	1.9	--	4.69	--	93.6	
Chloride	mg/L	Intrawell Background Value (UPL)	18.6		14.1		213	
		Detection Monitoring Data	16.9	--	**15.2**	**14.9**	**245**	155
Fluoride	mg/L	Intrawell Background Value (UPL)	3.49		0.67		0.25	
		Detection Monitoring Data	2.62	--	0.66	--	0.17	--
pH	SU	Intrawell Background Value (UPL)	9.1		8.6		7.7	
		Intrawell Background Value (LPL)	7.8		7.5		7.1	
		Detection Monitoring Data	**10.5**	8.8	**9.5**	8.2	**8.5**	7.4
Sulfate	mg/L	Intrawell Background Value (UPL)	67.3		47.1		259	
		Detection Monitoring Data	28.7	--	37.6	--	105	--
TDS	mg/L	Intrawell Background Value (UPL)	1600		551		696	
		Detection Monitoring Data	809	--	**577**	**574**	**702**	661

Notes
UPL: Upper prediction limit
LPL: Lower prediction limit
TDS: Total dissolved solids
Bold values exceed the background value.
Background values are shaded gray.

Table 2: Leachate and MW-1102F Concentration Comparison
Mitchell Plant - Landfill

	Leachate	**MW-1102F**
Boron	66.7	0.168
Calcium	342	5.21
Chloride	464	13.6
Fluoride	2.20	0.635
pH	8.7	8.3
Sulfate	8917	35.0
TDS	13140	576
Sodium	1806	228
Potassium	222	1.58

Notes:
TDS - Total dissolved solids
Average concentrations are shown for all parameters.
All concentrations except pH are shown in milligrams per liter (mg/L).
pH is reported as standard units (SU).

FIGURES

Legend

- Compliance Sampling Location
- Upgradient Sampling Location
- CCR Landfill (Approximate Limits of Waste)

Notes

- Monitoring well coordinates provided by AEP.
-Site features based on information available in the Groundwater Monitoring Network Evaluation (CEC, 2016) provided by AEP.

Fish Creek Formation
Site Layout

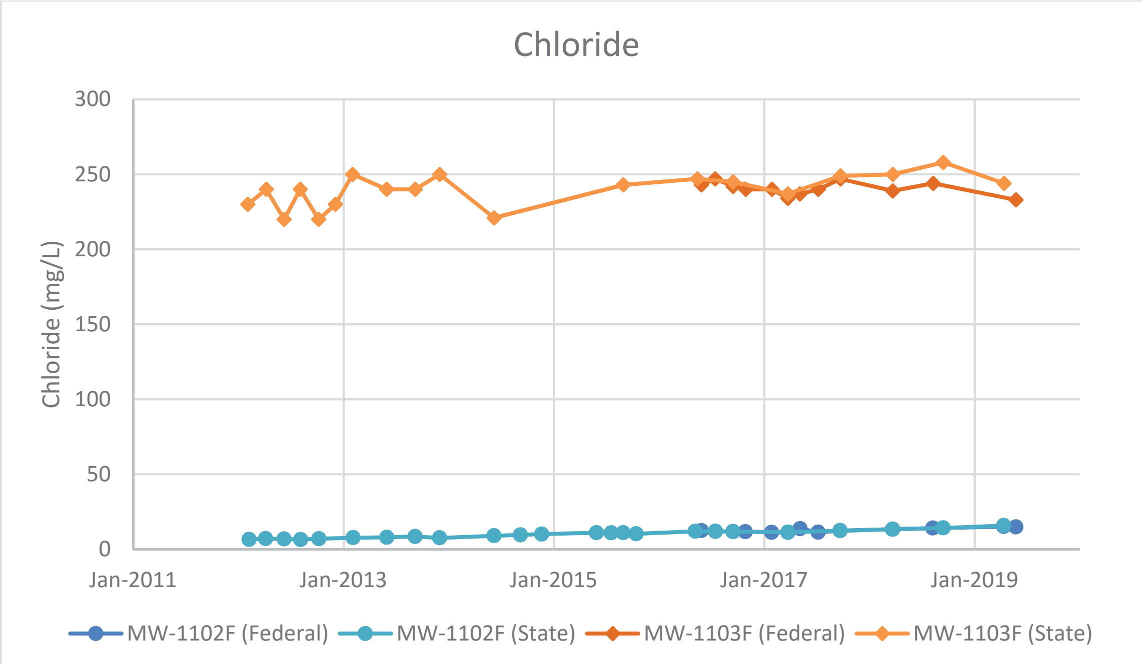
Mitchell Power Generation Plant
Marshall County, West Virginia

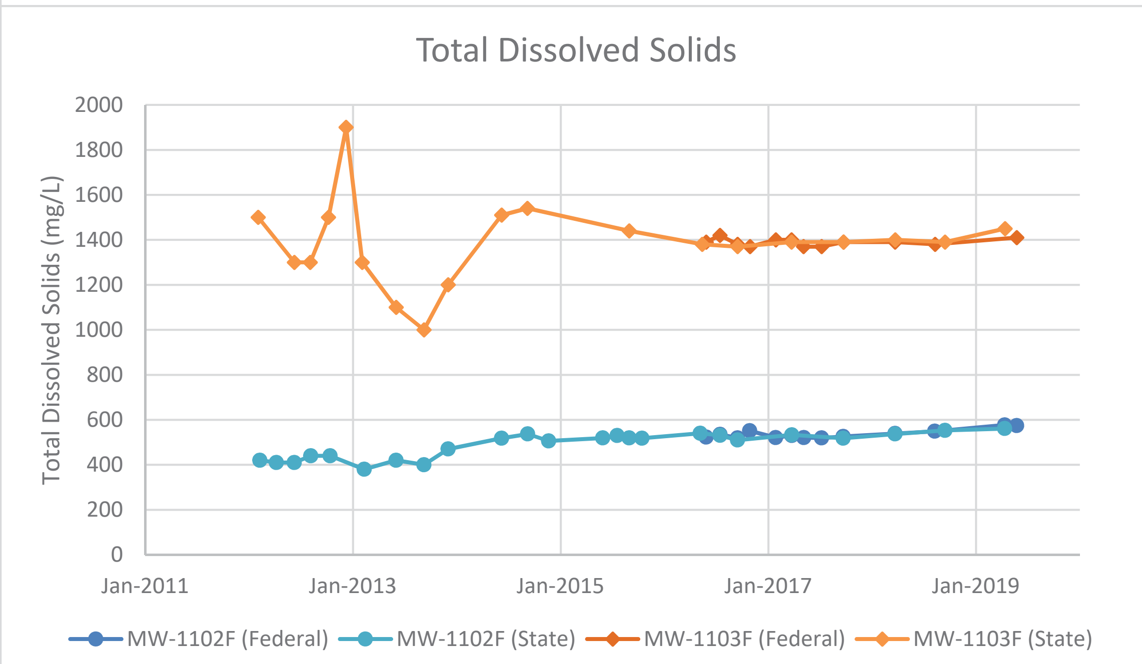
Geosyntec consultants

Columbus, Ohio | 20-Nov-2019

Figure **1**

C:\Users\mmuenich\Documents\local_projects\AEP_GIS\Mitchell\MXDs\Landfill-FC\AEP-Mitchell_LF-Fish-Creek_Site_Layout.mxd. MMuenich. 1/26/2018. Project/Phase/Task.





Notes: Data are shown for both the federal and state monitoring program. MW-1103F is a background monitoring location for the Fish Creek Formation. Downgradient location MW-1102F is also screened in the Fish Creek Formation.

Chloride and TDS Time Series Graphs

Mitchell Landfill

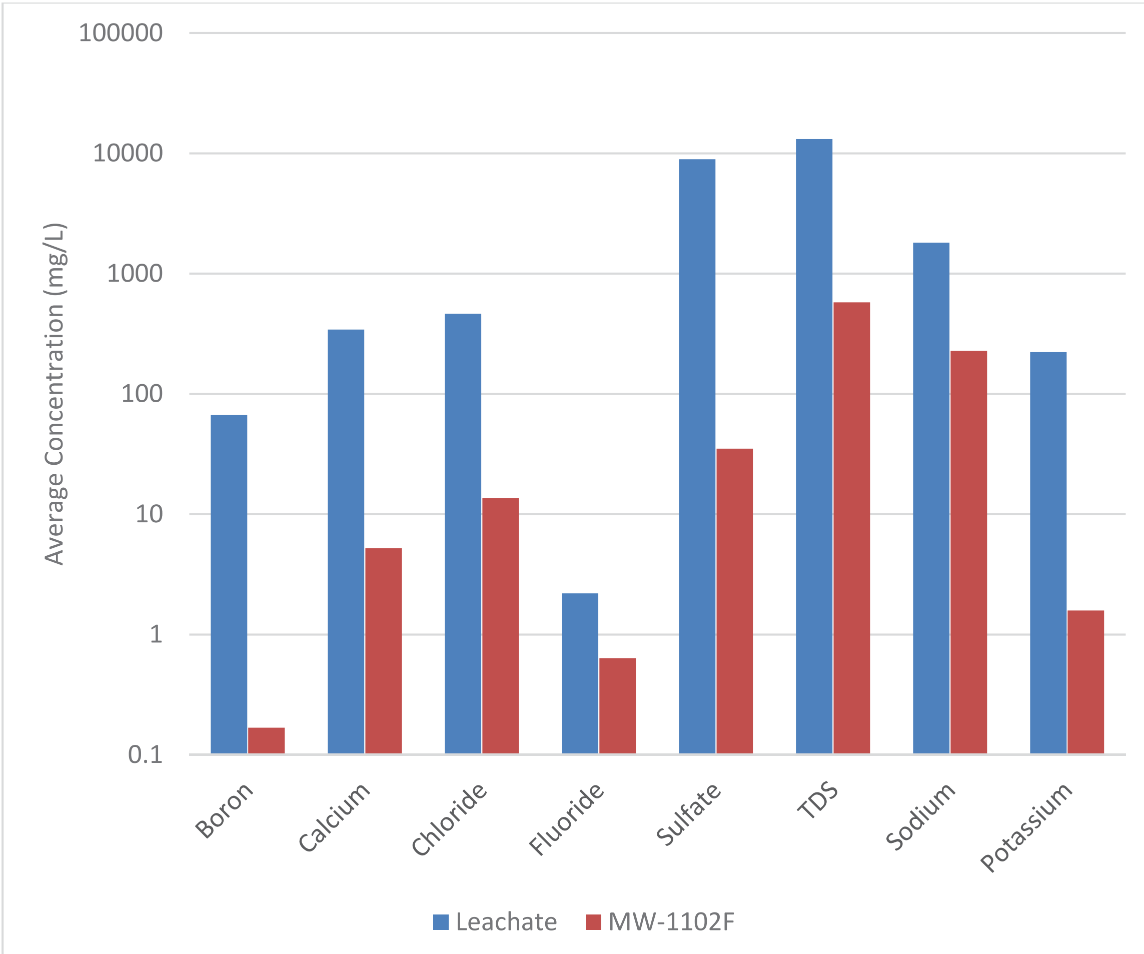
Geosyntec consultants

AMERICAN ELECTRIC POWER

Figure 2

Columbus, Ohio

20-Nov-2019



Notes: pH is not shown, as it is measured in log scale. The average concentration for samples collected during the Federal monitoring program at MW-1102F are shown. Leachate data were collected under the state monitoring program.

Leachate and MW-1102F Concentration Comparison

Mitchell Landfill

Geosyntec consultants

AMERICAN ELECTRIC POWER

Figure

3

Columbus, Ohio

20-Nov-2019

internal info: path, date revised, author

Notes: Solid lines represent reported concentrations for MW-1120F in 2012 (prior to waste placement) and for MW-1120F and Landfill leachate in 2017. Dashed lines represent output of a mixing model for MW-1120F data from 2012 mixed with leachate at varying ratios.

Leachate and MW-1102F Mixing Model

Mitchell Landfill

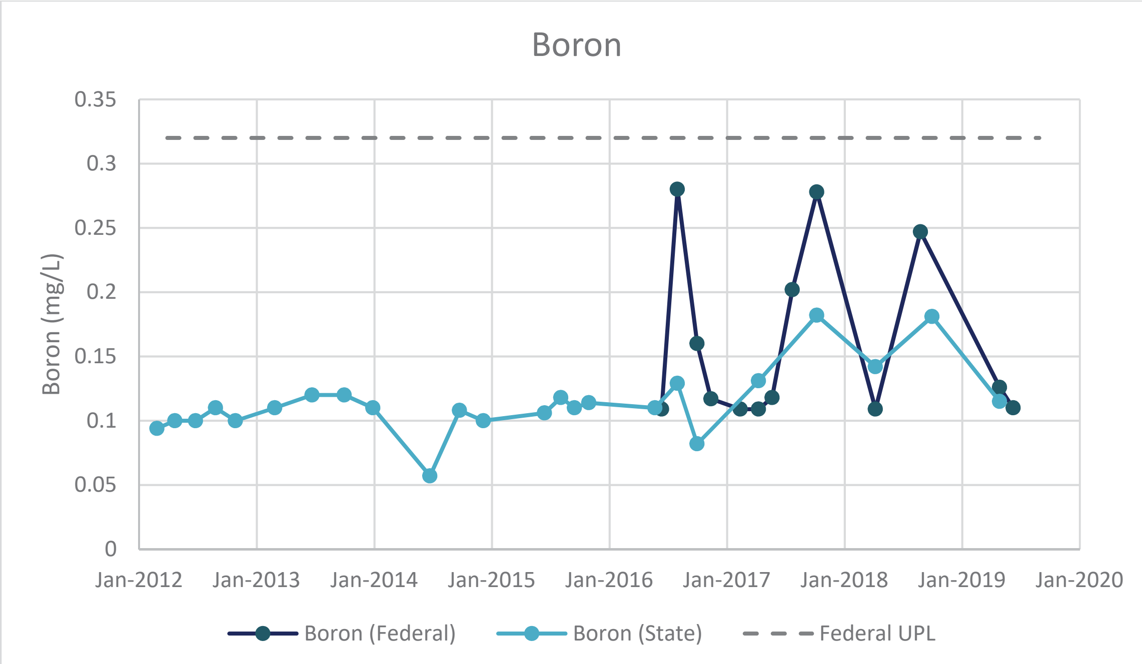
Geosyntec consultants

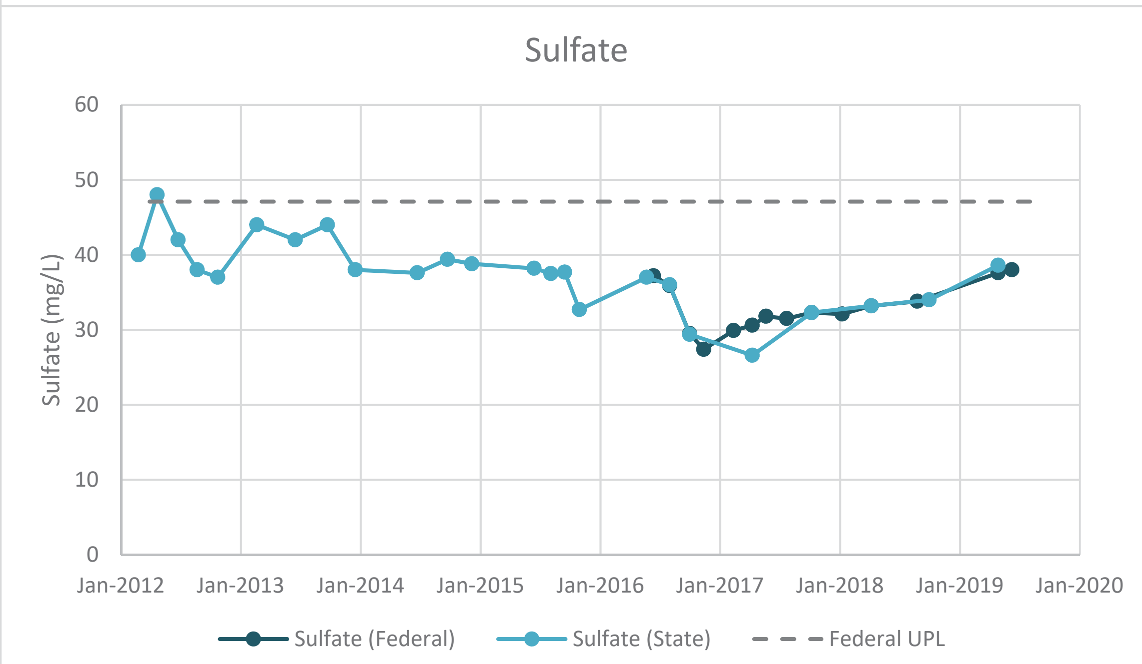
AMERICAN ELECTRIC POWER

Figure 4

Columbus, Ohio

20-Nov-2019





Notes: Data are shown for both the Federal and state monitoring program. UPLs shown were calculated for the Federal monitoring program.

Boron and Sulfate Time Series Graphs

Mitchell Landfill

Geosyntec consultants

AMERICAN ELECTRIC POWER

Figure 5

Columbus, Ohio

20-Nov-2019

internal info: path, date revised, author

ATTACHMENT A

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

CERTIFICATION BY A QUALIFIED PROFESSIONAL ENGINEER

I certify that the selected and above described alternative source demonstration is appropriate for evaluating the groundwater monitoring data for the Mitchell Landfill CCR management area and that the requirements of 40 CFR 257.94(e)(2) have been met.

JOHN P. SEYMOUR
REGISTERED
17091
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

John Seymour
Printed Name of Licensed Professional Engineer

Signature

017091	West Virginia	12/2/2019
License Number	Licensing State	Date

APPENDIX 4 - Notices for Monitoring Program Transitions

No transition between monitoring requirements occurred in 2019; the CCR unit remained in detection monitoring over the entire year. Notices for monitoring program transitions are not applicable at this time.

APPENDIX 5 - Well Installation/Decommissioning Logs

No monitoring wells installed or decommissioned in 2019. Well installation/decommissioning logs are not applicable at this time.

Appendix F

Structural Stability Assessment Required at § 257.73(d)

STRUCTURAL STABILITY ASSESSMENT

CFR 257.73(d)

Bottom Ash Complex

Mitchell Plant
Marshall County, West Virginia

October, 2016

Prepared for: Wheeling Power Company & Kentucky Power Company

Prepared by: American Electric Power Service Corporation

1 Riverside Plaza

Columbus, OH 43215

GERS-16-111

STRUCTURAL STABILITY ASSESSMENT
CFR 257.73(D)
MITCHELL POWER PLANT
BOTTOM ASH COMPLEX

PREPARED BY ______________________ DATE 9/28/2016
Daniel W. Pizzino, P.E.

REVIEWED BY ______________________ DATE 9/28/2016
Mohammad A. Ajlouni, Ph.D.,P.E.

APPROVED BY Gary F. Zych DATE 10/5/2016
Gary F. Zych, P.E.
Manager – AEP Geotechnical Engineering

Gary F. Zych
GARY F. ZYCH
REGISTERED
21201
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER
10/5/2016

I certify to the best of my knowledge, information and belief that the information contained in this structural stability assessment meets the requirements of 40 CFR 257.73(d)

Table of CONTENTS

1.0 OBJECTIVE 257.73(d)

This report was prepared by AEP- Geotechnical Engineering Services (GES) section to fulfill requirements of CFR 257.73(d) – document whether the design, construction, operations, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices.

2.0 NAME AND DESCRIPTION OF CCR SURFACE IMPOUNDMENT

The Mitchell Bottom Ash Pond Complex is located at the Mitchell Power Plant in Marshall County, West Virginia. The impoundment was constructed in 1977 and is comprised of a Bottom Ash Pond and a Clear Water Pond. The purpose of the pond is for the disposal of Bottom Ash produced at the Mitchell Power Plant.

The complex is surrounded by the Mitchell Power Plant on its north side, West Virginia State Route 2 on its east side, the adjacent wallboard facility and ancillary structures on its south side, and the metal cleaning tank, railroad tracks, and the Ohio River on its west side. The Bottom Ash Pond Complex is approximately 17 acres in size and consists of two impounding facilities, the Bottom Ash Pond which is approximately 10 acres, and the Clear Water Pond which is approximately 7 acres. The Bottom Ash Pond comprises the north portion of the complex and the Clear Water Pond comprises the southern portion. The Mitchell Bottom Ash Complex is regulated by the West Virginia Division of Water and Waste Management (WVDWWM) as a Hazard Class “2” Structure.

3.0 STABLE FOUNDATION AND ABUTMENTS 257.73(d)(1)(i)

[Was the facility designed for and constructed on stable foundations and abutments? Describe any foundation improvements required as part of construction.]

Based on the design drawings, the Bottom Ash Pond and Clear Water Pond were constructed partially as incised ponds and partially using raised dike construction.

Based on recent subsurface investigations, the foundation materials of the Bottom Ash Complex consist of a primarily loose to very dense sands and gravels with N-values ranging from 3 to 50. Laboratory testing concluded that foundation soils exhibit an effective cohesion (c’) of 0 and an internal friction angle (Φ) of 34. Based on the findings of the subsurface investigations the foundations materials are suitable for this CCR unit. A stability analysis was performed for the facility which includes an evaluation of the dike system including foundation materials for static, seismic conditions and liquefaction potential. The analysis demonstrates that facility has adequate factors of safety.

Operation of the impoundment is performed so as to not adversely affect the foundation and abutments. As required by the CCR rules the Bottom Ash Pond Complex is inspected at least every 7 days by a qualified person. Also as a requirement of the CCR rules, the impoundment is also inspected annually by a professional engineer. Maintenance items are addressed as they are discovered as a part of those inspections.

4.0 SLOPE PROTECTION 257.73(d)(1)(ii)

[Adequate slope protection to protect against surface erosion, wave action, and adverse effects of sudden drawdown.]

The Bottom Ash Complex was designed and constructed with inboard slopes which are lined with a geomembrane liner overlaid with 3 feet of soil fill. Above the soil fill the inboard slopes are primarily lined with vegetation with portions covered with coarse aggregate. At the portion of the pond where bottom ash removal is managed there is a layer of bottom ash built up along the inboard slopes providing further protection. The outboard slopes primarily consist of grass vegetation with portions of the outboard slope protected by coarse riprap.

Operation and maintenance of the aggregate primarily includes periodic spraying for vegetation control. Grassed slopes are mowed regularly. Any erosion or slips that may occur is repaired within a timely period.

5.0 EMBANKMENT CONSTRUCTION 257.73 (d)(1)(iii)

[Describe the specifications for compaction and/or recent boring to give a relative comparison of density.]

A recent subsurface investigation indicates that the embankment was constructed primarily of loose to very dense clayey, silty, sands that exhibit Standard Penetration Test blow counts (N-values) ranging from 7 to 67. Further laboratory testing on the embankment material was conducted. Recent borings through the embankment and laboratory testing indicate that the material is stiff and representative of a compacted earthen material. A stability analysis of the diking system was also conducted which demonstrates that the facility has a factor of safety greater than minimum values required by the CCR rule.

6.0 VEGETATION CONTROL 257.73 (d)(1)(iv)

[Describe the maintenance plan for vegetative cover.]

The vegetative areas are mowed to facilitate inspections and promote the growth of the vegetative layer; and prevent the growth of woody vegetation.

7.0 SPILLWAY SYSTEM 257.73(d)(1)(v)

[Describe the spillway system and its capacity to pass the Inflow Design Flood as per its Hazard Classification.]

The Bottom Ash Complex has been determined to be a Significant Hazard potential CCR impoundment. Based on this hazard classification the design flood is determined by section 257.82(a)(3) to be the 1000-year storm which corresponds to 7.10 inches in 24 hours for this site. An analysis was performed which demonstrates the Bottom Ash Complex can safely pass the 1/2 PMP (Probable Maximum Precipitation), which is equivalent to 13.45 inches in 6 hours and therefore exceeds the requirements of section 257.82(a)(3).

The Bottom Ash Complex is a raised dike structure with no offsite contributing drainage area. As runoff enters the Bottom Ash Pond is conveyed to the Clear Water Pond via a concrete overflow shaft and a 30-inch diameter reinforced concrete pipe to a 30-inch diameter perforated distribution pipe in the Clear Water Pond. Runoff entering the Clear Water Pond is conveyed through an overflow tower into a 36-inch diameter reinforced concrete pipe through the embankment and then a series of 36-inch diameter corrugated metal pipes which discharge into a riprap-lined channel leading to the Ohio River.

Maintenance of the conveyance structures is performed as needed based on periodic 7-day and annual inspections.

8.0 BURIED HYDRAULIC STRUCTURES 257.73 (d)(1)(vi)

[Describe the condition of the sections of any hydraulic structure that in buried beneath and/or in the embankment.]

The principal outlet pipe from the Clear Water Pond passes though the dike near the southwestern side of the impoundment. The portion of the outlet pipe that passes though the embankment is reinforced concrete pipe and was installed in 1977 as part of the original impoundment construction. The pipe was primarily installed within natural ground through the incised portion of the dike. There are no performance issues with the outlet pipe that would indicate plugging or failure of the pipe. Given that this portion of pipe is reinforced concrete, structural integrity is not considered to be an issue. In general reinforced concrete pipes have a long service life under a range of conditions and is an appropriate design for this application.

In 2015 a two 6" cooling tower blowdown water drain lines were installed along the northern embankment of the bottom ash pond. The lines were installed within a shallow trench excavation within the crest of the embankment. The project was designed by a professional engineer and permitted through the West Virginia Department of Environmental Protection – Division of Water and Waste Management (WVDWWM).

9.0 SUDDEN DRAWDOWN 257.73 (d)(1)(vii)

[If the downstream slope is susceptible to inundation, discuss the stability due to a sudden drawdown.]

The downstream slope of the Bottom Ash Pond is not expected to be inundated from any adjacent water bodies.

Appendix G

Safety Factor Assessment Required at

§ 257.73(e)

AEP AMERICAN ELECTRIC POWER

We power life's possibilities

CCR RULES ASSESSMENT AND CERTIFICATION
MITCHELL PLANT BOTTOM ASH COMPLEX
KENTUCKY POWER COMPANY
AEP SERVICE CORPORATION

PREPARED BY:

GEO/ENVIRONMENTAL ASSOCIATES, INC.
A SCHNABEL ENGINEERING COMPANY
KNOXVILLE, TENNESSEE

PROJECT NUMBER 15055013.00
DECEMBER 22, 2015

GA

TABLE OF CONTENTS

APPENDICES

CCR RULES ASSESSMENT AND CERTIFICATION
MITCHELL POWER PLANT BOTTOM ASH COMPLEX
KENTUCKY POWER COMPANY
MARSHALL COUNTY, WEST VIRGINIA
DECEMBER 22, 2015

INTRODUCTION

Geo/Environmental Associates, Inc. (GA) has performed a site inspection, conducted an engineering assessment, and prepared a certification statement for the Mitchell Power Plant Bottom Ash Complex. These services were performed to meet specific requirements set forth in the Environmental Protection Agency's CCR Rules.(1) Provided in this report is a discussion of GA's findings and a certification statement pertaining to the facility. Field and laboratory data, engineering analyses, and a drawing are included in the appendices.

SITE DESCRIPTION

General

The Mitchell Bottom Ash Complex is equally owned by American Electric Power Generation Resources, Inc. and Kentucky Power Company (KPC) and it is operated by KPC to provide disposal capacity for bottom ash generated at the Mitchell Power Plant. AEPSC, based in Columbus, Ohio, provides engineering support for the Bottom Ash Complex. The Mitchell Bottom Ash Complex is located near Cresap in Marshall County, West Virginia at approximately latitude 39° 49' 30" and longitude 80° 48' 56".

The complex is surrounded by: (1) the Mitchell Power Plant on its north side, (2) West Virginia State Route 2 on its east side, (3) the adjacent wallboard facility and ancillary structures on its south side, and (4) the metal cleaning tank, railroad tracks, and the Ohio River on its west side. As shown on drawing sheet 1 in Appendix IV, the Mitchell Bottom Ash Complex consists of two impounding facilities: (1) the Bottom Ash Pond and (2) the Clear Water Pond. The Bottom Ash Pond comprises the north portion of the complex and the Clear Water Pond comprises the southern portion. The Mitchell Bottom Ash Complex is regulated by the West Virginia Division of Water and Waste Management (WVDWWM) as a Hazard Class "2" structure.

The Bottom Ash Pond is separated into ponding areas in its western and northeastern portions. In general, bottom ash is sluiced into the northeastern portion of the pond; where after, the sluice water is routed through an interior splitter dike to the western portion of the pond. Flow through the western portion of the pond is routed around three interior flow diversion dikes. The southeastern portion of the Bottom Ash Pond is above the normal operating pool (pond) level

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(1) Environmental Protection Agency, 40 CFR Parts 257 and 261, "Hazardous and Solid Waste Management System; Disposal of Coal combustion Residuals from Electric Utilities; Final Rule," April 17, 2015

and is used as an excavation and loadout area for bottom ash. The Bottom Ash Pond was constructed partially as an incised pond and partially using raised dike construction. Specifically, the pool level on the east side of the pond is generally below the bottom elevation of the east dike (i.e., it is incised). The inside slopes of the Bottom Ash Pond are lined with a composite soil and PVC liner. The southern dike separates the Bottom Ash Pond and Clear Water Pond.

Overflow from the western portion of the Bottom Ash Pond is conveyed to the Clear Water Pond via a concrete overflow shaft and a 30-inch diameter reinforced concrete pipe to a 30-inch diameter perforated distribution pipe in the Clear Water Pond. The Clear Water Pond was constructed using both incised pond and diked pond construction methods. In general, the pool levels along the southern and eastern sides of the Clear Water Pond are primarily incised. Similar to the Bottom Ash Pond, the inside slopes of the Clear Water Pond are lined with a composite soil and PVC liner. Overflow from the Clear Water Pond is conveyed through an overflow tower into a 36-inch diameter reinforced concrete pipe through the embankment and then a series of 36-inch diameter corrugated metal pipes which discharge into a riprap-lined channel leading to the Ohio River.

Approximate Existing Conditions

A summary of the approximate existing conditions for the Mitchell Bottom Ash Complex is provided in List 1. A site plan view of the facility is included in Appendix IV.

LIST 1
SUMMARY OF APPROXIMATE EXISTING CONDITIONS
FOR MITCHELL BOTTOM ASH COMPLEX

Bottom Ash Pond Crest Elevation .... 690 feet, NAVD
Bottom Ash Pond Normal Operating Pool Level .... 681 feet, NAVD
Bottom Ash Pond Design Storm Level (1) .... 682.98 feet, NAVD
Bottom Ash Pond Bottom Level .... 660 feet, NAVD
Clear Water Pond Crest Elevation .... 675 feet, NAVD
Clear Water Pond Normal Operating Pool Level .... 664 feet, NAVD
Clear Water Pond Design Storm Level (2) .... 665.62 feet, NAVD
Clear Water Pond Bottom Level .... 645 feet, NAVD

Notes:

(1) The Bottom Ash Pond maximum design storm level is based on a normal operating pool elevation of 681 feet, NAVD and a pool increase of 1.98 feet during the 1/2 PMP 6-hour storm event.
(2) The Clear Water Pond maximum design storm level is based on a normal operating pool elevation of 664 feet, NAVD and a pool increase of 1.62 feet during the 1/2 PMP 6-hour storm event.

SITE INSPECTION

At the request of AEPSC, GA personnel performed a site inspection of the Bottom Ash Complex to observe and document the prevalent site conditions. Specifically, Seth W. Frank, P.E. (GA) performed a site inspection of the Bottom Ash Complex on July 14, 2015. It is GA's opinion that the Bottom Ash Complex is in good condition. Moreover, GA believes that the conditions observed, during the July 14, 2015, site inspection, are representative of the conditions modeled in the assessments and analyses provided in this report.

FIELD, LABORATORY, AND INSTRUMENTATION DATA

For reference, pertinent field and laboratory data for the Bottom Ash Complex is provided in Appendix I. The field and laboratory data were gathered during a subsurface investigation coordinated by GA in 2009. The field data includes detailed borehole logs and results of in-situ testing (i.e., standard penetration testing). Laboratory data provided in Appendix I includes: (1) grain size distributions, (2) Atterberg limits test results, (3) unconfined compressive strength test results, and (4) triaxial compressive strength test results.

AEP monitors four standpipe piezometers, at the Bottom Ash Complex facility, monthly. Results of instrumentation monitoring are collected and summarized in annual inspection reports.

Locations of the site boreholes/piezometers are shown on the Site Plan View drawing in Appendix IV.

HYDRAULICS AND HYDROLOGY

Flood routing analyses were developed for the existing conditions at the Bottom Ash Complex using the *HEC-1* computer program, developed by the U.S. Army Corps of Engineers. Flood routing parameters and the *HEC-1* output are provided in Appendix II. In accordance with the 40 CFR Parts 257 and 261 (CCR Rules), the flood routing analyses were performed using the 1/2 PMP 6-hour storm event. A summary of the flood routing results is provided in Table 1.

TABLE 1
SUMMARY OF FLOOD ROUTING ANALYSES FOR EXISTING CONDITIONS

Pond	Crest Elevation (ft, NAVD)	Design Storm	Principal Spillway/Overflow Structure Invert Elevation/Pool at Start of storm (ft, NAVD)	Peak Inflow (cfs)	Peak Outflow (cfs)	Peak Stage (ft, NAVD)	Minimum Freeboard (ft)
Bottom Ash	690'	1/2 PMP6-hour	681'	111.08	23.83	683.51	6.49
Clearwater	675'	1/2 PMP6-hour	664'	71.44	44.76	666.50	8.50

As shown in Table 1, the as-built Bottom Ash Pond and Clearwater Pond are capable of storing/routing the 1/2 PMP 6-hour storm event, while providing at least 3 feet of freeboard for the minimum embankment crest elevations of 690 feet, NAVD and 675 feet, NAVD respectively. Note that the storm routing analyses assume a constant, peak inflow of 7.5 million gallons per day from plant processes, in addition to the storm runoff.

SLOPE STABILITY ANALYSES

General

The computer program *SLOPE/W*, developed by GEO-SLOPE International, Ltd., was used to perform slope stability analyses on two critical embankment profiles for the as-built Bottom Ash Complex. Specifically, the Morgenstern-Price limit equilibrium method was applied in the slope stability analyses. The slope stability analyses were conducted for the as-built Bottom Ash Complex Profiles SP1-SP1 and SP2-SP2. Locations of the critical profiles are shown on the drawing in Appendix IV. Section SP1-SP1 was chosen as a critical section because of its height and potential to directly release material during a failure. Section SP2-SP2 was selected as a critical section because it is the highest embankment (measured from the crest to the downstream toe) and impounds water against both the upstream face and the downstream toe. A failure at Section SP2-SP2 would likely be contained in the Clear Water Pond, but would likely release sediment/ash through the Clear Water Pond spillway causing environmental damage and potentially clogging the spillway. Slope stability loading conditions and factor of safety requirements are outlined in the CCR Rules. Where applicable, those requirements were modeled for the critical embankment profiles. A description of the slope stability analyses/assessments follows.

Static Factor of Safety Under Long Term, Maximum Storage Pool Loading Conditions

The long term, maximum storage pool loading condition was modeled in the downstream direction for the critical embankment profiles. Specifically, the Bottom Ash Pond normal operating pool elevation of 681 feet, NAVD and the Clearwater Pond normal operating pool elevation of 664 feet, NAVD were modeled in the slope stability analyses. The phreatic levels within the profiles were conservatively assumed to extend linearly from the pool on the upstream side to the toe or pool on the downstream side. Historical piezometer levels indicate phreatic levels considerably lower than those modeled.

Static Factor of Safety Under Maximum Surcharge Pool Loading Conditions

The maximum surcharge pool loading condition was modeled in the downstream direction for the critical embankment profiles. Specifically, the 1/2 PMP 6-hour design storm peak stage for the Bottom Ash Pond and the Clearwater Pond of 682.98 feet, NAVD and 665.62 feet, NAVD respectively, were modeled in the impoundments for the slope stability analyses. For the maximum surcharge pool loading condition a minimum factor of safety equal to 1.2 is required. The phreatic levels within the profiles were conservatively assumed to extend linearly from the pool on the upstream side to the toe or pool on the downstream side. Historical piezometer levels indicate phreatic levels considerably lower than those modeled. It should be noted that the existing principal spillway and overflow structures are capable of routing the excess storage in a short period of time. Therefore, it is unlikely that an elevated steady-state phreatic level will fully develop through the embankment during the maximum surcharge pool loading conditions.

Seismic Factor of Safety

The seismic loading condition was modeled in the upstream and downstream direction for the critical embankment profiles. The Bottom Ash Pond normal operating pool elevation of 681 feet, NAVD and the Clearwater Pond normal operating pool elevation of 664 feet, NAVD were modeled in the seismic slope stability analysis. Based on the *2008 Interactive Deaggregations* website provided online through the USGS Geologic Hazards Science Center, the Bottom Ash Complex facility has a peak ground acceleration of 0.046g for a seismic loading event with a mean return time of 2,475 years. Conservatively assuming soft soil ground conditions above rock, translates to a peak horizontal ground surface acceleration of approximately 0.*12* g. Using a commonly applied factor of 0.5 times the peak horizontal acceleration yields the conservative horizontal seismic coefficient of 0.06 that was applied in the slope stability analyses. As described in the previous sections, the phreatic levels within the profiles were conservatively assumed to extend linearly from the pool on the upstream side to the toe or pool on the downstream side of the embankment.

Liquefaction Assessment

The CCR Rules state that "Liquefaction analysis is only necessary in instances where CCR surface impoundments show, through representative soil sampling, construction documentation, or anecdotal evidence from personnel with knowledge of the CCR unit's construction, that soils of the embankment are susceptible to liquefaction." Based on the results of the 2009 subsurface investigation, the embankment consists primarily of dense to very dense silty, clayey sands. However, the original ground (foundation) materials consist primarily of loose to medium dense, silty sands (i.e., corrected SPT blow count – N – values ranging from 2.3 to 43.6, with median values for each boring ranging from 5.2 to 18.1). See the boring logs and summary of corrected SPT blow counts located in Appendix I. Strength loss in sands during an earthquake is generally considered unlikely when blow counts are greater than 15[(2)]. Although the majority of blow counts occurred at lower depths of natural materials tested, for our liquefaction analyses, we conservatively assume uniform material parameters throughout the natural ground interval.

The *QUAKE/W* computer program developed by GEO-SLOPE International, Ltd., was used to perform dynamic finite element stress analyses for the two critical sections, SP1-SP1 and SP2-SP2. The dynamic analysis consisted of the following three steps/analyses: (1) an initial static analysis that determines the initial stress conditions, (2) a dynamic analysis using a scaled

(2) Engineering and Design Manual – Coal Refuse Disposal Facilities, 2nd Ed., Mine Safety and Health Administration (based on data from Seed and Harder, 1990; Castro, 1995; Wride et. al., 1999)

earthquake record that determines potentially liquefiable zones, and (3) a Newmark Deformation analysis that determines the critical failure surface and corresponding factor of safety. The dynamic conditions were modeled using earthquake time-acceleration data for an earthquake centered in the Giles County, Virginia, area. Time-acceleration data for the Giles County earthquake was provided in *Research Report KTC-96-4 Source Zones, Recurrence Rates, and Time Histories for Earthquakes Affecting Kentucky*. The earthquake was scaled to the earthquake ground acceleration value of 0.05g, based on the *2008 Interactive Deaggregations* value described in the previous section. The phreatic levels used in the initial static analyses are conservatively applied using approximately the maximum phreatic level recorded since piezometers were installed in 2009.

End of Construction Analyses

The CCR Rules require that "End-of-Construction loading condition must be calculated for new CCR surface impoundments to ensure that the CCR surface impoundment can withstand a "first filling" of the embankment, during which time the embankment first becomes saturated and is subject to phreatic flow through the cross-section." First filling of the Bottom Ash Complex occurred in the mid to late 1970s and the embankments have developed a "measureable" steady-state phreatic surface through the critical profiles. Therefore, an End-of-Construction analysis is not necessary for the Bottom Ash Complex embankments.

Assumptions and Parameters

GA selected the strength parameters that were applied in the slope stability analyses using site specific field and laboratory data. Strength parameters are based on field and laboratory data gathered during a subsurface investigation coordinated by GA in 2009. For reference, the laboratory testing data is provided in Appendix I. A summary of material strength parameters is provided in Table 2.

TABLE 2
SUMMARY OF STRENGTH PARAMETERS USED IN SLOPE STABILITY ANALYSES

Material	Moist Unit Weight (pcf)	Saturated Unit Weight (pcf)	Effective Strength Parameters	
			Cohesion, c' (psf)	Friction Angle, φ' (degrees)
Soil Dike	124	134	300	29
Original Soil	120	130	0	34
Cohesive Liner	121	131	900	0

Material parameters used in the finite element liquefaction assessment are provided in Table 3. Parameters were based on site specific data and from accepted reference materials in relation to the site specific soils/conditions.

TABLE 3
SUMMARY OF MATERIAL PARAMETERS USED IN LIQUEFACTION ANALYSES

	Soil Dike (Clayey, Silty, Sand)	Original Ground (Silty Sand)	Cohesive Liner (Clay)
Damping Ratio Function[1]	Seed – Idriss	Seed – Idriss	Clay – Sun
Small Strain Shear Modulus G_{max} (psf)	121,540	166,540	QUAKE/W Function
Source[2]	GA – Triaxial Estimate	GA – Triaxial Estimate	QUAKE/W
Poisson's Ratio	0.28	0.28	0.3
Source[3]	Bowles	Bowles	Bowles
Cyclic Number Function[4]	QUAKE/W	QUAKE/W	None

Notes: (1) Damping Ratios from:
- Seed – Idriss (SHAKE91 User's Manual)
- Clay – Sun, et.al.

(2) G_{max} values estimated from results of triaxial tests performed by GA and built-in QUAKE/W function based on work by Hardin, Drnevich, Mayne, and Rix.

(3) Poisson's Ratio based on typical values described in Foundation Analysis and Design, 4th Ed., Joseph E. Bowles, P.E., S.E.

(4) Cyclic Number Function is a QUAKE/W built-in function based on work by Seed and Lee.

Summary of Results

A summary of the slope stability analysis results are provided in Table 4. *SLOPE/W* and *QUAKE/W* results showing the modeled profiles, loading conditions, areas of potential liquefaction, and critical failure surfaces are provided in Appendix III.

TABLE 4 SUMMARY OF SLOPE STABILITY ANALYSES RESULTS						
	Slope Stability Safety Factors					
Profile	Downstream Static Long-Term Maximum Storage Pool	Downstream Static Maximum Surcharge Pool	Downstream Seismic	Upstream Seismic	Downstream Liquefaction Assessment	Upstream Liquefaction Assessment
SP1-SP1	2.09	2.04	1.80	2.08	2.02	1.20
SP2-SP2	1.87	1.87	1.53	2.01	1.21	1.24

As shown in the slope stability analysis results in Table 4, and the *SLOPE/W* and *QUAKE/W* computer output in Appendix III, the factors of safety meet the requirements specified in the CCR Rules. Although the liquefaction assessment shows areas that are potentially liquefiable (see elements shaded in yellow in the *QUAKE/W* results in Appendix III), we feel that the assessment is very conservative based on parameter selection. A summary of the phreatic levels modeled in the stability analyses is provided in Table 5.

TABLE 5 SUMMARY OF PHREATIC LEVELS USED IN STABILITY ANALYSES				
	Piezometric Surface Elevation at Piezometer Location (Feet, NAVD)			
Profile	Downstream Static Long-Term Maximum Storage Pool	Downstream Static Maximum Surcharge Pool	Seismic	Liquefaction Assessment
SP1-SP1	675	677	675	669 (2) (maximum measured)
SP2-SP2	675	676.5	675	669 (2) (maximum measured)
	690 (1) (FS = 1.35)			
	682 (1) (FS = 1.5)			

(1) For reference, we included hypothetical elevated phreatic levels for Section SP2 (the more critical section for Static Stability). Specifically, we assumed the embankment was fully saturated to the crest (690 feet, NAVD) and to elevation 682 feet, NAVD, corresponding to a Factor of Safety (FS) of 1.5.

(2) 669 feet, NAVD is approximately the maximum measured piezometer level for Sections SP1 and SP2, since piezometers were installed in March of 2009.

CERTIFICATION STATEMENT

Based on the site inspections, review of construction monitoring and periodic inspection data, the results of the field and laboratory testing of the materials used in the embankment construction, and our review of the as-built embankment geometry; it is our opinion that the embankments within the Bottom Ash Complex have slope stability factors of safety that meet or exceed the requirements in the CCR Rules. Furthermore, based on our review of the as-built embankment geometries, current operating pool levels, and the existing spillway and overflow system; we believe that the facility is capable of storing/routing the runoff from the 1/2 PMP 6-hour storm event.

Accordingly, I hereby certify that the Bottom Ash Complex is generally maintained in good condition and the facility generally meets the stability requirements in the CCR Rules. It should be clearly noted that this certification is not a legal guarantee. This certification is merely a statement by a registered professional engineer that, to the best of his knowledge, the facility was generally constructed according to the approved plan and that it meets the applicable stability requirements set forth in the CCR Rules. No warranties, expressed or implied, are provided. If you have any questions regarding the information provided, please contact me at 865-584-0344.

Seth W. Frank | 12-22-2015

Seth W. Frank, P.E. | Date

West Virginia R.P.E. No. 20574

SETH W. FRANK
REGISTERED
20574
STATE OF
WEST VIRGINIA
PROFESSIONAL ENGINEER

Appendix I

Field and Laboratory Data

Geo/Environmental Associates, Inc.

Boring No. B-1

PROJECT: AEP Mitchell BAP

PROJECT NO: 09-379

Start Date: 3-4-09

Finish Date: 3-4-09

Logged By: Seth Frank

Location: N 485362.82 E 1599372.71NAD83

Ground Elevation: 692.42' NAVD88

Drilling Contractor: Horn and Associates

Driller: Tom Leininger

Helper: Jared and Bradley

Drill Type: Dietrick D50

Notes:

Thickness of Soil:

Depth Drilled In Rock:

Total Depth of Boring: 51.0'

DEPTH (FEET) FROM	TO	SAMPLE NOS., & SPLIT SPOON RECOVERY	SOIL/BEDROCK DESCRIPTION	BLOW COUNTS AND COMMENTS
2.0	3.5	S-1 / 1.2'	SAND, brown w/green & yellow, gravel, dense, damp	15-22-19
4.5	6.0	S-2 / 1.3'	SAND, brown w/grey & yellow, gravel, very dense, damp	17-32-24
7.0	8.5	S-3 / 1.3'	SAND, clayey, silty , brown, gravel, medium dense, moist	10-11-15
9.5	9.9	ST-1 / 0.4'	SAND, clayey, silty, brown, gravel, moist	
12.0	13.5	S-4 / 1.4'	0-0.2': SAND, brown, gravel; 0.2-0.6': SAND, black (possible bottom of preexisting fill); 0.6-1.0': SAND, grey/white; 1.0-1.4': SAND- silty, brown, dense, damp	10-20-19
14.5	16.0	S-5 / 1.2'	SILT, sandy, clayey, gravel, medium dense to very stiff (qu>5tsf), damp	8-12-13
17.0	18.5	S-6 / 1.5'	SAND, brown, gravel, medium dense, damp	9-9-10
19.5	20.5	S-7 / 1.1'	SAND, gravely, brown, medium dense, damp	6-7-5
22.0	23.5	S-8 / 1.3'	SAND, brown, gravel, medium dense, damp	5-5-6

Geo/Environmental Associates, Inc.

Project Name/ Job Number: 09-379

Boring Log No.: B-1

Page 2 of 2

DEPTH (FEET)		SAMPLE NO., SAMPLE INTERVAL & SPLIT SPOON RECOVERY	SOIL/BEDROCK DESCRIPTION	BLOW COUNTS AND COMMENTS
FROM	TO			
24.5	26.0	S-9 / 1.3'	SAND, brown, river rock, medium dense, wet	4-5-6
30.0	31.5	S-10 / 1.2'	GRAVEL, sandy, brown, very loose, wet	1-2-1
35.0	36.5	S-11 / 1.3'	SAND, silty, brown, gravel, loose, wet	3-4-3
39.5	42.0	ST-2 / 2.3'	SAND, gravely, brown, wet	
44.5	46.0	S-12 / 1.2'	SAND, gravely, brown, loose, wet	4-4-4
49.5	51.0	S-13 / 1.2'	SAND, brown, mottled black, medium dense, wet	5-5-5
			TRANSITION FROM DIKE TO ORIGINAL AT APPROXIMATELY 10.0'-12.0'	

Geo/Environmental Associates, Inc.

PROJECT: AEP Mitchell BAP	PROJECT NO: 09-379
Start Date: 3-4-09	Drilling Contractor: Horn and Associates
Finish Date: 3-5-09	Driller: Tom Leininger
Logged By: Seth Frank	Helper: Jared and Bradley
Location: N 485698.27 E 1598947.58 NAD83	Drill Type: Dietrick D50
Ground Elevation: 690.72' NAVD88	
Notes: Set piezometer to tip depth of 31.0'	Thickness of Soil:
Well dry at 31' on 3-5-09.	Depth Drilled In Rock:
Piezometer Elevation: 690.59' NAVD88	Total Depth of Boring: 51.0'
Casing Elevation: 691.78' NAVD88	

DEPTH (FEET)		SAMPLE NOS., & SPLIT SPOON RECOVERY	SOIL/BEDROCK DESCRIPTION	BLOW COUNTS AND COMMENTS
FROM	TO			
2.0	3.5	S-1 / 1.3'	SAND, brown, gravel, medium dense, moist	6-6-6
4.5	6.0	S-2 / 1.4'	SAND, brown, gravel, medium dense, moist	5-8-9
7.0	8.5	S-3 / 1.4'	SAND, silty, brown, gravel, very dense, damp	15-22-32
9.5	11.0	S-4 / 1.4'	SAND, silty, brown, gravel, very dense, moist	15-26-31
12.0	13.5	S-5 / 1.2'	SAND, clayey, silty, brown, gravel, medium dense, damp-moist	12-15-15
14.5	14.7	ST-1 / 0.2'	SAND, clayey, silty, brown, gravel, moist	
17.0	18.5	S-6 / 1.3'	CLAY, sandy, silty, brown mottled black, gravel, medium dense – very stiff (qu = 2.5tsf), moist	6-5-10
19.5	19.5	S-7 / 0.0'		NO RECOVERY
22.0	23.5	S-8 / 1.0'	SAND, brown, gravel, medium dense, damp (estimated original ground)	4-5-6
24.5	26.0	2-9 / 1.1'	SAND, brown, gravel, loose, damp – distinct 0.2' black, sandy layer at top of sample	4-5-4
29.0	30.5	S-10 / 1.2'	SAND, brown, clean, loose, damp	1-4-3
34.5	36.5	ST-2 / 1.7'	SAND, brown, light brown, damp	

Geo/Environmental Associates, Inc.

Project Name/ Job Number: 09-379

Boring/Well Log No.: B-2

DEPTH (FEET)		SAMPLE NO., SAMPLE INTERVAL & SPLIT SPOON RECOVERY	SOIL/BEDROCK DESCRIPTION	BLOW COUNTS AND COMMENTS
FROM	TO			
44.5	46.0	S-12 / 1.4'	SAND, brown, clean, loose, damp	3-3-4
49.5	51.0	S-13 / 1.5'	SAND, brown, clean, loose, moist – transition at 0.7' to clay, sandy, brown, firm (qu=1.0tsf), wet	3-2-2

TRANSITION FROM DIKE TO ORIGINAL AT APPROXIMATELY 24.5
SET PIPE AT 31.0'

51.0	to	35.0	SAND CUTTINGS
35.0	to	32.0	BENTONITE
32.0	to	31.0	SAND
31.0	to	20.8	SCREEN
20.8	to	0.3	RISER
32.0	to	14.5	SAND
19.5	to	16.5	BENTONITE
16.5	to	3.0	GROUT
3.0	to	0.0	CONCRETE WITH MAN HOLE

W/L DRY @ 50.0'

Geo/Environmental Associates, Inc.

Boring No. B-3

Page 1 Of 2

PROJECT: AEP Mitchell BAP

PROJECT NO: 09-379

Start Date: 3-3-09

Finish Date: 3-5-09

Logged By: Seth Frank

Location: N 485238.72 E1598811.08 NAD83

Ground Elevation: 691.80' NAVD88

Drilling Contractor: Horn and Associates

Driller: Tom Leininger

Helper: Jared and Bradley

Drill Type: Dietrick D50

Notes: Set piezometer to tip depth of 31.0'

W/L at 23.3' below top of pipe on 3-5-09

Casing Elevation: 691.85' NAVD88

Piezometer Elevation: 691.54' NAVD88

Thickness of Soil:

Depth Drilled In Rock:

Total Depth of Boring: 51.0'

DEPTH (FEET)		SAMPLE NOS., & SPLIT SPOON RECOVERY	SOIL/BEDROCK DESCRIPTION	BLOW COUNTS AND COMMENTS
FROM	TO			
2.0	3.5	S-1 / 1.2'	SAND, brown, gravel, very dense, damp	12-27-39
4.5	6.0	S-2 / 1.3'	SAND, brown, gravel, very dense, damp	14-29-30
7.0	8.5	S-3 / 1.4'	SAND, brown, gravel, dense, moist	18-23-26
9.5	9.9	ST-1 / 0.4'	SAND, brown, gravel, moist	
12.0	13.5	S-4 / 1.0'	SAND, dark brown, gravel, very dense, moist	17-29-38
14.5	16.0	S-5 / 1.1'	SAND, brown mottled grey, gravel, dense, moist	8-14-23
17.0	18.5	S-6 / 1.5'	SAND, clayey, silty, brown mottled black and grey, gravel, medium dense, moist	9-9-10
19.5	21.0	S-7 / 1.4'	SAND - gravely, brown mottled grey, medium dense, damp-moist	21-21-23
22.0	23.5	S-8 / 1.4'	SAND, brown & black, gravel, dense, moist	15-21-20
24.5	26.0	S-9 / 1.3'	SAND brown mottled black, very dense, wet	15-24-23
27.0	28.5	S-10 / 1.3'	SAND, brown, gravel, dense, very wet	8-13-23

Geo/Environmental Associates, Inc.

Project Name/ Job Number: 09-379

Boring/Well Log No.: B-3

DEPTH (FEET)		SAMPLE NO., SAMPLE INTERVAL & SPLIT SPOON RECOVERY	SOIL/BEDROCK DESCRIPTION	BLOW COUNTS AND COMMENTS
FROM	TO			
29.5	31.0	S-11 / 1.1'	SAND, silty, clayey, brown, medium dense - very stiff (qu = 3.25tsf), moist	12-15-35
32.0	33.5	S-12 / 0.2'	SAND, silty, clayey, brown, very dense, wet **split spoon blocked by rock*	19-29-29
34.5	35.5	ST-2 / 1.0'	CLAY, silty, sandy, brown, gravel, wet	
39.5	41.0	S-13 / 1.1'	SAND, brown, gravel, medium dense, wet	4-6-7
45.0	46.5	S-14 / 1.2'	SAND, brown, gravel, medium dense, wet	3-4-7
49.5	51.0	S-15 / 1.0'	SAND, brown, medium dense, wet	3-6-8

TRANSITION FROM DIKE TO ORIGINAL AT
APPROXIMATELY 29.5 - 30'
SET PIPE AT 31'

51.0	to	35.0	SAND CUTTINGS
35.0	to	32.0	BENTONITE
32.0	to	31.0	SAND
31.0	to	20.8	SCREEN
20.8	to	0.2	RISER
32.0	to	19.5	SAND
19.5	to	16.5	BENTONITE
16.5	to	3.0	GROUT
3.0	to	0.0	CONCRETE WITH MAN HOLE

Geo/Environmental Associates, Inc.

Boring No. B-4

PROJECT: AEP Mitchell BAP | **PROJECT NO: 09-379**

Start Date: 3-2-09

Finish Date: 3-3-09

Logged By: Seth Frank & Robby Reynolds

Location: N 484958.8 E 1599000.96 NAD83

Ground Elevation: 692.17' NAVD88

Drilling Contractor: Horn and Associates

Driller: Tom Leininger

Helper: Jared and Bradley

Drill Type: Dietrick D50

Notes: Set piezometer to tip depth of 30.0'

W/L at 24.6' below top of pipe on 3/5/09

Piezometer Elevation: 691.91' NAVD88

Casing Elevation: 692.20' NAVD88

Thickness of Soil:

Depth Drilled In Rock:

Total Depth of Boring: 51.0'

DEPTH (FEET)		SAMPLE NOS., & SPLIT SPOON RECOVERY	SOIL/BEDROCK DESCRIPTION	BLOW COUNTS AND COMMENTS
FROM	TO			
2.0	3.5	S-1	SAND, brown, gravel, very dense, damp	25-41-26
4.5	6.0	S-2	SAND, brown, gravel, dense, damp	12-17-23
7.0	8.5	S-3	SAND, brown, gravel, very dense, damp	19-28-30
9.5	10.0	ST-1 / 0.5'	SAND, clayey, silty, brown, gravel, damp	
12.0	13.5	S-4	SAND, silty, black / brown, gravel, dense, damp	12-17-23
14.5	16.0	S-5	SAND, black / brown, gravel, dense, damp	12-20-21
17.0	18.5	S-6	SAND, clayey, silty, brown / black, gravel, dense, damp	11-12-19
19.5	21.0	S-7	SAND, gravely . brown mottled grey, medium dense, damp-moist	8-13-13
22.0	23.5	S-8	SAND, silty, clayey, dark brown / black, dense, moist	8-13-20
24.5	26.0	S-9	SAND, gravely, brown, medium dense, moist - wet	19-17-13
27.0	28.5	S-10	SAND, brown, gravel, dense, very wet	17-24-20

Geo/Environmental Associates, Inc.

Project Name/ Job Number: 09-379

Boring/Well Log No.: B-4

Page 2 **of** 2

DEPTH (FEET)		SAMPLE NO., SAMPLE INTERVAL & SPLIT SPOON RECOVERY	SOIL/BEDROCK DESCRIPTION	BLOW COUNTS AND COMMENTS
FROM	TO			
29.5	31.0	S-11	SAND, silty, clayey, black / dark brown, organic matter, medium dense, moist (qu = 3.25tsf)	8-11-14
34.5	36.5	ST-2 / 1.7'	SAND, brown, wet	
39.5	41.0	S-12	SAND, brown, loose, wet	2-3-4
45.0	46.5	S-13	SAND, brown, medium, wet	3-4-6
49.5	51.0	S-14	SAND, brown, medium, wet	3-6-7

TRANSITION FROM DIKE TO ORIGINAL AT APPROXIMATELY 24.5'
SET PIPE AT 30.0'

51.0	to	34.0	SAND CUTTINGS
34.0	to	31.0	BENTONITE
31.0	to	30.0	SAND
30.0	to	19.8	SCREEN
19.8	to	0.2	RISER
31.0	to	18.0	SAND
18.0	to	15.0	BENTONITE
15.0	to	3.0	GROUT
3.0	to	0.0	CONCRETE WITH MAN HOLE

Geo/Environmental Associates, Inc.

Boring No. B-5

Page 1 Of 2

PROJECT: AEP Mitchell BAP	PROJECT NO: 09-379
Start Date: 3-2-09	Drilling Contractor: Horn and Associates
Finish Date: 3-3-09	Driller: Tom Leininger
Logged By: Seth Frank & Robby Reynolds	Helper: Jared and Bradley
Location: N 484664.32 E 1598966.05 NAD83	Drill Type: Dietrick D50
Ground Elevation: 674.82' NAVD88	
Notes: Set piezometer to tip depth of 17.0'	Thickness of Soil:
Well dry at 17.0' on 3-5-09	Depth Drilled In Rock:
Piezometer Elevation: 674.43' NAVD88	Total Depth of Boring: 36.0'
Casing Elevation: 674.86' NAVD88	

DEPTH (FEET) FROM	TO	SAMPLE NOS., & SPLIT SPOON RECOVERY	SOIL/BEDROCK DESCRIPTION	BLOW COUNTS AND COMMENTS
2.0	3.5	S-1	SAND, silty, brown, slightly gravely, medium, dense, damp	7-10-9
4.5	6.0	S-2	SAND, silty, grey to brown, slightly gravely medium dense, damp	3-5-7
7.0	8.5	S-3	SAND, silty, brown, slightly gravely, loose, damp	4-4-3
9.5	11.0	S-4	SAND, silty, brown, dark brown, gravel, loose damp	1-2-2
12.0	13.5	S-5	Transition: SAND, black, slightly gravely, damp To SAND clayey silty, dark brown, gravel, dense, damp	12-26-3
14.5	16.0	S-6	SAND, clayey, silty, brown, river rock, dense, damp	12-15-22
17.0	18.5	S-7	SILT, clayey, brown, very stiff, damp (qu=5tsf)	7-12-13
19.5	20.5	ST-1 / 0.8'	SAND, clayey, silty, brown, gravel, damp	
24.5	26.0	S-8	SAND, clayey, silty, dark brown, gravel, loose, damp	3-4-5

Geo/Environmental Associates, Inc.

Project Name/ Job Number: 09-379

Boring/Well Log No.: B-5

DEPTH (FEET)		SAMPLE NO., SAMPLE INTERVAL & SPLIT SPOON RECOVERY	SOIL/BEDROCK DESCRIPTION	BLOW COUNTS AND COMMENTS
FROM	TO			
29.5	31.0	S-9	SAND, dark brown, gravel, medium dense, damp	4-5-7
34.5	36.0	S-10	SAND, gravely, light brown, medium dense, damp	6-9-9

TRANSITION FROM DIKE TO ORIGINAL AT APPROXIMATELY 12.0'
SET PIPE AT 17.0'

36.0	to	21.0	SAND CUTTINGS
21.0	to	18.0	BENTONITE
18.0	to	17.0	SAND
17.0	to	7.0	SCREEN
7.0	to	0.6	RISER
18.0	to	5.0	SAND
5.0	to	2.5	BENTONITE
2.5	to	0.0	CONCRETE WITH MAN HOLE

W/L DRY @ 36.0'

Geo/Environmental Associates, Inc.

Job: Mitchell Plant Bottom Ash Complex
Title: SPT Correction
Performed By: BTK
G.A. Job Number: 15055013
Date: October 29, 2015

Unit Weights: Overburden= 124 pcf

Boring	Sample No	Depth	Uncorrected N	Depth to Water (ft)	Thickness of Moist Soil (ft)	Thickness of Sat Soil (ft)	Effective Stress (psf)	N Correction	Corrected N	
B-1 (Embankment)	1	3.5	41	25	3.5	0.0	434	1.70	50+	
B-1 (Embankment)	2	6	56	25	6.0	0.0	744	1.68	50+	
B-1 (Embankment)	3	8.5	26	25	8.5	0.0	1,054	1.41	36.6	
									Median=	50+
B-1 (Natural Soil))	4	13.5	39	25	13.5	0.0	1,674	1.12	43.6	
B-1 (Natural Soil))	5	16	25	25	16.0	0.0	1,984	1.03	25.7	
B-1 (Natural Soil))	6	18.5	19	25	18.5	0.0	2,294	0.95	18.1	
B-1 (Natural Soil))	7	20.5	12	25	20.5	0.0	2,542	0.91	10.9	
B-1 (Natural Soil))	8	23.5	11	25	23.5	0.0	2,914	0.85	9.3	
B-1 (Natural Soil))	9	26	11	25	25.0	1.0	3,162	0.81	8.9	
B-1 (Natural Soil))	10	31.5	3	25	25.0	6.5	3,500	0.77	2.3	
B-1 (Natural Soil))	11	36.5	7	25	25.0	11.5	3,808	0.74	5.2	
B-1 (Natural Soil))	12	46	8	25	25.0	21.0	4,394	0.69	5.5	
B-1 (Natural Soil))	13	51	10	25	25.0	26.0	4,702	0.67	6.7	
									Median=	9.1
B-2 (Embankment)	1	3.5	12	50	3.5	0.0	434	1.70	20.4	
B-2 (Embankment)	2	6	17	50	6.0	0.0	744	1.68	28.5	
B-2 (Embankment)	3	8.5	54	50	8.5	0.0	1,054	1.41	50+	
B-2 (Embankment)	4	11	57	50	11.0	0.0	1,364	1.24	50+	
B-2 (Embankment)	5	13.5	30	50	13.5	0.0	1,674	1.12	33.5	
B-2 (Embankment)	6	18.5	15	50	18.5	0.0	2,294	0.95	14.3	
									Median=	31.0
B-2 (Natural Soil)	8	23.5	11	50	23.5	0.0	2,914	0.85	9.3	
B-2 (Natural Soil)	9	26	9	50	26.0	0.0	3,224	0.81	7.2	
B-2 (Natural Soil)	10	30.5	7	50	30.5	0.0	3,782	0.74	5.2	
B-2 (Natural Soil)	12	46	7	50	46.0	0.0	5,704	0.61	4.2	
B-2 (Natural Soil)	13	51	4	50	50.0	1.0	6,262	0.58	2.3	
									Median=	5.2
B-3 (Embankment)	1	3.5	66	25	3.5	0.0	434	1.70	50+	
B-3 (Embankment)	2	6	59	25	6.0	0.0	744	1.68	50+	
B-3 (Embankment)	3	8.5	49	25	8.5	0.0	1,054	1.41	50+	
B-3 (Embankment)	4	13.5	67	25	13.5	0.0	1,674	1.12	50+	
B-3 (Embankment)	5	16	37	25	16.0	0.0	1,984	1.03	38.0	
B-3 (Embankment)	6	18.5	19	25	18.5	0.0	2,294	0.95	18.1	
B-3 (Embankment)	7	21	44	25	21.0	0.0	2,604	0.90	39.4	
B-3 (Embankment)	8	23.5	41	25	23.5	0.0	2,914	0.85	34.7	
B-3 (Embankment)	9	26	47	25	25.0	1.0	3,162	0.81	38.2	
B-3 (Embankment)	10	28.5	36	25	25.0	3.5	3,316	0.79	28.6	
B-3 (Embankment)	11	31	50	25	25.0	6.0	3,470	0.78	38.8	
B-3 (Embankment)	12	33.5	58	25	25.0	8.5	3,624	0.76	44.0	
									Median=	39.1
B-3 (Natural Soil)	13	41	13	25	25.0	16.0	4,086	0.72	9.3	
B-3 (Natural Soil)	14	46.5	11	25	25.0	21.5	4,424	0.69	7.6	
B-3 (Natural Soil)	15	51	14	25	25.0	26.0	4,702	0.67	9.3	
									Median=	9.3
B-4 (Embankment)	1	3.5	67	25	3.5	0.0	434	1.70	50+	
B-4 (Embankment)	2	6	40	25	6.0	0.0	744	1.68	50+	
B-4 (Embankment)	3	8.5	58	25	8.5	0.0	1,054	1.41	50+	
B-4 (Embankment)	4	13.5	40	25	13.5	0.0	1,674	1.12	44.7	
B-4 (Embankment)	5	16	41	25	16.0	0.0	1,984	1.03	42.1	
B-4 (Embankment)	6	18.5	31	25	18.5	0.0	2,294	0.95	29.6	
B-4 (Embankment)	7	21	26	25	21.0	0.0	2,604	0.90	23.3	
B-4 (Embankment)	8	23.5	33	25	23.5	0.0	2,914	0.85	27.9	
B-4 (Embankment)	9	26	30	25	25.0	1.0	3,162	0.81	24.4	
									Median=	42.1
B-4 (Natural Soil)	10	28.5	44	25	25.0	3.5	3,316	0.79	34.9	
B-4 (Natural Soil)	11	31	25	25	25.0	6.0	3,470	0.78	19.4	
B-4 (Natural Soil)	12	41	7	25	25.0	16.0	4,086	0.72	5.0	
B-4 (Natural Soil)	13	46.5	10	25	25.0	21.5	4,424	0.69	6.9	
B-4 (Natural Soil)	14	51	13	25	25.0	26.0	4,702	0.67	8.7	
									Median=	8.7
B-5 (Embankment)	1	3.5	19	50	3.5	0.0	434	1.70	32.3	
B-5 (Embankment)	2	6	12	50	6.0	0.0	744	1.68	20.1	
B-5 (Embankment)	3	8.5	7	50	8.5	0.0	1,054	1.41	9.9	
B-5 (Embankment)	4	11	4	50	11.0	0.0	1,364	1.24	5.0	
									Median=	15.0
B-5 (Natural Soil)	5	13.5	29	50	13.5	0.0	1,674	1.12	32.4	
B-5 (Natural Soil)	6	16	37	50	16.0	0.0	1,984	1.03	38.0	
B-5 (Natural Soil)	7	18.5	25	50	18.5	0.0	2,294	0.95	23.9	
B-5 (Natural Soil)	8	26	9	50	26.0	0.0	3,224	0.81	7.2	
B-5 (Natural Soil)	9	31	12	50	31.0	0.0	3,844	0.74	8.8	
B-5 (Natural Soil)	10	36	18	50	36.0	0.0	4,464	0.68	12.3	
									Median=	18.1

SUMMARY OF LABORATORY TEST RESULTS

Project: Mitchell Bottom Ash Pond

Project Number: 09-379

Date: March 18, 2009

Boring	Sample No.	Sample Type*	Depth (ft)	Natural Moisture	Dry Density	Specific Gravity	ATTERBERG LIMITS Liquid Limit	Plasticity Index	USCS	Other Test	Soil Description
B-1	S-3	SS	7.0-8.5	11.0	--	2.68	19	7	SC-SM	S	Sand, clayey, silty, brown, black, gray w/rock
B-1	S-11	SS	35.0-36.5	15.2	--	2.74	12	np	SW-SM	S	Sand, silty, black w/rock
B-2	S-5	SS	12.0-13.5	5.7	--	2.67	15	5	SP-SC	S	Sand, clayey, silty, brown, dark brown w/rock
B-2	S-10	SS	29.0-30.5	5.4	--	2.71	--	np	SP-SM	S	Sand, brown
B-2	ST-2	ST	34.5-36.5	8.7	105.5	2.70	--	np	SM	K,S,T	Sand, brown, light brown (Sand Foundation)
B-3	S-6	SS	17.0-18.5	9.2	--	2.71	17	5	SC-SM	S	Sand, clayey, silty, dark brown, brown w/rock
B-3	S-11	SS	29.5-31.0	13.0	--	2.65	17	5	SC-SM	S	Sand, clayey, silty, black, brown, w/rock &
B-3	ST-2	ST	34.5-35.5	18.5	112.1	2.62	26	9	CL	K,S,U	Clay, silty, sandy, brown w/rock
B-4	S-4	SS	12.0-13.5	7.9	--	2.69	--	np	SM	S	Sand, silty, brown, dark brown w/rock
B-4	S-12	SS	39.5-41.0	5.2	--	2.71	--	np	SP	S	Sand, brown
B-1,B-3,B-4	ST-1	ST	9.5-10.0	9.3	114.5	2.68	16	4	SC-SM	K,S,T	Sand, clayey, silty, brown w/rock
B-5	S-3	SS	7.0-8.5	7.9	--	2.70	12	np	SM	S	Sand, silty, dark brown w/rock
B-5	S-8	SS	24.5-26.0	7.8	--	2.66	16	4	SP-SC	S	Sand, clayey, silty, brown w/rock
na	B	B	na	3.6	--	2.26	--	np	SP	S	Bottom Ash

*ST-SHELBY TUBE SAMPLE, SS-SPLIT SPOON SAMPLE, B-BAG SAMPLE, J-JAR SAMPLE

**TEST RESULTS REPORTED ON OTHER SHEETS:

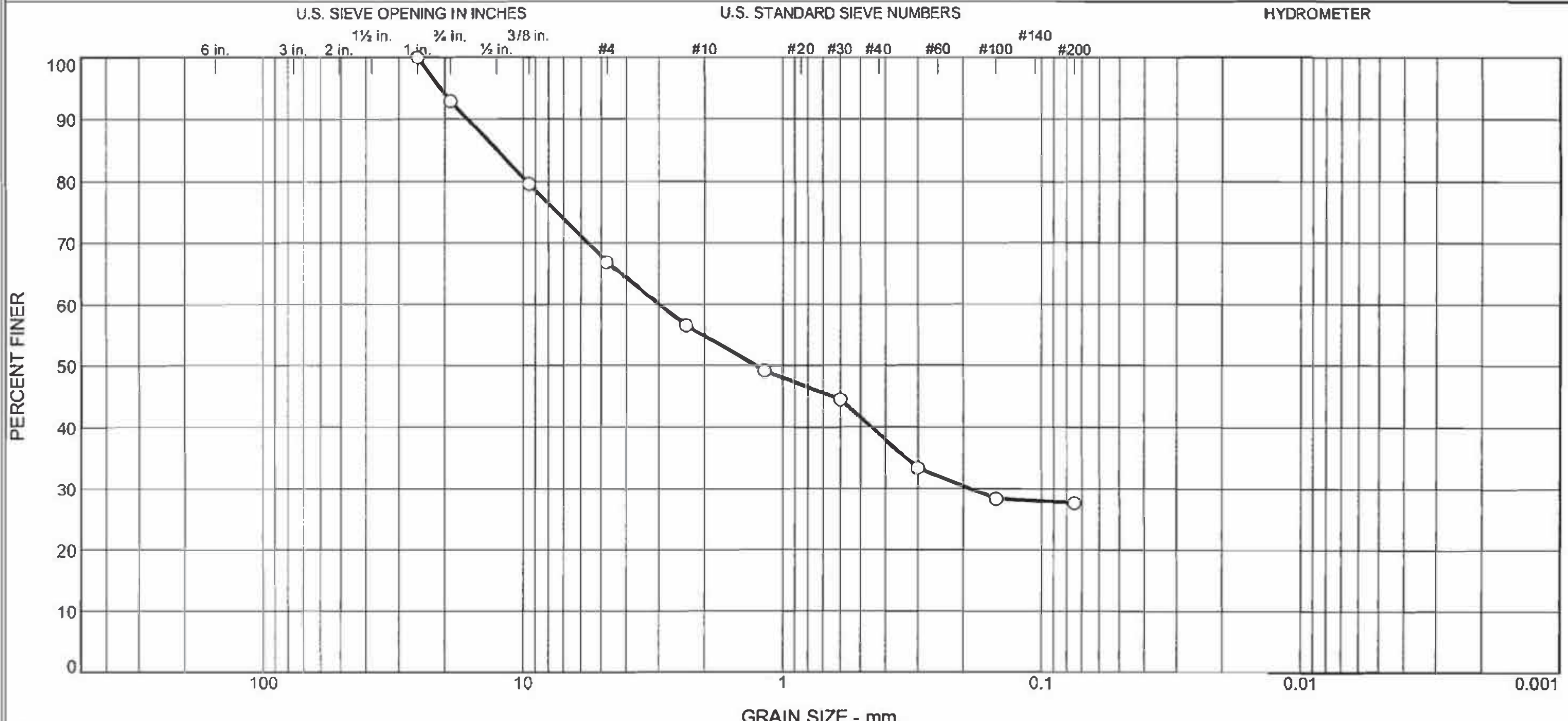
Geo/Environmental Associates

T-TRIAXIAL
S-SIEVE OR GRAIN SIZE ANALYSIS
U-UNCONFINED COMPRESSION

P-PROCTOR TEST
K-PERMEABILITY
C-CONSOLIDATION

DATA CHECKED BY ________

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	7.2	26.0	12.1	15.8	11.3	27.6	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○		B-1 S-3	7.0'-8.5'		SC-SM	Sand, clayey, silty, brown, black, gray w/rock	11.0	19	12

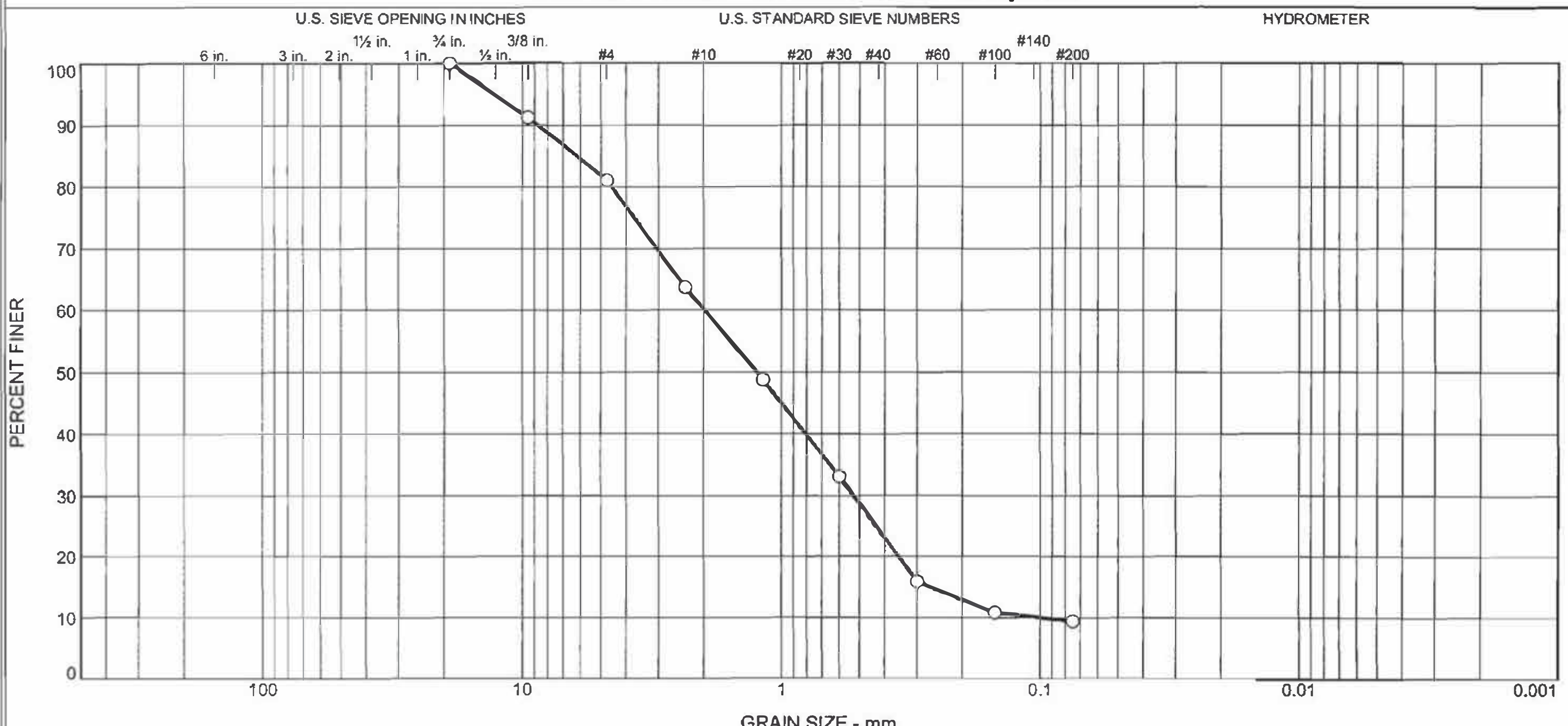
Client American Electric Power

Project Mitchell Bottom Ash Pond

Project No. 09-379 Figure

Geo/Environmental Associates, Inc.
Knoxville, Tennessee

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	19.0	20.9	35.6	15.1	9.4	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○		B-1 S-11	35.0'-36.5'		SW-SM	Sand, silty, black w/rock	15.2	12	np

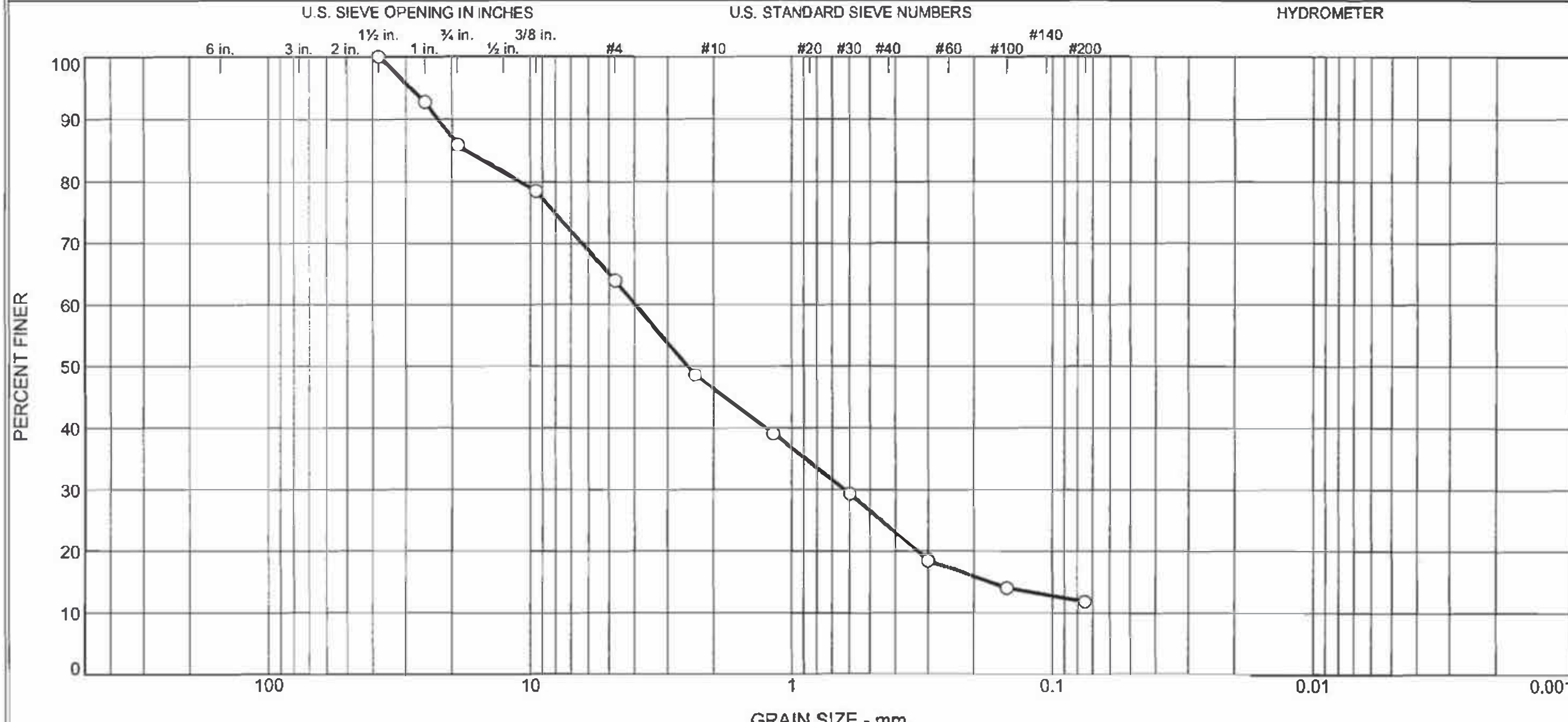
Client American Electric Power

Project Mitchell Bottom Ash Pond

Project No. 09-379 Figure

Geo/Environmental Associates, Inc. Knoxville, Tennessee

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
O	0.0	14.2	21.9	17.7	22.2	12.2	11.8	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
O		B-2 S-5	12.0'-13.5'		SP-SC	Sand, clayey, silty, brown, dark brown w/rock	5.7	15	10

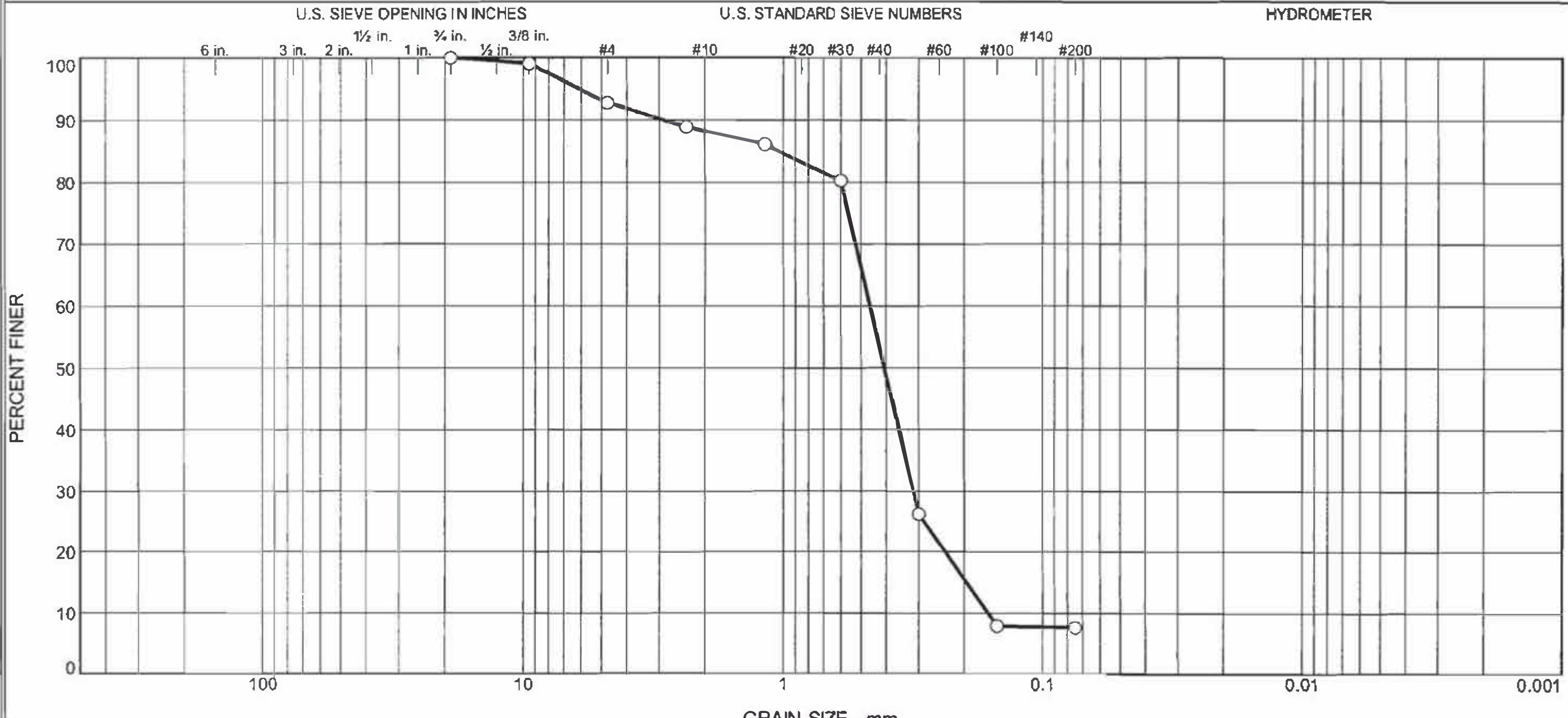
Client American Electric Power

Project Mitchell Bottom Ash Pond

Project No. 09-379 Figure

Geo/Environmental Associates, Inc. Knoxville, Tennessee

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	7.3	4.5	34.9	45.7	7.6	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○		B-2 S-10	29.0'-30.5'		SP-SM	Sand, brown	5.4	nv	np

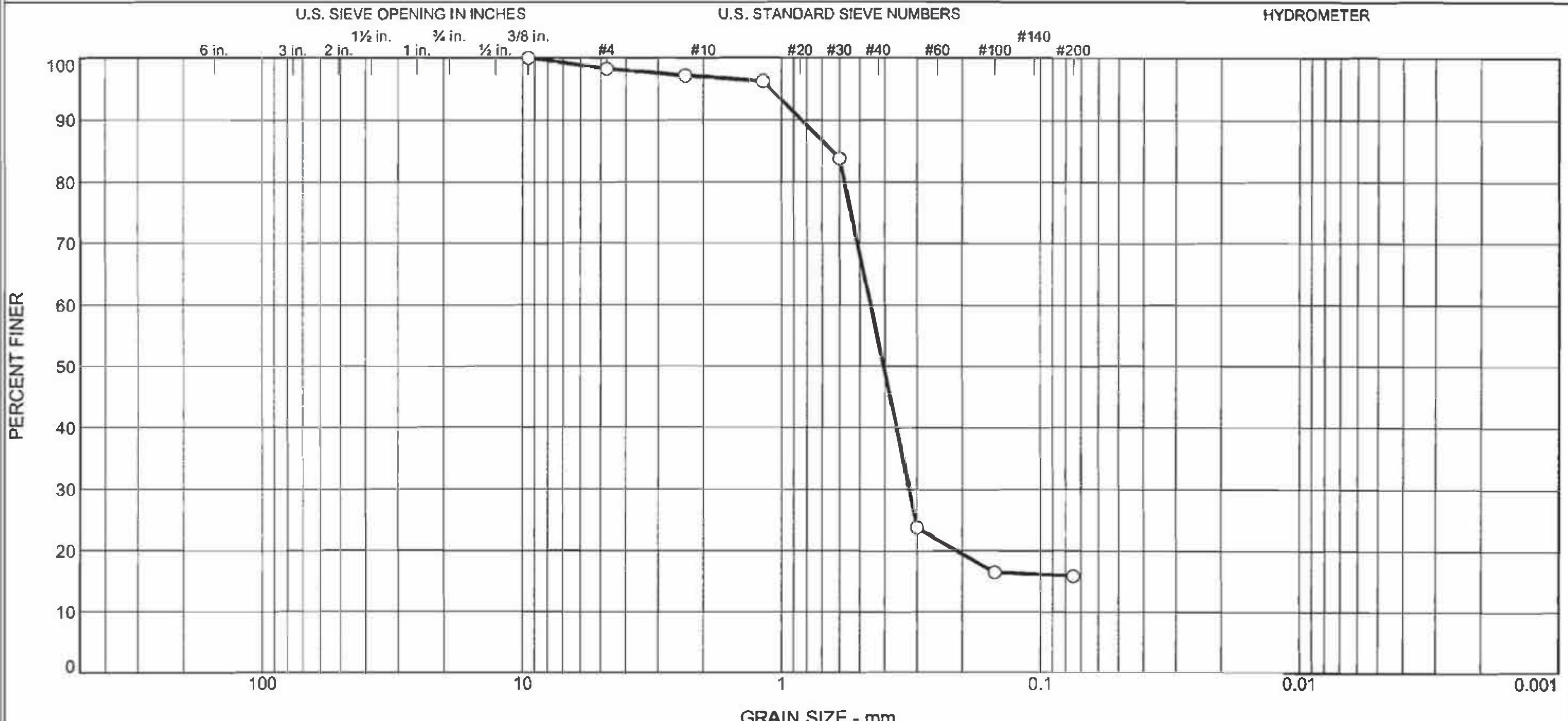
Client American Electric Power

Project Mitchell Bottom Ash Pond

Project No. 09-379 Figure

Geo/Environmental Associates, Inc.
Knoxville, Tennessee

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.8	1.3	43.0	38.0	15.9	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○		B-2 ST-2	34.5'-36.5'		SM	Sand, brown, light brown	8.7	nv	np

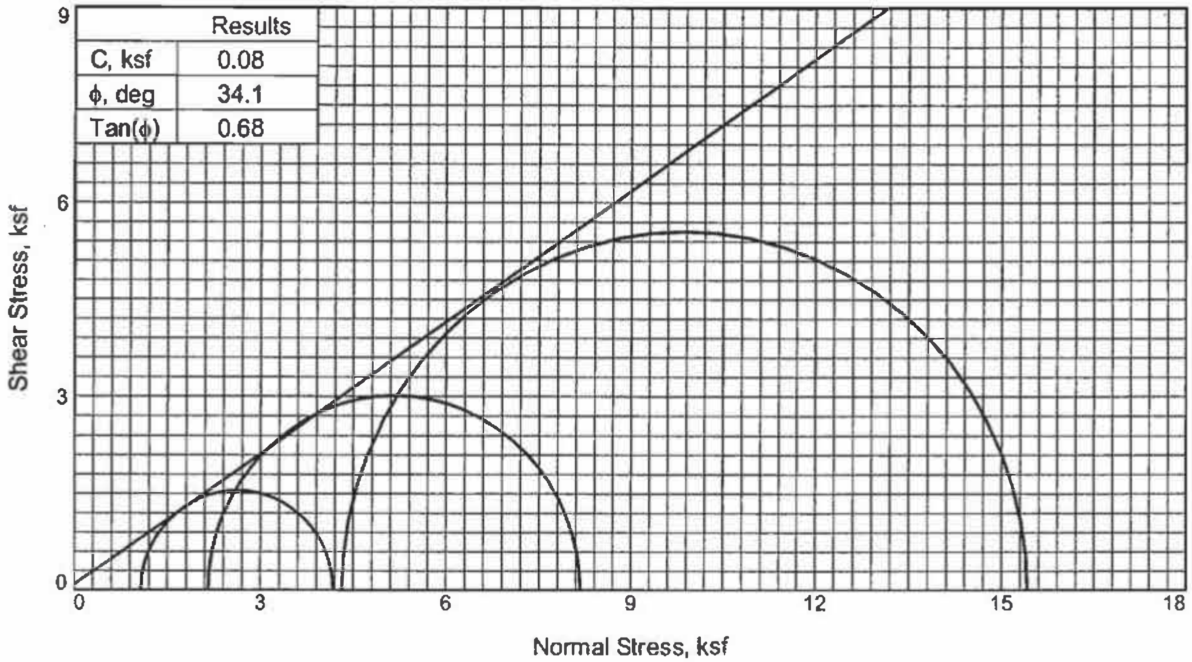
Client American Electric Power

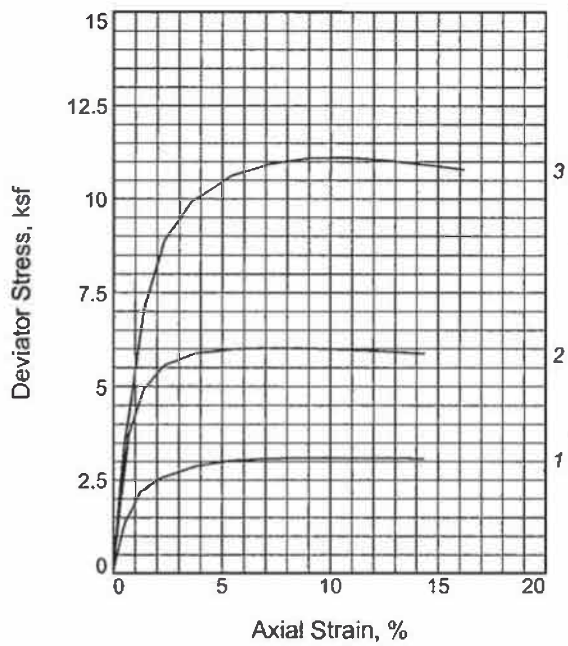
Project Mitchell Bottom Ash Pond

Project No. 09-379 Figure

Geo/Environmental Associates, Inc.
Knoxville, Tennessee

○ Sand Foundation Material





Sample No.		1	2	3
Initial	Water Content, %	8.6	9.0	8.7
	Dry Density, pcf	105.3	105.8	105.5
	Saturation, %	38.7	40.9	39.3
	Void Ratio	0.6009	0.5926	0.5976
	Diameter, in.	2.80	2.80	2.80
	Height, in.	5.60	5.60	5.60
At Test	Water Content, %	21.6	21.0	20.8
	Dry Density, pcf	106.4	107.6	107.9
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.5838	0.5670	0.5618
	Diameter, in.	2.79	2.78	2.78
	Height, in.	5.58	5.57	5.56
Strain rate, in./min.		0.00	0.00	0.00
Back Pressure, psi		0.00	0.00	0.00
Cell Pressure, psi		7.50	15.00	30.00
Fail. Stress, ksf		3.1	6.0	11.1
Ult. Stress, ksf				
σ_1 Failure, ksf		4.2	8.2	15.4
σ_3 Failure, ksf		1.1	2.2	4.3

Type of Test:
Consolidated Drained

Sample Type: Shelby Tube

Description: Sand, brown, light brown

LL= nv **PI=** np

Specific Gravity= 2.70

Remarks:

Client: American Electric Power

Project: Mitchell Bottom Ash Pond

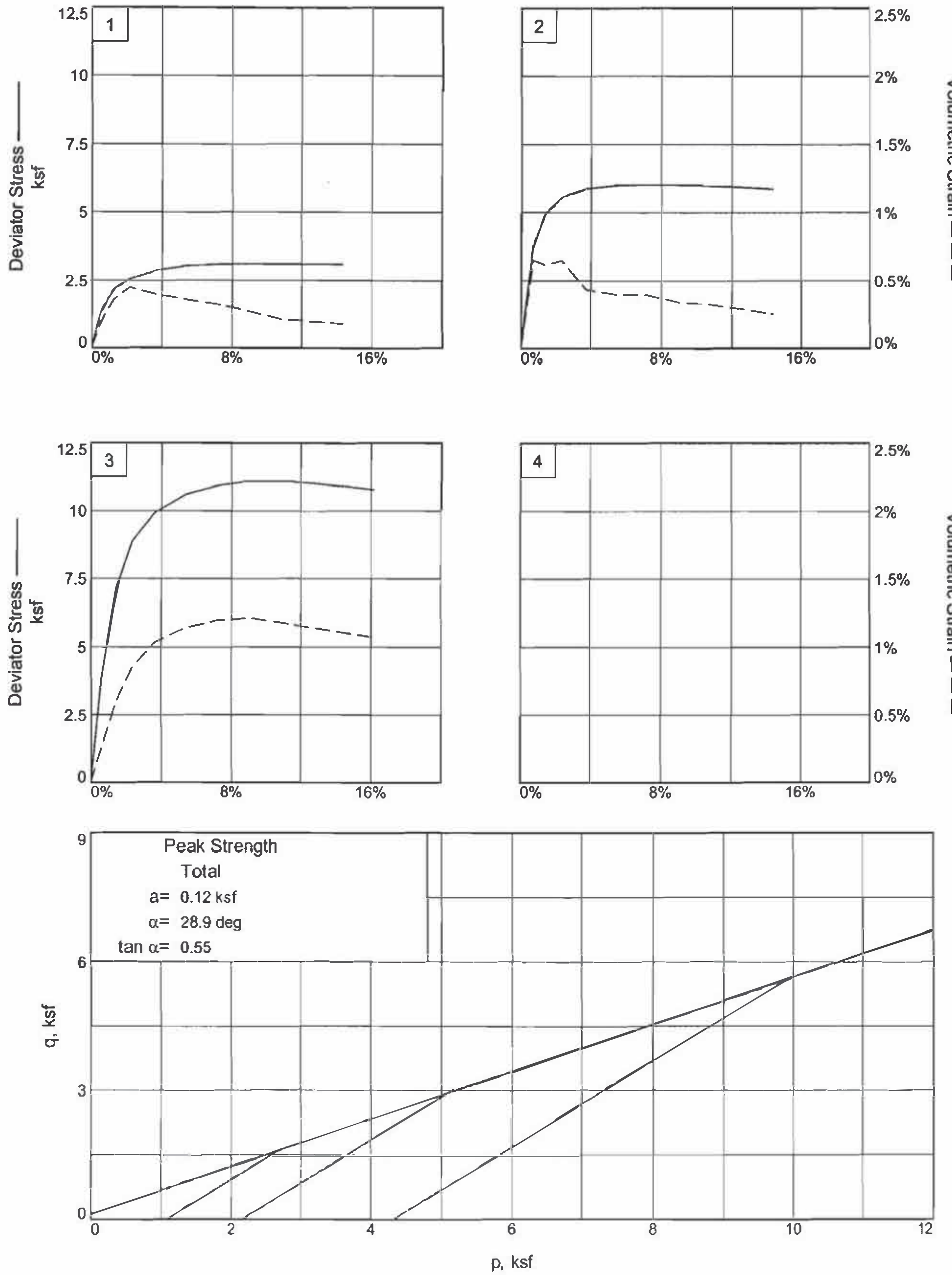
Sample Number: B-2 ST-2 **Depth:** 34.5'-36.5'

Proj. No.: 09-379 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT

Geo/Environmental Associates, Inc.

Figure 1



Client: American Electric Power
Project: Mitchell Bottom Ash Pond
Depth: 34.5'-36.5' **Sample Number:** B-2 ST-2
Project No.: 09-379

Figure 2

Geo/Environmental Associates, Inc.

CONSTANT HEAD PERMEABILITY TESTING
ASTM D5084-90/SW846 Method 9100 Section 2.8

PROJECT NAME : Mitchell Bottom Ash Pond | **PROJECT NUMBER** : 09-379

CLIENT : American Electric Power | **DATE** : March 13, 2009

SAMPLE LOCATION AND CONDITIONS

Sample Id. : B-2 ST-2 | **Depth of Tested Sample** : 34.5'-35.5'

Specimen : 7.5 psi Triaxial Specimen | **Remolded** : Yes

Sample Description : Sand, brown, light brown (Sand Foundation)

INITIAL SPECIMEN PROPERTIES

Length (in.):	5.6	**Volume (ft^3):**	0.0200	**Wet Density (PCF):**	114.3
Diameter (in.):	2.8	**Weight (lbs):**	2.28	**Dry Density (PCF):**	105.3
Area (ft^2):	0.0428	**Moisture (%):**	8.6		

Chamber Pressure (psi):	5	**Change in Pore Pressure (psi):**	2.0
Influent Pressure (psi):	3	**Change in Chamber Pressure (psi):**	2.0
Back Pressure (psi):	0	**"B" Factor:**	1.0

PERMEABILITY CALCULATIONS

k = Hydraulic Conductivity, (cm/sec)

L = Length of Sample, along path of flow, (cm)

Q = Quantity of flow, taken as the average of inflow and outflow, (cm^3)

A = Cross-sectional area of specimen, (cm^2)

t = Interval of time, over which the flow Q occurs, (sec)

h = Difference in hydraulic head across specimen, (cm)

$$k = \frac{QL}{Ath} = \text{cm/sec}$$

$$k = \frac{(700.0)(14.22)}{(39.73)(893)(211.01)}$$

$$= \frac{9{,}954.00}{7{,}486{,}400.58}$$

$$= 1.33 \times 10^{-3} \text{ cm/sec}$$

CONSTANT HEAD PERMEABILITY TESTING
ASTM D5084-90/SW846 Method 9100 Section 2.8

PROJECT NAME : Mitchell Bottom Ash Pond

PROJECT NUMBER : 09-379

CLIENT : American Electric Power

DATE : March 13, 2009

SAMPLE LOCATION AND CONDITIONS

Sample Id. : B-2 ST-2

Depth of Tested Sample : 34.5'-35.5'

Specimen : 15 psi Triaxial Specimen

Remolded : Yes

Sample Description : Sand, brown, light brown (Sand Foundation)

INITIAL SPECIMEN PROPERTIES

Length (in.): 5.6 **Volume (ft^3):** 0.0200 **Wet Density (PCF):** 115.3

Diameter (in.): 2.8 **Weight (lbs):** 2.30 **Dry Density (PCF):** 105.8

Area (ft^2): 0.0428 **Moisture (%):** 9.0

Chamber Pressure (psi): 8

Influent Pressure (psi): 6

Back Pressure (psi): 3

Change in Pore Pressure (psi): 2.0

Change in Chamber Pressure (psi): 2.0

"B" Factor: 1.0

PERMEABILITY CALCULATIONS

k = Hydraulic Conductivity, (cm/sec)

L = Length of Sample, along path of flow, (cm)

Q = Quantity of flow, taken as the average of inflow and outflow, (cm^3)

A = Cross-sectional area of specimen, (cm^2)

t = Interval of time, over which the flow Q occurs, (sec)

h = Difference in hydraulic head across specimen, (cm)

$$k = \frac{QL}{Ath} = \text{cm/sec}$$

$$k = \frac{(700.0)(14.22)}{(39.73)(942)(211.01)}$$

$$= \frac{9{,}954.00}{7{,}897{,}188.52}$$

$$= 1.26 \times 10^{-3} \text{ cm/sec}$$

CONSTANT HEAD PERMEABILITY TESTING
ASTM D5084-90/SW846 Method 9100 Section 2.8

PROJECT NAME : Mitchell Bottom Ash Pond **PROJECT NUMBER** : 09-379

CLIENT : American Electric Power **DATE** : March 13, 2009

SAMPLE LOCATION AND CONDITIONS

Sample Id. : B-2 ST-2 **Depth of Tested Sample** : 34.5'-35.5'

Specimen : 30 psi Triaxial Specimen **Remolded** : Yes

Sample Description : Sand, brown, light brown (Sand Foundation)

INITIAL SPECIMEN PROPERTIES

Length (in.):	5.6	**Volume (ft^3):**	0.0200	**Wet Density (PCF):**	114.7
Diameter (in.):	2.8	**Weight (lbs):**	2.29	**Dry Density (PCF):**	105.5
Area (ft^2):	0.0428	**Moisture (%):**	8.7		

Chamber Pressure (psi):	10	**Change in Pore Pressure (psi):**	5.0
Influent Pressure (psi):	8	**Change in Chamber Pressure (psi):**	5.0
Back Pressure (psi):	5	**"B" Factor:**	1.0

PERMEABILITY CALCULATIONS

k = Hydraulic Conductivity, (cm/sec)

L = Length of Sample, along path of flow, (cm)

Q = Quantity of flow, taken as the average of inflow and outflow, (cm^3)

A = Cross-sectional area of specimen, (cm^2)

t = Interval of time, over which the flow Q occurs, (sec)

h = Difference in hydraulic head across specimen, (cm)

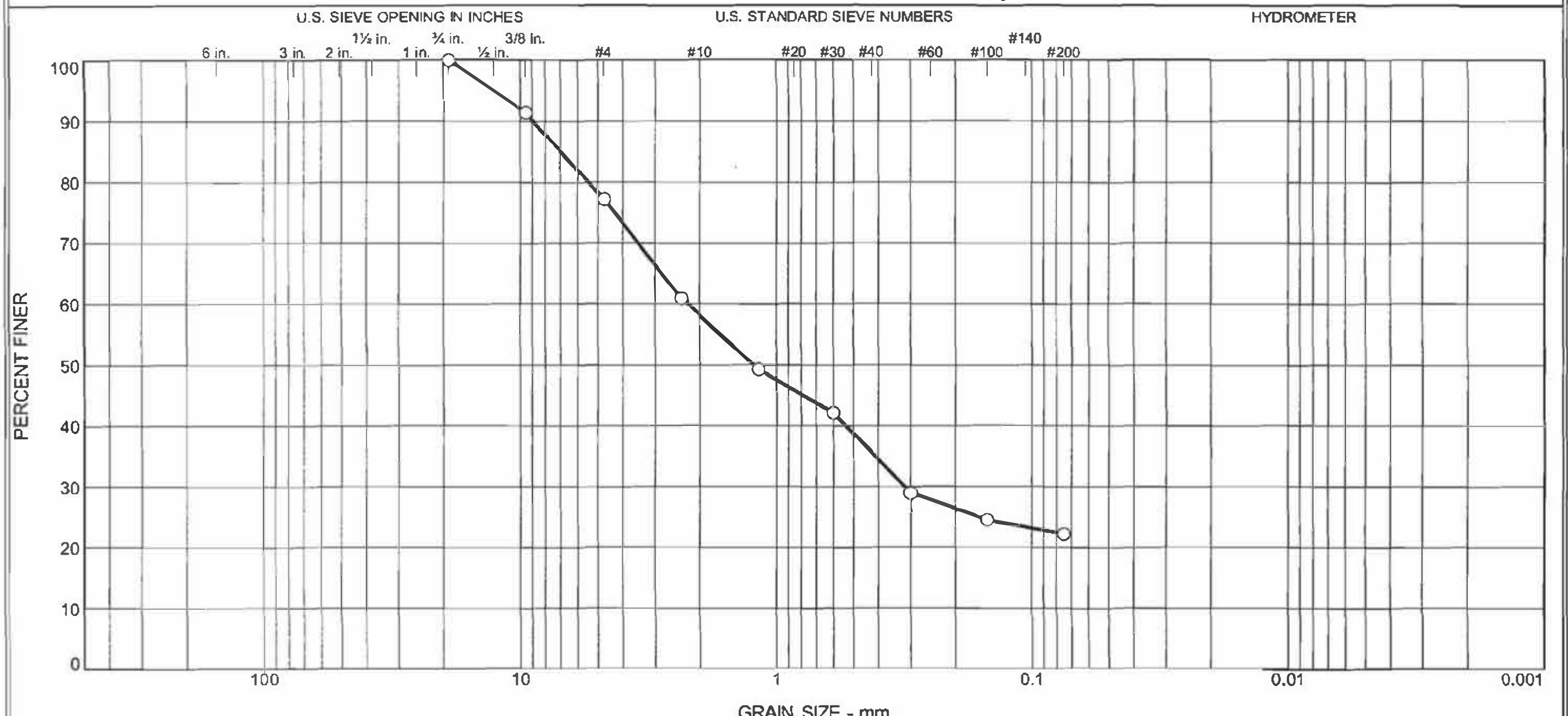
$$k = \frac{QL}{Ath} = \text{cm/sec}$$

$$k = \frac{(700.0)(14.22)}{(39.73)(735)(211.01)}$$

$$= \frac{9{,}954.00}{6{,}161{,}819.07}$$

$$= 1.62 \times 10^{-3} \text{ cm/sec}$$

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	22.8	19.1	22.6	13.3	22.2	

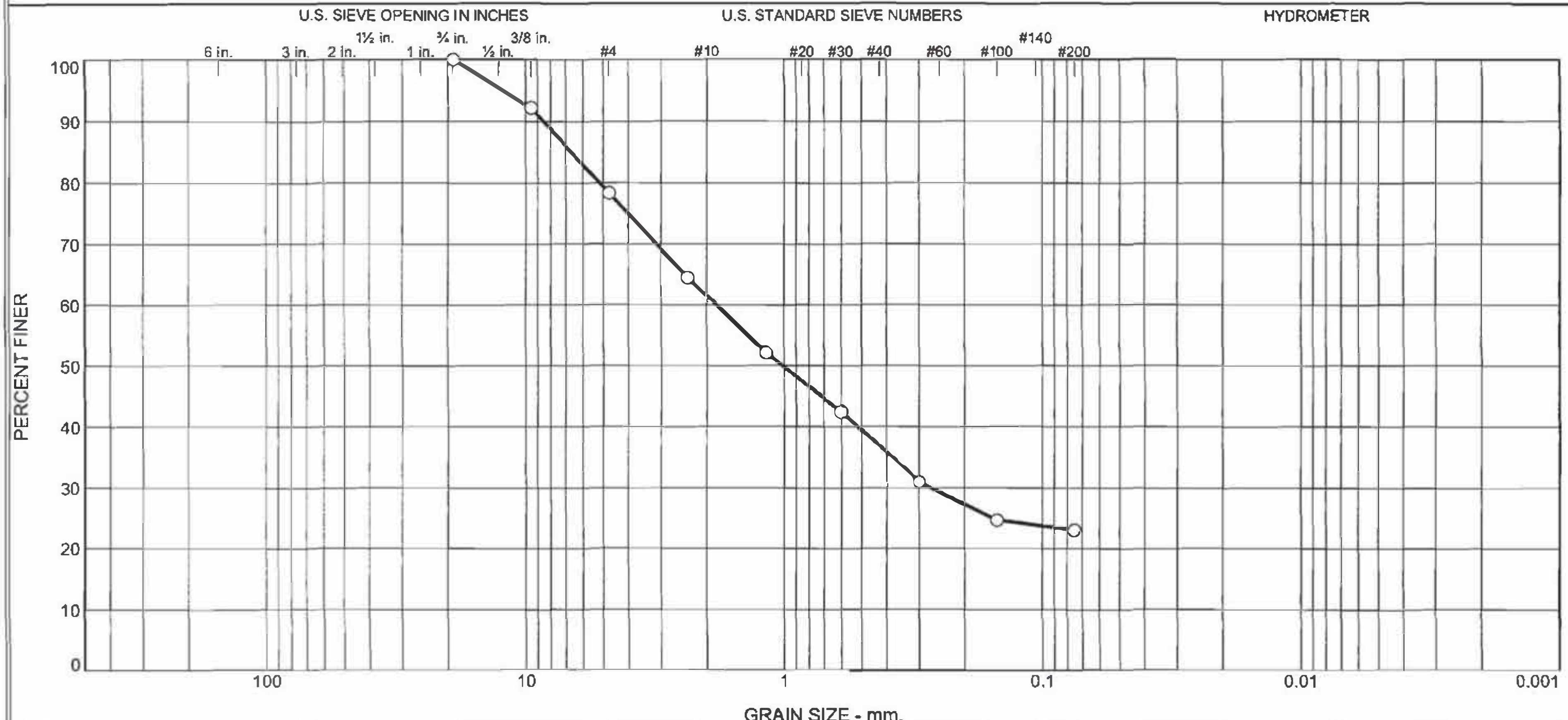
	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○		B-3 S-6	17.0'-18.5'		SC-SM	Sand, clayey, silty, dark brown, brown w/rock	9.2	17	12

Client American Electric Power
Project Mitchell Bottom Ash Pond

Project No. 09-379 Figure

Geo/Environmental Associates, Inc.
Knoxville, Tennessee

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	21.7	16.8	24.8	13.7	23.0	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○		B-3 S-11	29.5'-31.0'		SC-SM	Sand, clayey, silty, black, brown w/rock & cinders	13.0	17	12

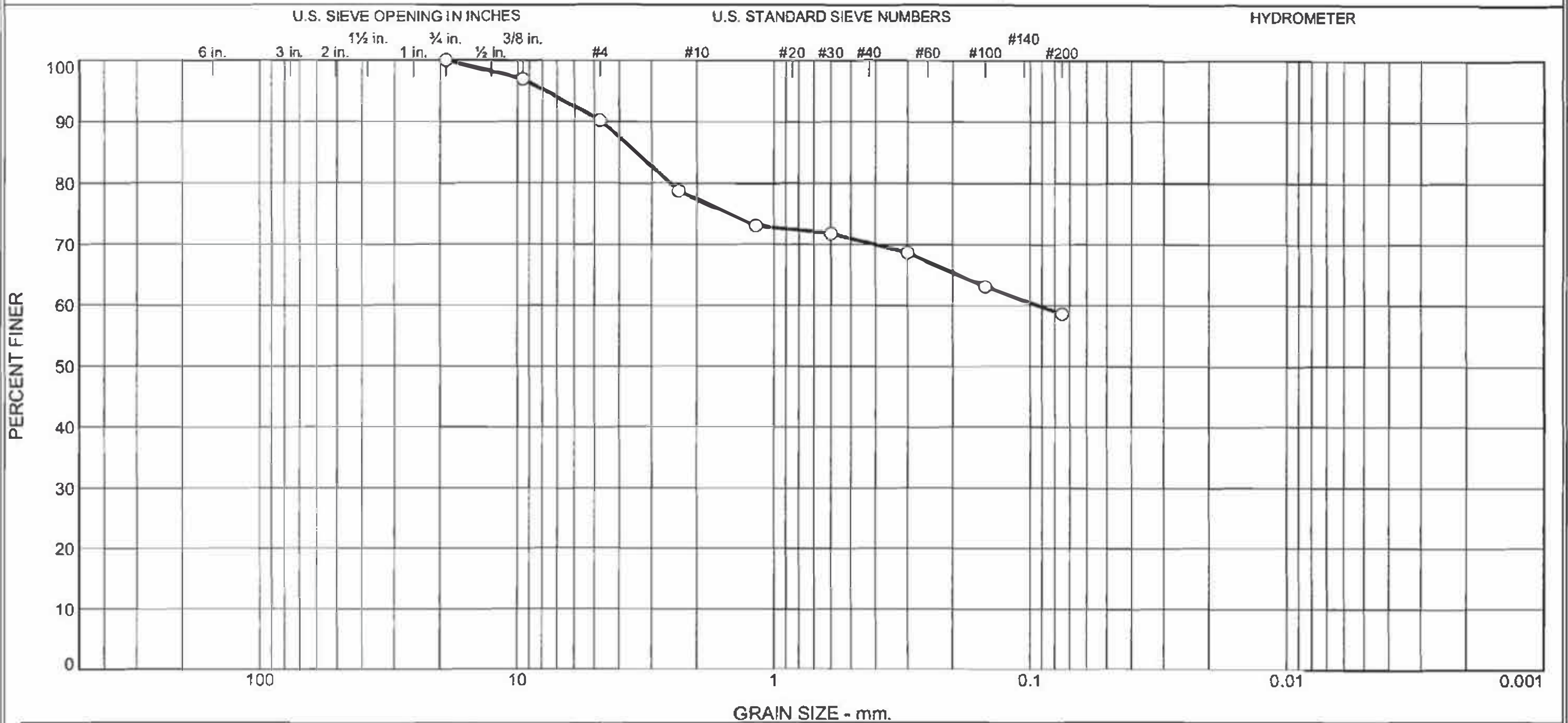
Client American Electric Power

Project Mitchell Bottom Ash Pond

Project No. 09-379 Figure

Geo/Environmental Associates, Inc.
Knoxville, Tennessee

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	9.8	12.8	7.2	11.7	58.5	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○		B-3 ST-2	34.5'-35.5'		CL	Clay, silty, sandy, brown w/rock	18.5	26	17

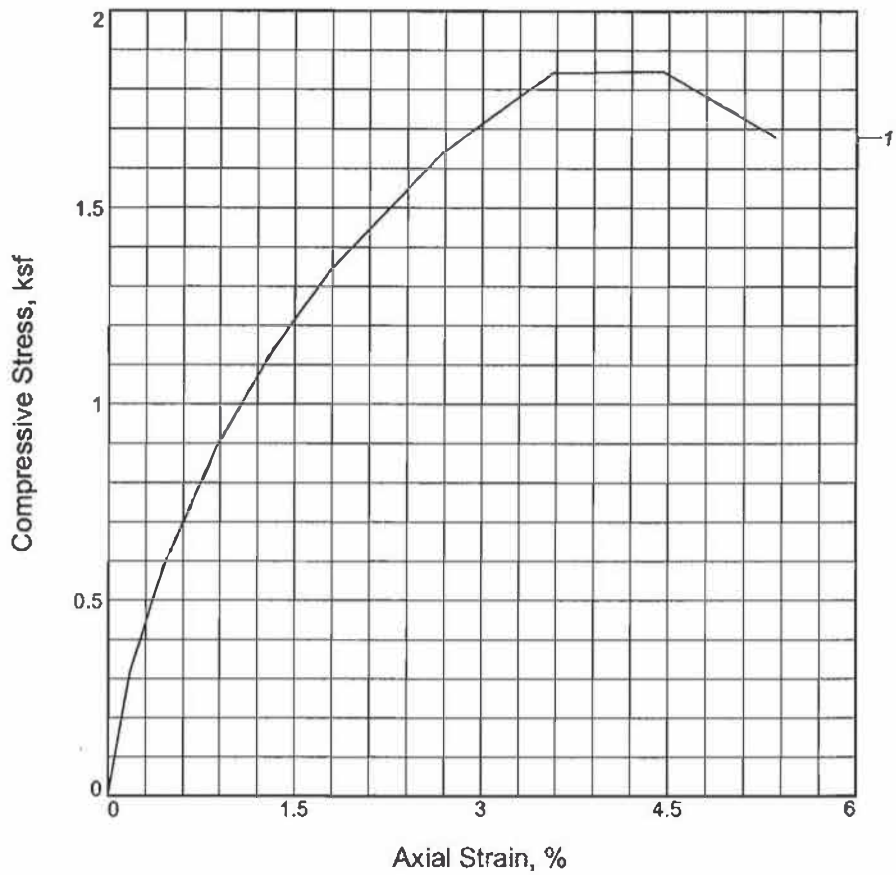
Client American Electric Power

Project Mitchell Bottom Ash Pond

Project No. 09-379 | Figure

Geo/Environmental Associates, Inc.
Knoxville, Tennessee

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, ksf	1.85			
Undrained shear strength, ksf	0.92			
Failure strain, %	4.5			
Strain rate, in./min.	0.01			
Water content, %	12.6			
Wet density, pcf	131.2			
Dry density, pcf	116.5			
Saturation, %	82.0			
Void ratio	0.4041			
Specimen diameter, in.	2.84			
Specimen height, in.	5.61			
Height/diameter ratio	1.98			

Description: Clay, silty, sandy, brown w/rock

LL = 26	PL = 17	PI = 9	GS= 2.62	Type: Shelby Tube

Project No.: 09-379

Date Sampled:

Remarks:

Figure ________

Client: American Electric Power

Project: Mitchell Bottom Ash Pond

Sample Number: B-3 ST-2 **Depth:** 34.5'-35.5'

UNCONFINED COMPRESSION TEST

Geo/Environmental Associates, Inc.

CONSTANT HEAD PERMEABILITY TESTING
ASTM D5084-90/SW846 Method 9100 Section 2.8

PROJECT NAME	: Mitchell Bottom Ash Pond	**PROJECT NUMBER**	: 09-379
CLIENT	: American Electric Power	**DATE**	: March 13, 2009

SAMPLE LOCATION AND CONDITIONS

Sample Id. :	B-3 ST-2	**Depth of Tested Sample** :	34.5'-35.5'
Date Tested :	03/10/09	**Remolded** :	no

Sample Description : Clay, silty, sandy, brown w/rock

INITIAL SPECIMEN PROPERTIES

Length (in.):	4.25	**Volume (ft^3):**	0.0159	**Wet Density (PCF):**	132.8
Diameter (in.):	2.87	**Weight (lbs):**	2.11	**Dry Density (PCF):**	112.1
Area (ft^2):	0.0449	**Moisture (%):**	18.5		

Chamber Pressure (psi):	20	**Change in Pore Pressure (psi):**	5.0
Influent Pressure (psi):	18	**Change in Chamber Pressure (psi):**	5.0
Back Pressure (psi):	15	**"B" Factor:**	1.0

PERMEABILITY CALCULATIONS

k = Hydraulic Conductivity, (cm/sec)

L = Length of Sample, along path of flow, (cm)

Q = Quantity of flow, taken as the average of inflow and outflow, (cm^3)

A = Cross-sectional area of specimen, (cm^2)

t = Interval of time, over which the flow Q occurs, (sec)

h = Difference in hydraulic head across specimen, (cm)

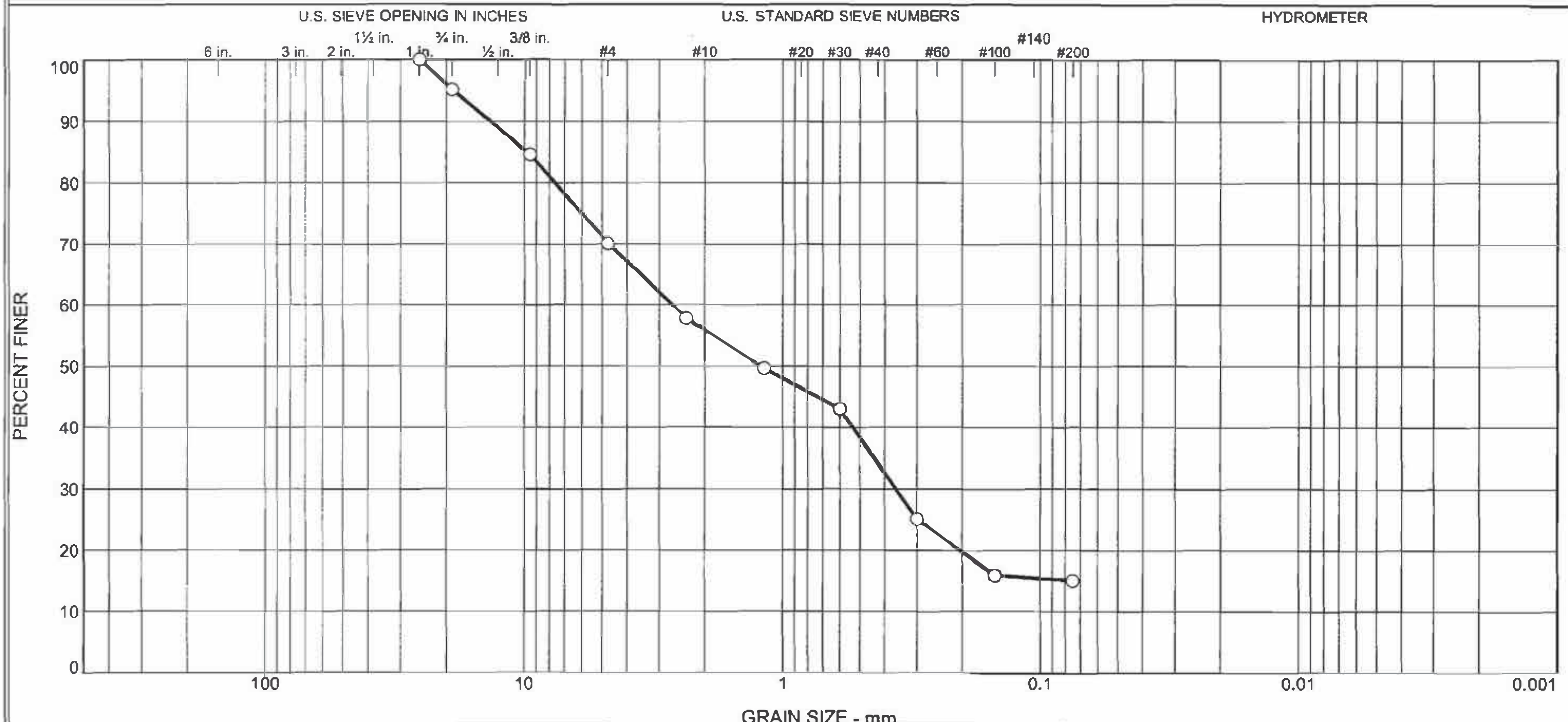
$$k = \frac{QL}{Ath} = \text{cm/sec}$$

$$k = \frac{(15.2)(10.80)}{(41.74)(155,400)(211.01)}$$

$$= \frac{164.16}{1,368,694,419.96}$$

$$= 1.20 \times 10^{-7} \text{ cm/sec}$$

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	4.8	25.1	14.2	21.8	19.1	15.0	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○		B-4 S-4	12.0'-13.5'		SM	Sand, silty, brown, dark brown w/rock	7.9	nv	np

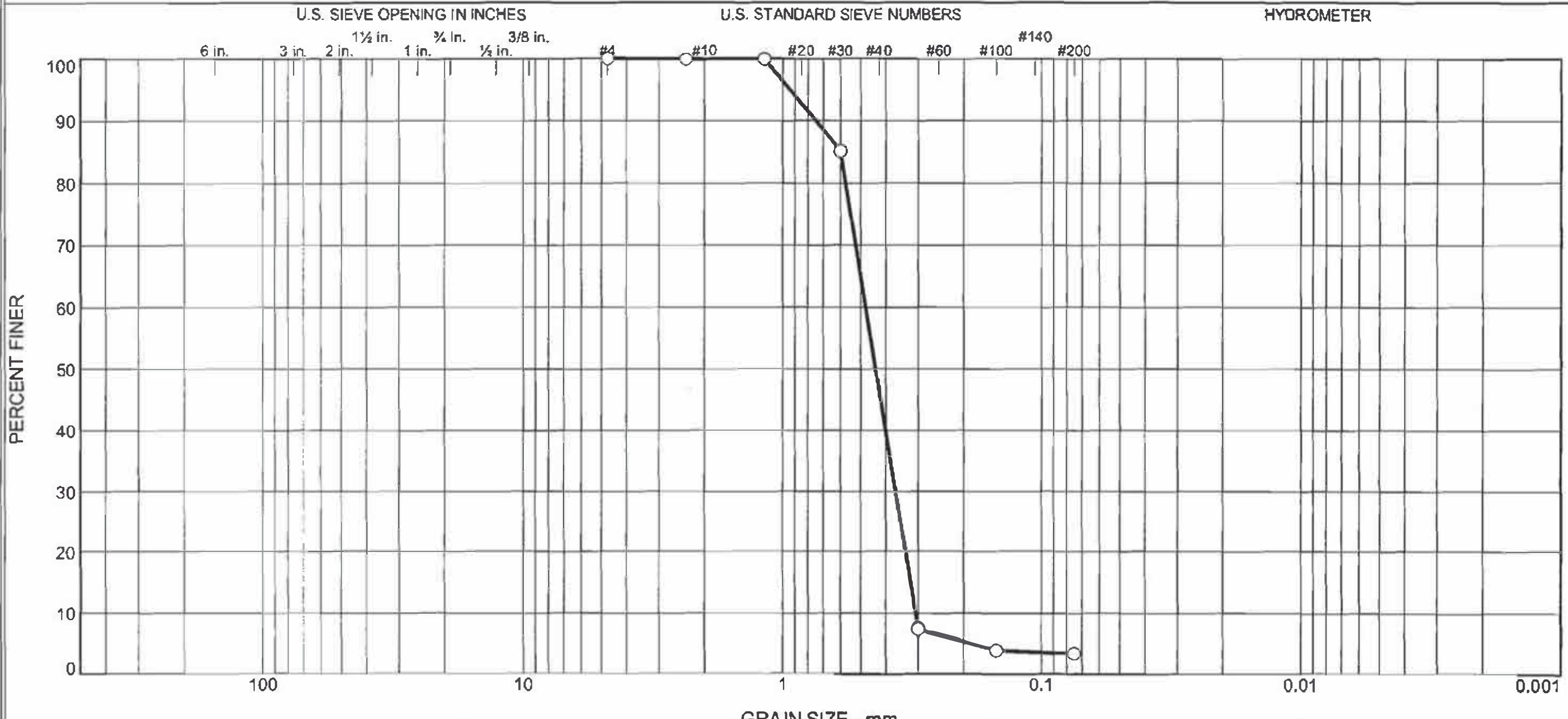
Client American Electric Power

Project Mitchell Bottom Ash Pond

Project No. 09-379 Figure

Geo/Environmental Associates, Inc. Knoxville, Tennessee

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	53.4	43.2	3.3	

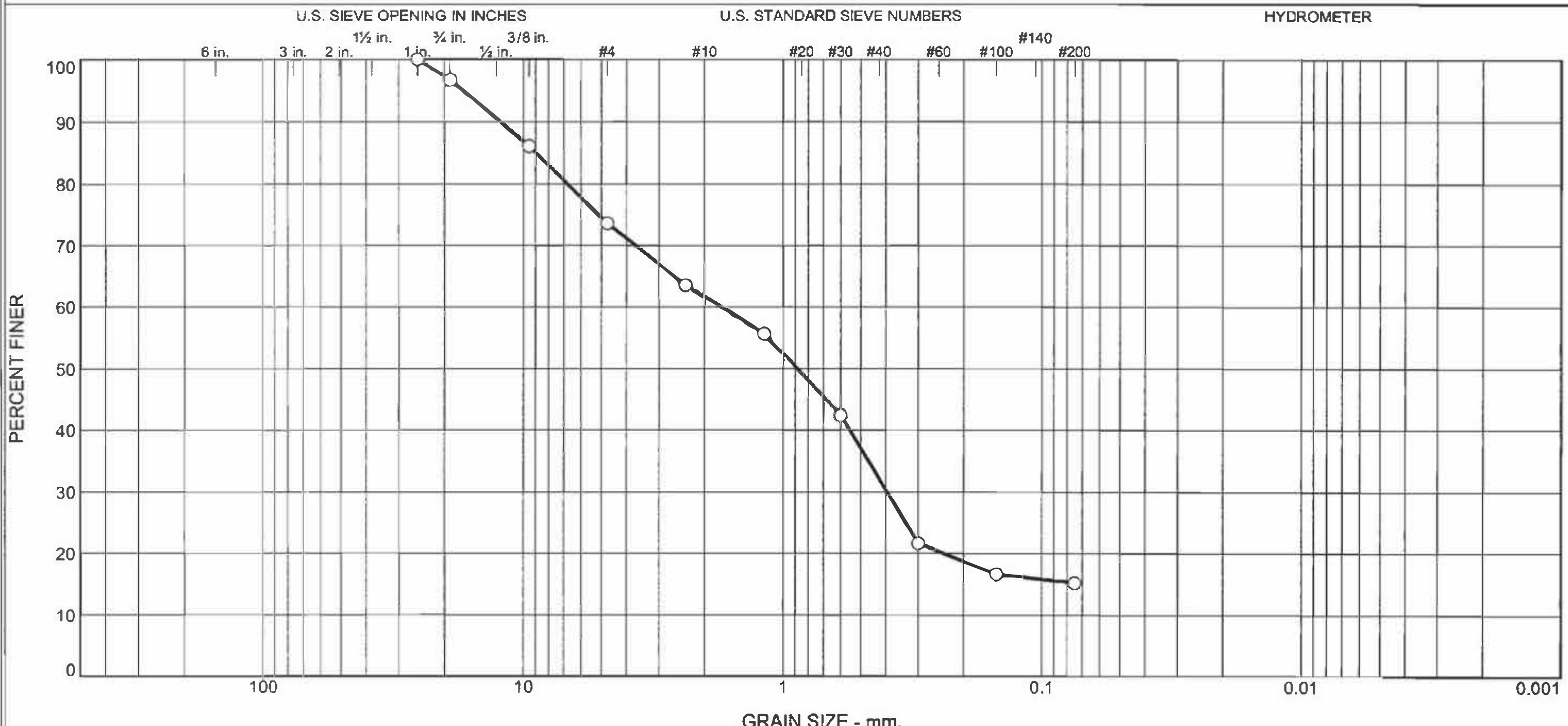
	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○		B-4 S-12	39.5'-41.0'		SP	Sand, brown	5.2	nv	np

Client American Electric Power
Project Mitchell Bottom Ash Pond

Project No. 09-379 Figure

Geo/Environmental Associates, Inc. Knoxville, Tennessee

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	3.3	23.1	12.0	29.5	16.9	15.2	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○		B-1,B-3,B-4	9.5'-10.0'		SC-SM	Sand, clayey, silty, brown w/rock	9.3	16	12
		ST-1							

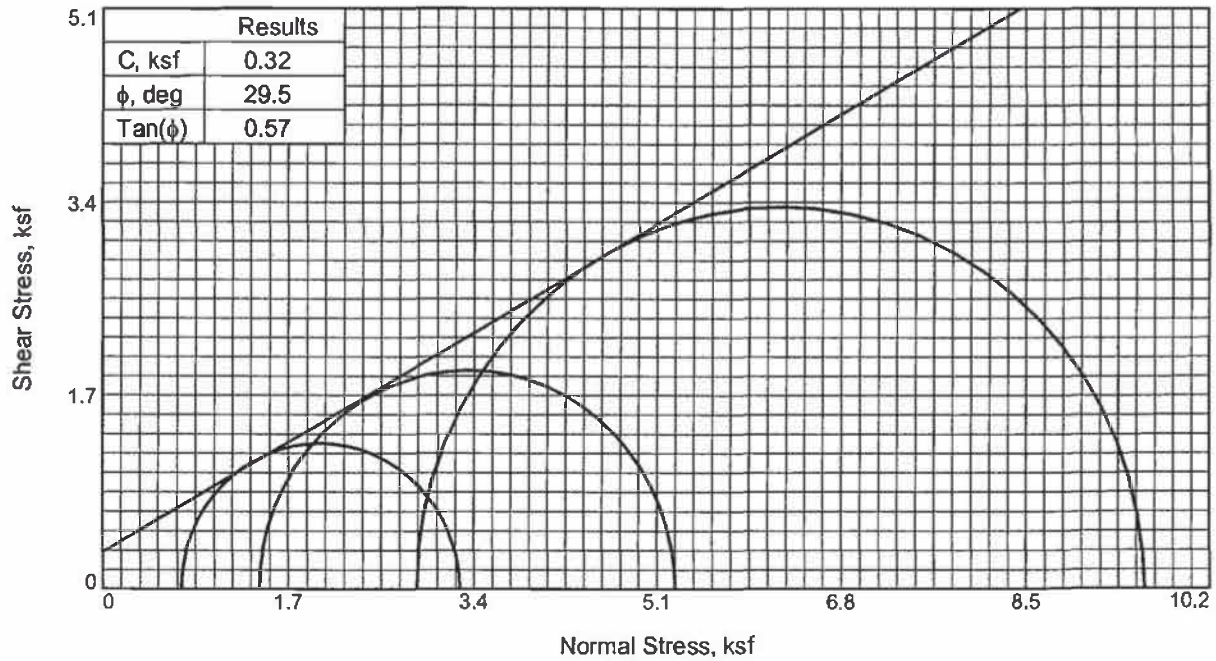
Client American Electric Power

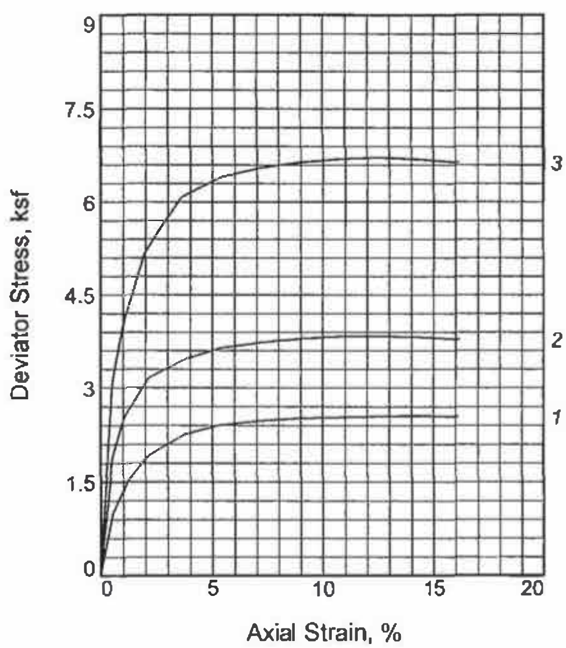
Project Mitchell Bottom Ash Pond

Project No. 09-379 Figure

Geo/Environmental Associates, Inc. Knoxville, Tennessee

○ Sand Dike Material





Sample No.		1	2	3
Initial	Water Content, %	9.2	9.3	9.3
	Dry Density, pcf	114.3	114.5	113.2
	Saturation, %	53.1	53.8	52.0
	Void Ratio	0.4632	0.4617	0.4774
	Diameter, in.	2.80	2.80	2.80
	Height, in.	5.60	5.60	5.60
At Test	Water Content, %	16.8	16.2	16.9
	Dry Density, pcf	115.5	116.6	115.1
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.4491	0.4344	0.4538
	Diameter, in.	2.79	2.78	2.78
	Height, in.	5.58	5.56	5.57
Strain rate, in./min.		0.00	0.00	0.00
Back Pressure, psi		0.00	0.00	0.00
Cell Pressure, psi		5.00	10.00	20.00
Fail. Stress, ksf		2.55	3.83	6.72
Ult. Stress, ksf				
σ_1 Failure, ksf		3.27	5.27	9.60
σ_3 Failure, ksf		0.72	1.44	2.88

Type of Test:
Consolidated Drained

Sample Type: Shelby Tubes

Description: Sand, clayey, silty, brown w/rock

LL= 16 **PL=** 12 **PI=** 4

Specific Gravity= 2.68

Remarks: Remolded specimens from B-1 ST-1, B-3 ST-1 & B-4 ST-1

Figure 1

Client: American Electric Power

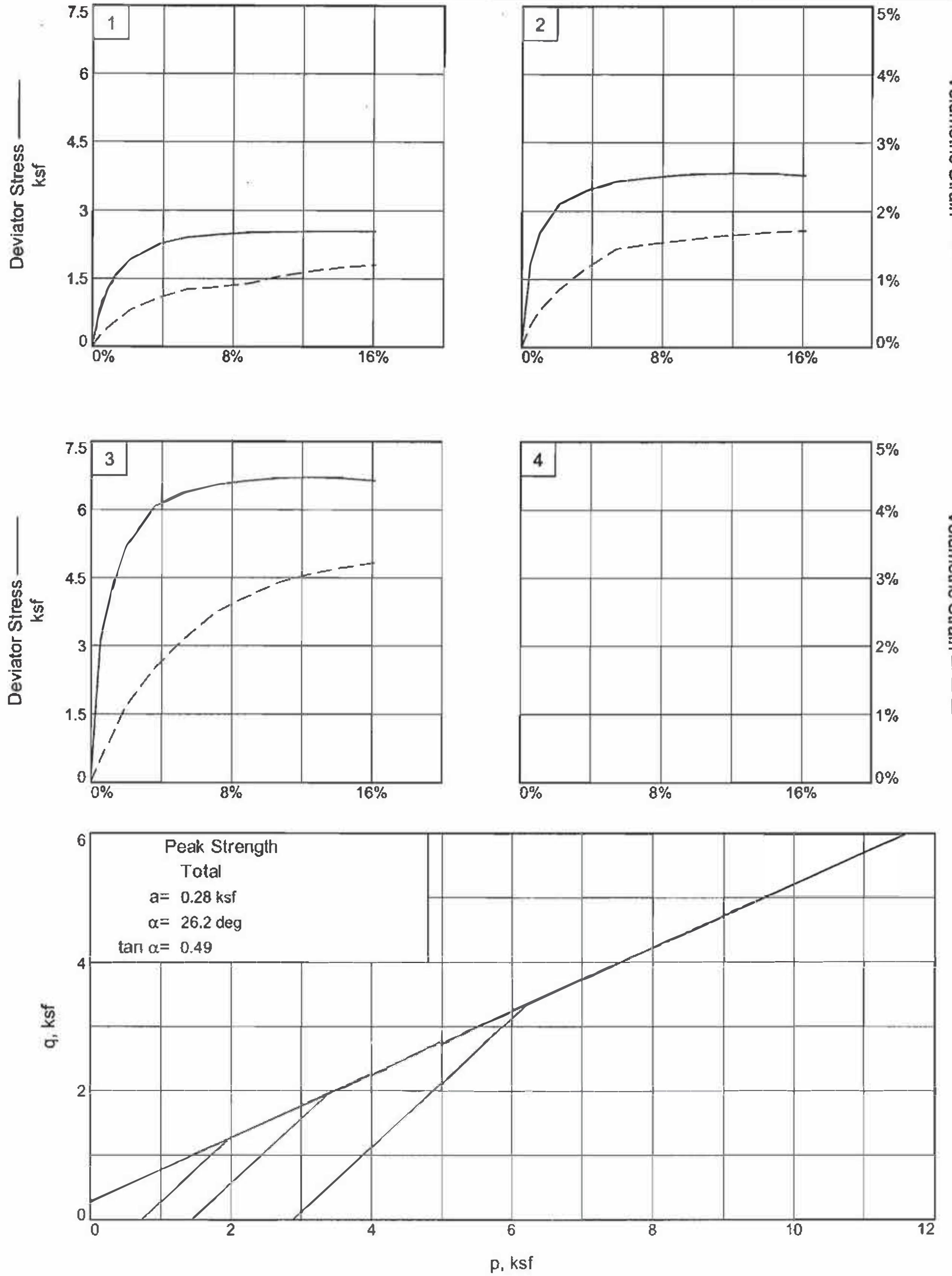
Project: Mitchell Bottom Ash Pond

Sample Number: B-1,B-3,B-4 ST-1 **Depth:** 9.5'-10.0'

Proj. No.: 09-379 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT

Geo/Environmental Associates, Inc.



Client: American Electric Power
Project: Mitchell Bottom Ash Pond
Depth: 9.5'-10.0' **Sample Number:** B-1,B-3,B-4 ST-1
Project No.: 09-379 **Figure** 2

Geo/Environmental Associates, Inc.

CONSTANT HEAD PERMEABILITY TESTING
ASTM D5084-90/SW846 Method 9100 Section 2.8

PROJECT NAME	: Mitchell Bottom Ash Pond	**PROJECT NUMBER**	: 09-379
CLIENT	: American Electric Power	**DATE**	: March 16, 2009

SAMPLE LOCATION AND CONDITIONS

Sample Id. :	B-1, B-3 & B-4; ST-1	**Depth of Tested Sample** :	9.5'-10.0'
Specimen :	5 psi Triaxial Specimen	**Remolded** :	Yes

Sample Description : Sand, clayey, silty, brown w/rock (Sand Dike)

INITIAL SPECIMEN PROPERTIES

Length (in.):	5.6	**Volume (ft^3):**	0.0200	**Wet Density (PCF):**	124.8
Diameter (in.):	2.8	**Weight (lbs):**	2.49	**Dry Density (PCF):**	114.3
Area (ft^2):	0.0428	**Moisture (%):**	9.2		

Chamber Pressure (psi):	5	**Change in Pore Pressure (psi):**	2.0
Influent Pressure (psi):	3	**Change in Chamber Pressure (psi):**	2.0
Back Pressure (psi):	0	**"B" Factor:**	1.0

PERMEABILITY CALCULATIONS

k = Hydraulic Conductivity, (cm/sec)

$$k = \frac{QL}{Ath} = \text{cm/sec}$$

L = Length of Sample, along path of flow, (cm)

Q = Quantity of flow, taken as the average of inflow and outflow, (cm^3)

$$k = \frac{(700.0)(14.22)}{(39.73)(2352)(211.01)}$$

A = Cross-sectional area of specimen, (cm^2)

$$= \frac{9{,}954.00}{19{,}717{,}821.01}$$

t = Interval of time, over which the flow Q occurs, (sec)

h = Difference in hydraulic head across specimen, (cm)

$$= 5.05 \times 10^{-4} \text{ cm/sec}$$

CONSTANT HEAD PERMEABILITY TESTING
ASTM D5084-90/SW846 Method 9100 Section 2.8

PROJECT NAME : Mitchell Bottom Ash Pond

PROJECT NUMBER : 09-379

CLIENT : American Electric Power

DATE : March 16, 2009

SAMPLE LOCATION AND CONDITIONS

Sample Id. : B-1, B-3 & B-4; ST-1

Depth of Tested Sample : 9.5'-10.0'

Specimen : 10 psi Triaxial Specimen

Remolded : Yes

Sample Description : Sand, clayey, silty, brown w/rock (Sand Dike)

INITIAL SPECIMEN PROPERTIES

Length (in.): 5.6 **Volume (ft^3):** 0.0200 **Wet Density (PCF):** 125.1

Diameter (in.): 2.8 **Weight (lbs):** 2.50 **Dry Density (PCF):** 114.5

Area (ft^2): 0.0428 **Moisture (%):** 9.3

Chamber Pressure (psi): 7 **Change in Pore Pressure (psi):** 2.0

Influent Pressure (psi): 5 **Change in Chamber Pressure (psi):** 2.0

Back Pressure (psi): 2 **"B" Factor:** 1.0

PERMEABILITY CALCULATIONS

k = Hydraulic Conductivity, (cm/sec)

L = Length of Sample, along path of flow, (cm)

Q = Quantity of flow, taken as the average of inflow and outflow, (cm^3)

A = Cross-sectional area of specimen, (cm^2)

t = Interval of time, over which the flow Q occurs, (sec)

h = Difference in hydraulic head across specimen, (cm)

$$k = \frac{QL}{Ath} = \text{cm/sec}$$

$$k = \frac{(700.0)(14.22)}{(39.73)(2662)(211.01)}$$

$$= \frac{9{,}954.00}{22{,}316{,}683.47}$$

$$= 4.46 \times 10^{-4} \text{ cm/sec}$$

CONSTANT HEAD PERMEABILITY TESTING
ASTM D5084-90/SW846 Method 9100 Section 2.8

PROJECT NAME	: Mitchell Bottom Ash Pond	**PROJECT NUMBER**	: 09-379
CLIENT	: American Electric Power	**DATE**	: March 16, 2009

SAMPLE LOCATION AND CONDITIONS

Sample Id. :	B-1, B-3 & B-4; ST-1	**Depth of Tested Sample** :	9.5'-10.0'
Specimen :	20 psi Triaxial Specimen	**Remolded** :	Yes

Sample Description : Sand, clayey, silty, brown w/rock (Sand Dike)

INITIAL SPECIMEN PROPERTIES

Length (in.):	5.6	**Volume (ft^3):**	0.0200	**Wet Density (PCF):**	123.7
Diameter (in.):	2.8	**Weight (lbs):**	2.47	**Dry Density (PCF):**	113.2
Area (ft^2):	0.0428	**Moisture (%):**	9.3		

Chamber Pressure (psi):	10	**Change in Pore Pressure (psi):**	2.0
Influent Pressure (psi):	8	**Change in Chamber Pressure (psi):**	2.0
Back Pressure (psi):	5	**"B" Factor:**	1.0

PERMEABILITY CALCULATIONS

k = Hydraulic Conductivity, (cm/sec)

$$k = \frac{QL}{Ath} = \text{cm/sec}$$

L = Length of Sample, along path of flow, (cm)

Q = Quantity of flow, taken as the average of inflow and outflow, (cm^3)

$$k = \frac{(700.0)(14.22)}{(39.73)(1424)(211.01)}$$

A = Cross-sectional area of specimen, (cm^2)

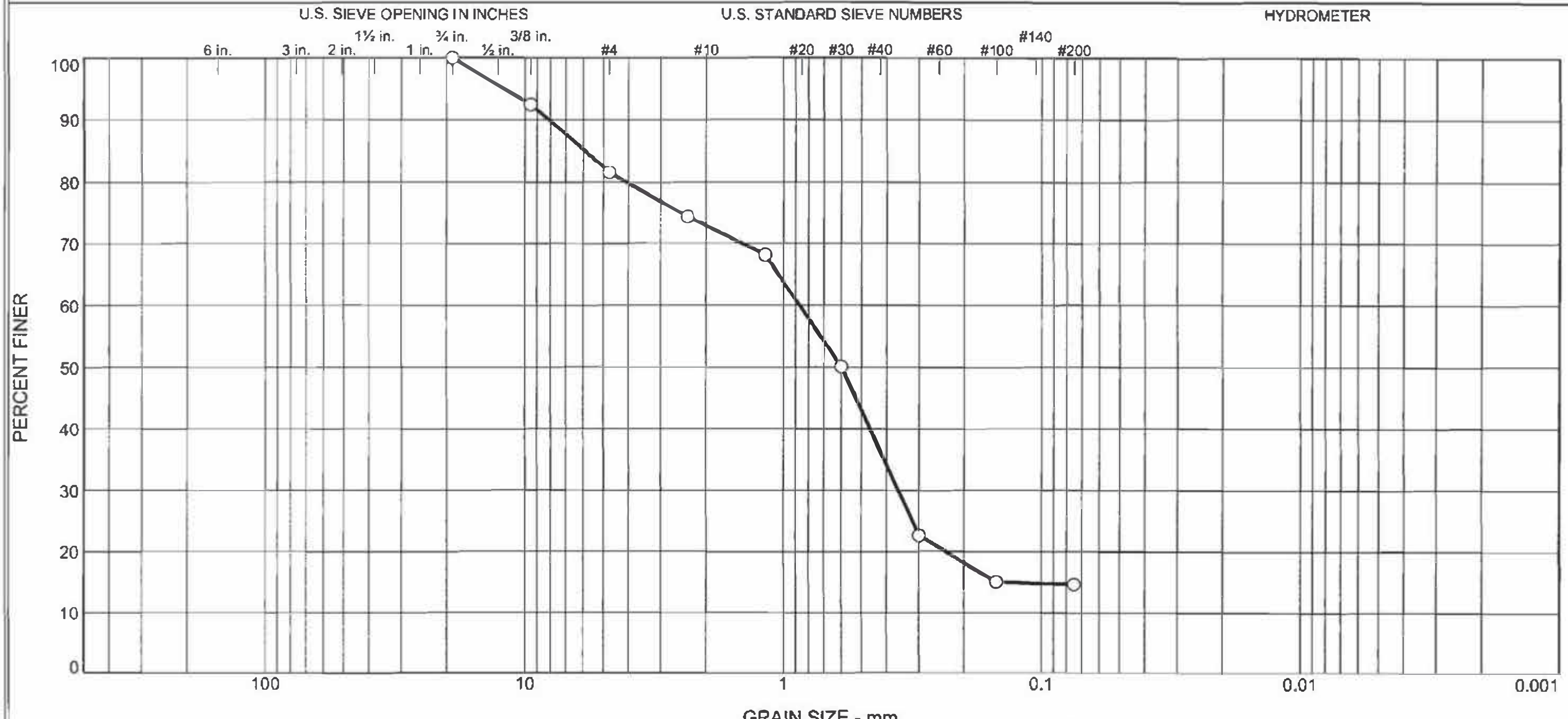
$$= \frac{9{,}954.00}{11{,}938{,}000.48}$$

t = Interval of time, over which the flow Q occurs, (sec)

h = Difference in hydraulic head across specimen, (cm)

$$= 8.34 \times 10^{-4} \text{ cm/sec}$$

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	18.4	8.8	36.4	21.8	14.6	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○		B-5 S-3	7.0'-8.5'		SM	Sand, silty, dark brown w/rock	7.9	12	np

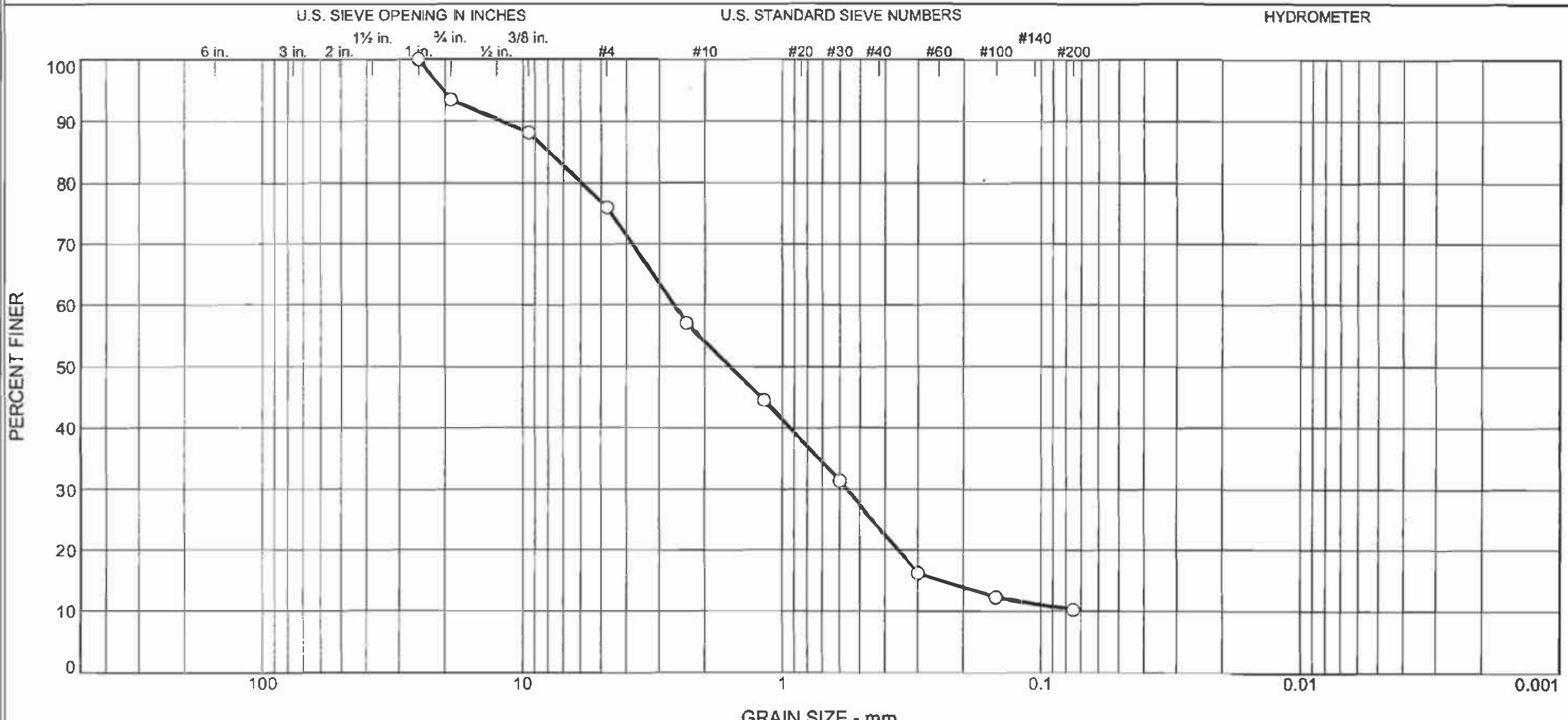
Client American Electric Power

Project Mitchell Bottom Ash Pond

Project No. 09-379 Figure

Geo/Environmental Associates, Inc.
Knoxville, Tennessee

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	6.6	17.4	22.0	30.2	13.6	10.2	

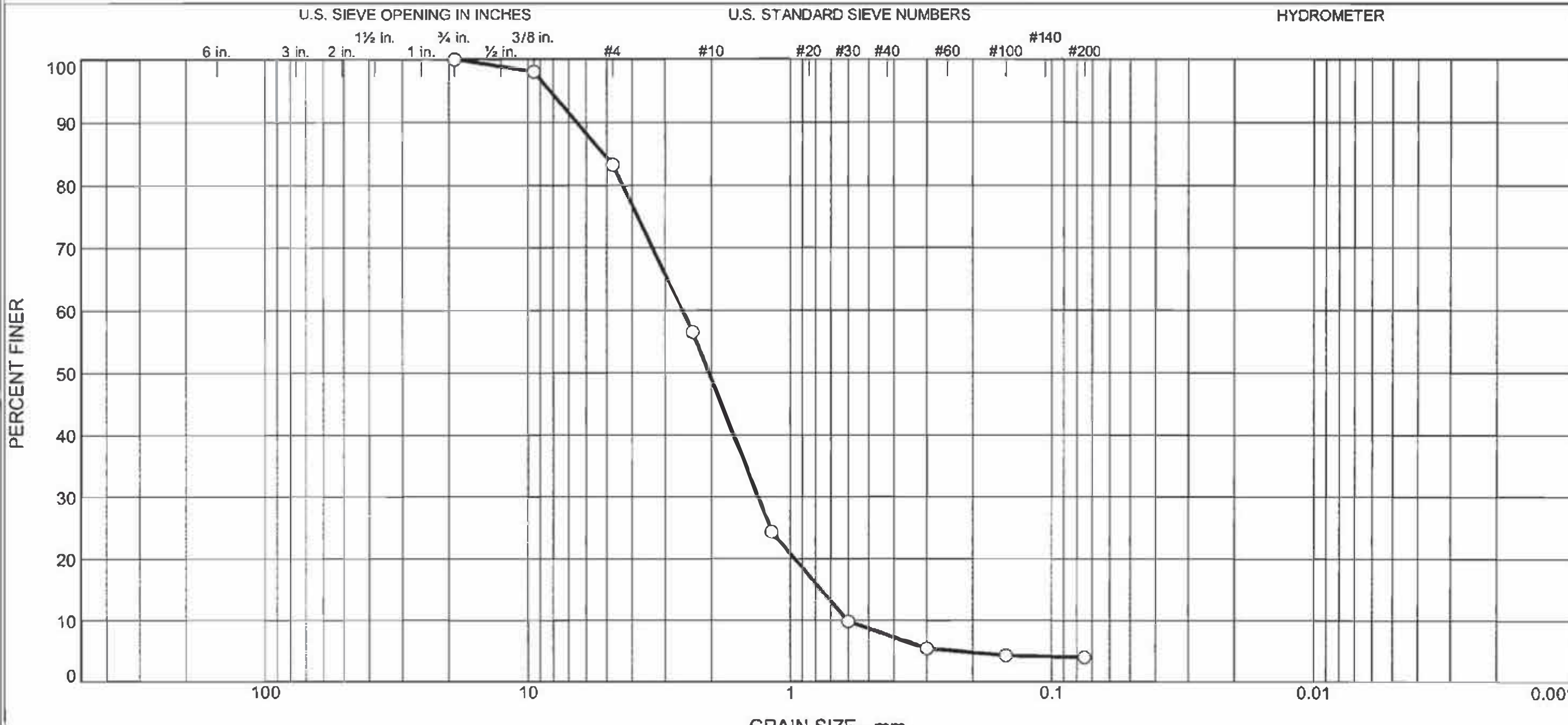
	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○		B-5 S-8	24.5'-26.0'		SP-SC	Sand, clayey, silty, brown w/rock	7.9	16	12

Client American Electric Power
Project Mitchell Bottom Ash Pond

Project No. 09-379 Figure

Geo/Environmental Associates, Inc. Knoxville, Tennessee

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	16.8	34.4	41.2	3.6	4.0	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○		Bucket			SP	Bottom Ash	3.6	nv	np

Client American Electric Power

Project Mitchell Bottom Ash Pond

Project No. 09-379 | Figure

Geo/Environmental Associates, Inc.
Knoxville, Tennessee

Appendix II

Hydraulics and Hydrology

Bottom Ash Pond

SUMMARY OF INFLOW HYDROGRAPH
AND FLOOD ROUTING THROUGH
MITCHELL BOTTOM ASH POND
FOR ½ 6-HOUR PMP STORM EVENT

Starting Pool Elevation	=	681 ft, NAVD
Pipe Spillway Invert Elevation	=	681 ft, NAVD
Crest Elevation	=	690 ft, NAVD
Peak Inflow	=	111.08 cfs
Peak Outflow	=	23.83 cfs
Peak Storage	=	10.75 ac-ft
Maximum Impoundment Level During Storm	=	683.51 ft, NAVD
Minimum Freeboard During Storm	=	6.49 ft

```
1***************************************                                                                              ***************************************
 *                                     *                                                                              *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                                            *    U.S. ARMY CORPS OF ENGINEERS     *
 *           SEPTEMBER 1990            *                                                                              *    HYDROLOGIC ENGINEERING CENTER    *
 *            VERSION 4.0              *                                                                              *         609 SECOND STREET           *
 *                                     *                                                                              *      DAVIS, CALIFORNIA 95616        *
 *  RUN DATE  12/21/2015  TIME  10:40:34 *                                                                            *         (916) 756-1104              *
 *                                     *                                                                              *                                     *
 ***************************************                                                                              ***************************************


                    X     X  XXXXXXX   XXXXX          X
                    X     X  X        X     X        XX
                    X     X  X        X               X
                    XXXXXXX  XXXX     X       XXXXX   X
                    X     X  X        X               X
                    X     X  X        X     X         X
                    X     X  XXXXXXX   XXXXX         XXX


     THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

     THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
     THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
     NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
     DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
     KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM
```

```
         LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 *** FREE ***
            1          ID  ****************************************************************************
            2          ID  *      Mitchell Bottom Ash Pond       File: MBAP.inp                           *
            3          ID  *      GA Project No. 15055007.00                                              *
            4          ID  *      Storm Storage for 1/2 6-Hour PMP                                        *
            5          ID  *      Crest Elevation = 690'                                                  *
            6          ID  ****************************************************************************
            7          ID  *      Analyses by: Geo/Environmental Associates, Inc.                         *
            8          ID  *                   Knoxville, TN                                              *
            9          ID  *                   Seth W. Frank P.E.                                         *
           10          ID  *                   August 2014                                                *
           11          ID  ****************************************************************************
           12          IT       5       0       0     300
           13          IO       1
           14          JR  PRECIP     0.5
           15          VS   BASIN    BASE      IN     IMP     IMP     IMP
           16          VV    2.11    2.11    2.11    2.11    6.11    7.11
           17          IN      15

           18          KK   BASIN
           19          KM   COMPUTE INFLOW HYDROGRAPH FOR MITCHELL BOTTOM ASH POND USING SCS METHOD
           20          PB       0
           21          PI   0.258   0.347   0.420   0.478   0.520   0.546   0.624   0.804   0.790   0.939
           22          PI   2.264   4.483   4.834   3.277   1.215   0.797   0.831   0.735   0.553   0.535
           23          PI   0.501   0.451   0.386   0.305
           24          BA   0.016
           25          LU       0    0.05    44.8
           26          UD     0.0

           27          KK    BASE
           28          KM   BASE FLOW
           29          IN     360
           30          QI    11.6    11.6    11.6

           31          KK      IN
           32          KM   COMBINE BASIN INFLOW AND BASEFLOW
           33          KO       1
           34          HC       2

           35          KK     IMP
           36          KM   ROUTE COMPUTED HYDROGRAPH AND BASE FLOW THROUGH CLEAR WATER POND
           37          RS       1    ELEV     681
           38          SA    4.03    4.18    4.45    4.72    6.27    7.81    8.03    8.26    8.48    8.71
           39          SQ       0    6.90   17.82   29.62   40.80   50.31   57.32   61.12   61.12   61.12
           40          SE     681     682     683     684     685     686     687     688     689     690
           41          ZZ
```

```
1***************************************                                                    ***************************************
 *                                     *                                                    *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                  *   U.S. ARMY CORPS OF ENGINEERS      *
 *           SEPTEMBER 1990            *                                                    *   HYDROLOGIC ENGINEERING CENTER     *
 *             VERSION 4.0             *                                                    *        609 SECOND STREET            *
 *                                     *                                                    *     DAVIS, CALIFORNIA 95616         *
 *  RUN DATE  12/21/2015  TIME  10:40:34 *                                                  *          (916) 756-1104             *
 *                                     *                                                    *                                     *
 ***************************************                                                    ***************************************



                         ***************************************************************************
                         *      Mitchell Bottom Ash Pond       File: MBAP.inp                       *
                         *      GA Project No. 15055007.00                                          *
                         *      Storm Storage for 1/2 6-Hour PMP                                    *
                         *      Crest Elevation = 690'                                              *
                         ***************************************************************************
                         *      Analyses by: Geo/Environmental Associates, Inc.                     *
                         *                   Knoxville, TN                                          *
                         *                   Seth W. Frank P.E.                                     *
                         *                   August 2014                                            *
                         ***************************************************************************

  13 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          1  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN          5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1    0  STARTING DATE
                       ITIME       0000  STARTING TIME
                          NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE      2    0  ENDING DATE
                      NDTIME       0055  ENDING TIME
                      ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE   24.92 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
             PRECIPITATION DEPTH   INCHES
             LENGTH, ELEVATION     FEET
             FLOW                  CUBIC FEET PER SECOND
             STORAGE VOLUME        ACRE-FEET
             SURFACE AREA          ACRES
             TEMPERATURE           DEGREES FAHRENHEIT

               USER-DEFINED OUTPUT SPECIFICATIONS

       TABLE 1
     VS       STATION     BASIN      BASE       IN       IMP       IMP       IMP
     VV VARIABLE CODE      2.11      2.11      2.11      2.11      6.11      7.11       .00       .00       .00       .00

     JP          MULTI-PLAN OPTION
                       NPLAN          1  NUMBER OF PLANS

     JR          MULTI-RATIO OPTION
                     RATIOS OF PRECIPITATION
                      .50


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
  18 KK   *     BASIN  *
          *            *
          **************
                          COMPUTE INFLOW HYDROGRAPH FOR MITCHELL BOTTOM ASH POND USING SCS METHOD

  17 IN          TIME DATA FOR INPUT TIME SERIES
                       JXMIN         15  TIME INTERVAL IN MINUTES
                      JXDATE      1    0  STARTING DATE
                      JXTIME          0  STARTING TIME
```

```
              SUBBASIN RUNOFF DATA

   24 BA          SUBBASIN CHARACTERISTICS
                        TAREA         .02  SUBBASIN AREA

                  PRECIPITATION DATA

   20 PB                STORM       26.89  BASIN TOTAL PRECIPITATION

   21 PI            INCREMENTAL PRECIPITATION PATTERN
                        .09       .09       .09       .12       .12       .12       .14       .14       .14       .16
                        .16       .16       .17       .17       .17       .18       .18       .18       .21       .21
                        .21       .27       .27       .27       .26       .26       .26       .31       .31       .31
                        .75       .75       .75      1.49      1.49      1.49      1.61      1.61      1.61      1.09
                       1.09      1.09       .41       .40       .41       .27       .27       .27       .28       .28
                        .28       .25       .24       .25       .18       .18       .18       .18       .18       .18
                        .17       .17       .17       .15       .15       .15       .13       .13       .13       .10
                        .10       .10

   25 LU          UNIFORM LOSS RATE
                        STRTL         .00  INITIAL LOSS
                        CNSTL         .05  UNIFORM LOSS RATE
                        RTIMP       44.80  PERCENT IMPERVIOUS AREA

   26 UD          SCS DIMENSIONLESS UNITGRAPH
                         TLAG         .00  LAG

                                                                       ***


  PEAK FLOW     TIME                         MAXIMUM AVERAGE FLOW
                                       6-HR       24-HR       72-HR     24.92-HR
+   (CFS)       (HR)
                             (CFS)
+      24.      4.58                    21.         15.         14.          14.
                          (INCHES)     6.212      17.047      17.093       17.093
                           (AC-FT)       11.         29.         29.          29.

 PEAK STORAGE   TIME                        MAXIMUM AVERAGE STORAGE
                                       6-HR       24-HR       72-HR     24.92-HR
+  (AC-FT)      (HR)
       11.      4.58                    10.          7.          7.           7.

  PEAK STAGE    TIME                         MAXIMUM AVERAGE STAGE
                                       6-HR       24-HR       72-HR     24.92-HR
+   (FEET)      (HR)
    683.51      4.58                  683.30      682.70      682.64       682.64

                             CUMULATIVE AREA =     .03 SQ MI
```

```
1

                PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
                                  FLOWS IN CUBIC FEET PER SECOND,  AREA IN SQUARE MILES
                                                 TIME TO PEAK IN HOURS


                                                              RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION     AREA    PLAN           RATIO 1
                                                        .50

 HYDROGRAPH AT
+                  BASIN       .02     1   FLOW          99.
                                           TIME        3.25

 HYDROGRAPH AT
+                   BASE       .02     1   FLOW          12.
                                           TIME         .08

  2 COMBINED AT
+                     IN       .03     1   FLOW         111.
                                           TIME        3.25

 ROUTED TO
+                    IMP       .03     1   FLOW          24.
                                           TIME        4.58

                                       ** PEAK STAGES IN FEET **
                                       1   STAGE      683.51
                                           TIME        4.58
```

1TABLE 1	STATION	BASIN FLOW	BASE FLOW	IN FLOW	IMP FLOW	IMP STORAGE	IMP STAGE
	PLAN	1	1	1	1	1	1
	RATIO	.50	.50	.50	.50	.50	.50
PER	DAY MON HRMN						
1	1 0000	.00	11.60	11.60	.00	.00	681.00
2	1 0005	3.75	11.60	15.35	.16	.09	681.02
3	1 0010	4.80	11.60	16.40	.34	.20	681.05
4	1 0015	5.00	11.60	16.60	.52	.31	681.08
5	1 0020	6.41	11.60	18.01	.72	.43	681.10
6	1 0025	6.79	11.60	18.39	.92	.55	681.13
7	1 0030	6.87	11.60	18.47	1.12	.67	681.16
8	1 0035	8.00	11.60	19.60	1.32	.79	681.19
9	1 0040	8.31	11.60	19.91	1.54	.91	681.22
10	1 0045	8.38	11.60	19.98	1.75	1.04	681.25
11	1 0050	9.28	11.60	20.88	1.96	1.17	681.28
12	1 0055	9.53	11.60	21.13	2.18	1.30	681.32
13	1 0100	9.58	11.60	21.18	2.40	1.43	681.35
14	1 0105	10.23	11.60	21.83	2.62	1.56	681.38
15	1 0110	10.41	11.60	22.01	2.84	1.69	681.41
16	1 0115	10.45	11.60	22.05	3.06	1.82	681.44
17	1 0120	10.85	11.60	22.45	3.28	1.95	681.48
18	1 0125	10.96	11.60	22.56	3.51	2.09	681.51
19	1 0130	10.99	11.60	22.59	3.73	2.22	681.54
20	1 0135	12.19	11.60	23.79	3.95	2.35	681.57
21	1 0140	12.52	11.60	24.12	4.18	2.49	681.61
22	1 0145	12.59	11.60	24.19	4.41	2.62	681.64
23	1 0150	15.36	11.60	26.96	4.65	2.77	681.67
24	1 0155	16.14	11.60	27.74	4.91	2.92	681.71
25	1 0200	16.29	11.60	27.89	5.18	3.08	681.75
26	1 0205	16.10	11.60	27.70	5.44	3.24	681.79
27	1 0210	16.04	11.60	27.64	5.69	3.39	681.83
28	1 0215	16.03	11.60	27.63	5.95	3.54	681.86
29	1 0220	18.32	11.60	29.92	6.21	3.69	681.90
30	1 0225	18.96	11.60	30.56	6.49	3.86	681.94
31	1 0230	19.08	11.60	30.68	6.76	4.02	681.98
32	1 0235	39.43	11.60	51.03	7.28	4.26	682.04
33	1 0240	45.13	11.60	56.73	8.09	4.57	682.11
34	1 0245	46.24	11.60	57.84	8.94	4.91	682.19
35	1 0250	80.51	11.60	92.11	10.08	5.36	682.29
36	1 0255	90.04	11.60	101.64	11.58	5.95	682.43
37	1 0300	91.92	11.60	103.52	13.15	6.58	682.57
38	1 0305	97.68	11.60	109.28	14.77	7.21	682.72
39	1 0310	99.18	11.60	110.78	16.41	7.86	682.87
40	1 0315	99.48	11.60	111.08	18.05	8.51	683.02
41	1 0320	75.65	11.60	87.25	19.47	9.06	683.14
42	1 0325	68.96	11.60	80.56	20.61	9.50	683.24
43	1 0330	67.65	11.60	79.25	21.65	9.91	683.32
44	1 0335	35.75	11.60	47.35	22.38	10.19	683.39
45	1 0340	26.89	11.60	38.49	22.74	10.33	683.42
46	1 0345	25.15	11.60	36.75	23.00	10.43	683.44
47	1 0350	18.39	11.60	29.99	23.18	10.50	683.45
48	1 0355	16.60	11.60	28.20	23.29	10.54	683.46
49	1 0400	16.24	11.60	27.84	23.37	10.58	683.47
50	1 0405	16.70	11.60	28.30	23.45	10.61	683.48

1TABLE 1 (CONT.)			STATION	BASIN FLOW	BASE FLOW	IN FLOW	IMP FLOW	IMP STORAGE	IMP STAGE	
			PLAN	1	1	1	1	1	1	
			RATIO	.50	.50	.50	.50	.50	.50	
PER	DAY	MON	HRMN							
51	1		0410	16.84	11.60	28.44	23.54	10.64	683.48	
52	1		0415	16.87	11.60	28.47	23.63	10.68	683.49	
53	1		0420	15.40	11.60	27.00	23.70	10.70	683.50	
54	1		0425	14.99	11.60	26.59	23.75	10.72	683.50	
55	1		0430	14.91	11.60	26.51	23.80	10.74	683.51	
56	1		0435	12.10	11.60	23.70	23.83	**10.75**	**683.51**	**Maximum impoundment stage/storage**
57	1		0440	11.32	11.60	22.92	23.82	10.75	683.51	
58	1		0445	11.17	11.60	22.77	23.80	10.74	683.51	
59	1		0450	10.86	11.60	22.46	23.78	10.73	683.51	
60	1		0455	10.78	11.60	22.38	23.75	10.72	683.50	
61	1		0500	10.77	11.60	22.37	23.73	10.72	683.50	
62	1		0505	10.24	11.60	21.84	23.70	10.70	683.50	
63	1		0510	10.10	11.60	21.70	23.67	10.69	683.50	
64	1		0515	10.07	11.60	21.67	23.63	10.68	683.49	
65	1		0520	9.29	11.60	20.89	23.59	10.66	683.49	
66	1		0525	9.08	11.60	20.68	23.54	10.64	683.48	
67	1		0530	9.04	11.60	20.64	23.49	10.62	683.48	
68	1		0535	8.03	11.60	19.63	23.43	10.60	683.48	
69	1		0540	7.75	11.60	19.35	23.36	10.57	683.47	
70	1		0545	7.70	11.60	19.30	23.29	10.55	683.46	
71	1		0550	6.44	11.60	18.04	23.21	10.51	683.46	
72	1		0555	6.10	11.60	17.70	23.12	10.48	683.45	
73	1		0600	6.03	11.60	17.63	23.02	10.44	683.44	
74	1		0605	1.55	11.60	13.15	22.89	10.39	683.43	
75	1		0610	.29	11.60	11.89	22.71	10.32	683.41	
76	1		0615	.05	11.60	11.65	22.51	10.24	683.40	
77	1		0620	.00	11.60	11.60	22.32	10.17	683.38	
78	1		0625	.00	11.60	11.60	22.13	10.09	683.37	
79	1		0630	.00	11.60	11.60	21.95	10.02	683.35	
80	1		0635	.00	11.60	11.60	21.77	9.95	683.33	
81	1		0640	.00	11.60	11.60	21.59	9.88	683.32	
82	1		0645	.00	11.60	11.60	21.41	9.81	683.30	
83	1		0650	.00	11.60	11.60	21.24	9.75	683.29	
84	1		0655	.00	11.60	11.60	21.07	9.68	683.28	
85	1		0700	.00	11.60	11.60	20.90	9.62	683.26	
86	1		0705	.00	11.60	11.60	20.74	9.55	683.25	
87	1		0710	.00	11.60	11.60	20.58	9.49	683.23	
88	1		0715	.00	11.60	11.60	20.42	9.43	683.22	
89	1		0720	.00	11.60	11.60	20.27	9.37	683.21	
90	1		0725	.00	11.60	11.60	20.11	9.31	683.19	
91	1		0730	.00	11.60	11.60	19.97	9.25	683.18	
92	1		0735	.00	11.60	11.60	19.82	9.20	683.17	
93	1		0740	.00	11.60	11.60	19.67	9.14	683.16	
94	1		0745	.00	11.60	11.60	19.53	9.08	683.15	
95	1		0750	.00	11.60	11.60	19.39	9.03	683.13	
96	1		0755	.00	11.60	11.60	19.26	8.98	683.12	
97	1		0800	.00	11.60	11.60	19.12	8.92	683.11	
98	1		0805	.00	11.60	11.60	18.99	8.87	683.10	
99	1		0810	.00	11.60	11.60	18.86	8.82	683.09	
100	1		0815	.00	11.60	11.60	18.73	8.77	683.08	

1TABLE 1 (CONT.)			STATION	BASIN FLOW	BASE FLOW	IN FLOW	IMP FLOW	IMP STORAGE	IMP STAGE
			PLAN	1	1	1	1	1	1
			RATIO	.50	.50	.50	.50	.50	.50
PER	DAY	MON	HRMN						
101	1		0820	.00	11.60	11.60	18.61	8.72	683.07
102	1		0825	.00	11.60	11.60	18.48	8.68	683.06
103	1		0830	.00	11.60	11.60	18.36	8.63	683.05
104	1		0835	.00	11.60	11.60	18.24	8.58	683.04
105	1		0840	.00	11.60	11.60	18.13	8.54	683.03
106	1		0845	.00	11.60	11.60	18.01	8.49	683.02
107	1		0850	.00	11.60	11.60	17.90	8.45	683.01
108	1		0855	.00	11.60	11.60	17.79	8.41	683.00
109	1		0900	.00	11.60	11.60	17.68	8.36	682.99
110	1		0905	.00	11.60	11.60	17.58	8.32	682.98
111	1		0910	.00	11.60	11.60	17.47	8.28	682.97
112	1		0915	.00	11.60	11.60	17.37	8.24	682.96
113	1		0920	.00	11.60	11.60	17.27	8.20	682.95
114	1		0925	.00	11.60	11.60	17.17	8.16	682.94
115	1		0930	.00	11.60	11.60	17.08	8.13	682.93
116	1		0935	.00	11.60	11.60	16.98	8.09	682.92
117	1		0940	.00	11.60	11.60	16.89	8.05	682.91
118	1		0945	.00	11.60	11.60	16.80	8.02	682.91
119	1		0950	.00	11.60	11.60	16.71	7.98	682.90
120	1		0955	.00	11.60	11.60	16.62	7.95	682.89
121	1		1000	.00	11.60	11.60	16.53	7.91	682.88
122	1		1005	.00	11.60	11.60	16.45	7.88	682.87
123	1		1010	.00	11.60	11.60	16.37	7.84	682.87
124	1		1015	.00	11.60	11.60	16.28	7.81	682.86
125	1		1020	.00	11.60	11.60	16.20	7.78	682.85
126	1		1025	.00	11.60	11.60	16.12	7.75	682.84
127	1		1030	.00	11.60	11.60	16.04	7.72	682.84
128	1		1035	.00	11.60	11.60	15.97	7.69	682.83
129	1		1040	.00	11.60	11.60	15.89	7.66	682.82
130	1		1045	.00	11.60	11.60	15.82	7.63	682.82
131	1		1050	.00	11.60	11.60	15.74	7.60	682.81
132	1		1055	.00	11.60	11.60	15.67	7.57	682.80
133	1		1100	.00	11.60	11.60	15.60	7.54	682.80
134	1		1105	.00	11.60	11.60	15.53	7.52	682.79
135	1		1110	.00	11.60	11.60	15.47	7.49	682.78
136	1		1115	.00	11.60	11.60	15.40	7.46	682.78
137	1		1120	.00	11.60	11.60	15.33	7.44	682.77
138	1		1125	.00	11.60	11.60	15.27	7.41	682.77
139	1		1130	.00	11.60	11.60	15.21	7.39	682.76
140	1		1135	.00	11.60	11.60	15.14	7.36	682.75
141	1		1140	.00	11.60	11.60	15.08	7.34	682.75
142	1		1145	.00	11.60	11.60	15.02	7.31	682.74
143	1		1150	.00	11.60	11.60	14.96	7.29	682.74
144	1		1155	.00	11.60	11.60	14.90	7.27	682.73
145	1		1200	.00	11.60	11.60	14.85	7.24	682.73
146	1		1205	.00	11.60	11.60	14.79	7.22	682.72
147	1		1210	.00	11.60	11.60	14.74	7.20	682.72
148	1		1215	.00	11.60	11.60	14.68	7.18	682.71
149	1		1220	.00	11.60	11.60	14.63	7.16	682.71
150	1		1225	.00	11.60	11.60	14.58	7.14	682.70

1TABLE 1 (CONT.)			STATION PLAN RATIO	BASIN FLOW 1 .50	BASE FLOW 1 .50	IN FLOW 1 .50	IMP FLOW 1 .50	IMP STORAGE 1 .50	IMP STAGE 1 .50
PER	DAY	MON	HRMN						
151	1		1230	.00	11.60	11.60	14.52	7.12	682.70
152	1		1235	.00	11.60	11.60	14.47	7.10	682.69
153	1		1240	.00	11.60	11.60	14.42	7.08	682.69
154	1		1245	.00	11.60	11.60	14.38	7.06	682.68
155	1		1250	.00	11.60	11.60	14.33	7.04	682.68
156	1		1255	.00	11.60	11.60	14.28	7.02	682.68
157	1		1300	.00	11.60	11.60	14.23	7.00	682.67
158	1		1305	.00	11.60	11.60	14.19	6.98	682.67
159	1		1310	.00	11.60	11.60	14.14	6.97	682.66
160	1		1315	.00	11.60	11.60	14.10	6.95	682.66
161	1		1320	.00	11.60	11.60	14.06	6.93	682.66
162	1		1325	.00	11.60	11.60	14.01	6.92	682.65
163	1		1330	.00	11.60	11.60	13.97	6.90	682.65
164	1		1335	.00	11.60	11.60	13.93	6.88	682.64
165	1		1340	.00	11.60	11.60	13.89	6.87	682.64
166	1		1345	.00	11.60	11.60	13.85	6.85	682.64
167	1		1350	.00	11.60	11.60	13.81	6.84	682.63
168	1		1355	.00	11.60	11.60	13.77	6.82	682.63
169	1		1400	.00	11.60	11.60	13.74	6.81	682.63
170	1		1405	.00	11.60	11.60	13.70	6.79	682.62
171	1		1410	.00	11.60	11.60	13.66	6.78	682.62
172	1		1415	.00	11.60	11.60	13.63	6.76	682.62
173	1		1420	.00	11.60	11.60	13.59	6.75	682.61
174	1		1425	.00	11.60	11.60	13.56	6.74	682.61
175	1		1430	.00	11.60	11.60	13.52	6.72	682.61
176	1		1435	.00	11.60	11.60	13.49	6.71	682.60
177	1		1440	.00	11.60	11.60	13.46	6.70	682.60
178	1		1445	.00	11.60	11.60	13.43	6.68	682.60
179	1		1450	.00	11.60	11.60	13.40	6.67	682.59
180	1		1455	.00	11.60	11.60	13.36	6.66	682.59
181	1		1500	.00	11.60	11.60	13.33	6.65	682.59
182	1		1505	.00	11.60	11.60	13.30	6.63	682.59
183	1		1510	.00	11.60	11.60	13.27	6.62	682.58
184	1		1515	.00	11.60	11.60	13.25	6.61	682.58
185	1		1520	.00	11.60	11.60	13.22	6.60	682.58
186	1		1525	.00	11.60	11.60	13.19	6.59	682.58
187	1		1530	.00	11.60	11.60	13.16	6.58	682.57
188	1		1535	.00	11.60	11.60	13.13	6.57	682.57
189	1		1540	.00	11.60	11.60	13.11	6.56	682.57
190	1		1545	.00	11.60	11.60	13.08	6.55	682.57
191	1		1550	.00	11.60	11.60	13.06	6.54	682.56
192	1		1555	.00	11.60	11.60	13.03	6.53	682.56
193	1		1600	.00	11.60	11.60	13.01	6.52	682.56
194	1		1605	.00	11.60	11.60	12.98	6.51	682.56
195	1		1610	.00	11.60	11.60	12.96	6.50	682.55
196	1		1615	.00	11.60	11.60	12.93	6.49	682.55
197	1		1620	.00	11.60	11.60	12.91	6.48	682.55
198	1		1625	.00	11.60	11.60	12.89	6.47	682.55
199	1		1630	.00	11.60	11.60	12.87	6.46	682.55
200	1		1635	.00	11.60	11.60	12.84	6.45	682.54

1TABLE 1 (CONT.)	STATION	BASIN FLOW	BASE FLOW	IN FLOW	IMP FLOW	IMP STORAGE	IMP STAGE
	PLAN	1	1	1	1	1	1
	RATIO	.50	.50	.50	.50	.50	.50
PER DAY MON	HRMN						
201 1	1640	.00	11.60	11.60	12.82	6.44	682.54
202 1	1645	.00	11.60	11.60	12.80	6.44	682.54
203 1	1650	.00	11.60	11.60	12.78	6.43	682.54
204 1	1655	.00	11.60	11.60	12.76	6.42	682.54
205 1	1700	.00	11.60	11.60	12.74	6.41	682.53
206 1	1705	.00	11.60	11.60	12.72	6.40	682.53
207 1	1710	.00	11.60	11.60	12.70	6.40	682.53
208 1	1715	.00	11.60	11.60	12.68	6.39	682.53
209 1	1720	.00	11.60	11.60	12.66	6.38	682.53
210 1	1725	.00	11.60	11.60	12.65	6.37	682.53
211 1	1730	.00	11.60	11.60	12.63	6.37	682.52
212 1	1735	.00	11.60	11.60	12.61	6.36	682.52
213 1	1740	.00	11.60	11.60	12.59	6.35	682.52
214 1	1745	.00	11.60	11.60	12.58	6.35	682.52
215 1	1750	.00	11.60	11.60	12.56	6.34	682.52
216 1	1755	.00	11.60	11.60	12.54	6.33	682.52
217 1	1800	.00	11.60	11.60	12.53	6.33	682.52
218 1	1805	.00	11.60	11.60	12.51	6.32	682.51
219 1	1810	.00	11.60	11.60	12.49	6.31	682.51
220 1	1815	.00	11.60	11.60	12.48	6.31	682.51
221 1	1820	.00	11.60	11.60	12.46	6.30	682.51
222 1	1825	.00	11.60	11.60	12.45	6.30	682.51
223 1	1830	.00	11.60	11.60	12.43	6.29	682.51
224 1	1835	.00	11.60	11.60	12.42	6.29	682.51
225 1	1840	.00	11.60	11.60	12.41	6.28	682.50
226 1	1845	.00	11.60	11.60	12.39	6.27	682.50
227 1	1850	.00	11.60	11.60	12.38	6.27	682.50
228 1	1855	.00	11.60	11.60	12.36	6.26	682.50
229 1	1900	.00	11.60	11.60	12.35	6.26	682.50
230 1	1905	.00	11.60	11.60	12.34	6.25	682.50
231 1	1910	.00	11.60	11.60	12.33	6.25	682.50
232 1	1915	.00	11.60	11.60	12.31	6.24	682.50
233 1	1920	.00	11.60	11.60	12.30	6.24	682.49
234 1	1925	.00	11.60	11.60	12.29	6.23	682.49
235 1	1930	.00	11.60	11.60	12.28	6.23	682.49
236 1	1935	.00	11.60	11.60	12.26	6.22	682.49
237 1	1940	.00	11.60	11.60	12.25	6.22	682.49
238 1	1945	.00	11.60	11.60	12.24	6.22	682.49
239 1	1950	.00	11.60	11.60	12.23	6.21	682.49
240 1	1955	.00	11.60	11.60	12.22	6.21	682.49
241 1	2000	.00	11.60	11.60	12.21	6.20	682.49
242 1	2005	.00	11.60	11.60	12.20	6.20	682.49
243 1	2010	.00	11.60	11.60	12.19	6.19	682.48
244 1	2015	.00	11.60	11.60	12.18	6.19	682.48
245 1	2020	.00	11.60	11.60	12.17	6.19	682.48
246 1	2025	.00	11.60	11.60	12.16	6.18	682.48
247 1	2030	.00	11.60	11.60	12.15	6.18	682.48
248 1	2035	.00	11.60	11.60	12.14	6.17	682.48
249 1	2040	.00	11.60	11.60	12.13	6.17	682.48
250 1	2045	.00	11.60	11.60	12.12	6.17	682.48

1TABLE 1 (CONT.)	STATION	BASIN FLOW	BASE FLOW	IN FLOW	IMP FLOW	IMP STORAGE	IMP STAGE
	PLAN	1	1	1	1	1	1
	RATIO	.50	.50	.50	.50	.50	.50
PER	DAY MON HRMN						
251	1 2050	.00	11.60	11.60	12.11	6.16	682.48
252	1 2055	.00	11.60	11.60	12.10	6.16	682.48
253	1 2100	.00	11.60	11.60	12.09	6.16	682.48
254	1 2105	.00	11.60	11.60	12.09	6.15	682.47
255	1 2110	.00	11.60	11.60	12.08	6.15	682.47
256	1 2115	.00	11.60	11.60	12.07	6.15	682.47
257	1 2120	.00	11.60	11.60	12.06	6.14	682.47
258	1 2125	.00	11.60	11.60	12.05	6.14	682.47
259	1 2130	.00	11.60	11.60	12.05	6.14	682.47
260	1 2135	.00	11.60	11.60	12.04	6.13	682.47
261	1 2140	.00	11.60	11.60	12.03	6.13	682.47
262	1 2145	.00	11.60	11.60	12.02	6.13	682.47
263	1 2150	.00	11.60	11.60	12.02	6.13	682.47
264	1 2155	.00	11.60	11.60	12.01	6.12	682.47
265	1 2200	.00	11.60	11.60	12.00	6.12	682.47
266	1 2205	.00	11.60	11.60	11.99	6.12	682.47
267	1 2210	.00	11.60	11.60	11.99	6.11	682.47
268	1 2215	.00	11.60	11.60	11.98	6.11	682.47
269	1 2220	.00	11.60	11.60	11.97	6.11	682.46
270	1 2225	.00	11.60	11.60	11.97	6.11	682.46
271	1 2230	.00	11.60	11.60	11.96	6.10	682.46
272	1 2235	.00	11.60	11.60	11.95	6.10	682.46
273	1 2240	.00	11.60	11.60	11.95	6.10	682.46
274	1 2245	.00	11.60	11.60	11.94	6.10	682.46
275	1 2250	.00	11.60	11.60	11.94	6.09	682.46
276	1 2255	.00	11.60	11.60	11.93	6.09	682.46
277	1 2300	.00	11.60	11.60	11.93	6.09	682.46
278	1 2305	.00	11.60	11.60	11.92	6.09	682.46
279	1 2310	.00	11.60	11.60	11.91	6.09	682.46
280	1 2315	.00	11.60	11.60	11.91	6.08	682.46
281	1 2320	.00	11.60	11.60	11.90	6.08	682.46
282	1 2325	.00	11.60	11.60	11.90	6.08	682.46
283	1 2330	.00	11.60	11.60	11.89	6.08	682.46
284	1 2335	.00	11.60	11.60	11.89	6.08	682.46
285	1 2340	.00	11.60	11.60	11.88	6.07	682.46
286	1 2345	.00	11.60	11.60	11.88	6.07	682.46
287	1 2350	.00	11.60	11.60	11.87	6.07	682.46
288	1 2355	.00	11.60	11.60	11.87	6.07	682.46
289	2 0000	.00	11.60	11.60	11.86	6.07	682.45
290	2 0005	.00	11.60	11.60	11.86	6.06	682.45
291	2 0010	.00	11.60	11.60	11.85	6.06	682.45
292	2 0015	.00	11.60	11.60	11.85	6.06	682.45
293	2 0020	.00	11.60	11.60	11.85	6.06	682.45
294	2 0025	.00	11.60	11.60	11.84	6.06	682.45
295	2 0030	.00	11.60	11.60	11.84	6.06	682.45
296	2 0035	.00	11.60	11.60	11.83	6.05	682.45
297	2 0040	.00	11.60	11.60	11.83	6.05	682.45
298	2 0045	.00	11.60	11.60	11.83	6.05	682.45
299	2 0050	.00	11.60	11.60	11.82	6.05	682.45
300	2 0055	.00	11.60	11.60	11.82	6.05	682.45
	MAX	99.48	11.60	111.08	23.83	10.75	683.51
	MIN	.00	11.60	11.60	.00	.00	681.00
	AVE	5.49	11.60	17.09	14.14	6.88	682.64

*** NORMAL END OF HEC-1 ***

Clear Water Pond

**SUMMARY OF INFLOW HYDROGRAPH
AND FLOOD ROUTING THROUGH
MITCHELL CLEAR WATER POND
FOR ½ 6-HOUR PMP STORM EVENT**

Starting Pool Elevation	=	664 ft, NAVD
Pipe Spillway Invert Elevation	=	664 ft, NAVD
Crest Elevation	=	675 ft, NAVD
Peak Inflow	=	71.44 cfs
Peak Outflow	=	44.76 cfs
Peak Storage	=	5.65 ac-ft
Maximum Impoundment Level During Storm	=	666.50 ft, NAVD
Minimum Freeboard During Storm	=	8.50 ft

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1***************************************                                                ***************************************
 *                                     *                                                *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                              *    U.S. ARMY CORPS OF ENGINEERS     *
 *           SEPTEMBER 1990            *                                                *    HYDROLOGIC ENGINEERING CENTER    *
 *             VERSION 4.0             *                                                *         609 SECOND STREET           *
 *                                     *                                                *       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE  12/21/2015  TIME  11:05:16 *                                              *          (916) 756-1104             *
 *                                     *                                                *                                     *
 ***************************************                                                ***************************************



                                        X     X  XXXXXXX   XXXXX          X
                                        X     X  X        X     X        XX
                                        X     X  X        X               X
                                        XXXXXXX  XXXX     X       XXXXX   X
                                        X     X  X        X               X
                                        X     X  X        X     X         X
                                        X     X  XXXXXXX   XXXXX         XXX



            THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

            THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
            THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
            NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
            DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
            KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM
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          LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 *** FREE ***
            1           ID  ***************************************************************************
            2           ID  *      Mitchell Clear Water Pond       File: MCWP.inp                     *
            3           ID  *      GA Project No. 01-269BA                                            *
            4           ID  *      Storm Routing for 1/2 6-Hour PMP                                   *
            5           ID  *      Crest Elevation = 675'                                             *
            6           ID  ***************************************************************************
            7           ID  *      Analyses by: Geo/Environmental Associates, Inc.                    *
            8           ID  *                   Knoxville, TN                                         *
            9           ID  *                   Seth W. Frank P.E.                                    *
           10           ID  *                   August 2014                                           *
           11           ID  ***************************************************************************
           12           IT      15       0       0     300
           13           IO       1
           14           JR  PRECIP     0.5
           15           VS   BASIN    BASE      IN     IMP     IMP     IMP
           16           VV    2.11    2.11    2.11    2.11    6.11    7.11
           17           IN      15

           18           KK   BASIN
           19           KM   COMPUTE INFLOW HYDROGRAPH FOR MITCHELL CLEAR WATER POND USING SCS METHOD
           20           PB       0
           21           PI   0.258   0.347   0.420   0.478   0.520   0.546   0.624   0.804   0.790   0.939
           22           PI   2.264   4.483   4.834   3.277   1.215   0.797   0.831   0.735   0.553   0.535
           23           PI   0.501   0.451   0.386   0.305
           24           BA   0.008
           25           LU       0    0.05    45.5
           26           UD     0.0

           27           KK    BASE
           28           KM   BASE FLOW
           29           IN     360
           30           QI   23.83   23.83   23.83

           31           KK      IN
           32           KM   COMBINE BASIN INFLOW AND BASEFLOW
           33           KO       1
           34           HC       2

           35           KK     IMP
           36           KM   ROUTE COMPUTED HYDROGRAPH AND BASE FLOW THROUGH CLEAR WATER POND
           37           RS       1    ELEV     664
           38           SA    2.18    2.24    2.30    2.38    2.45    2.56    2.67    2.79    2.91    3.03
           39           SA    3.15    3.30
           40           SQ       0   12.15   32.67    56.9   68.98   71.79   74.50   77.12   79.65   82.10
           41           SQ   84.48   86.79
           42           SE     664     665     666     667     668     669     670     671     672     673
           43           SE     674     675
           44           ZZ
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1***************************************                                                  ***************************************
 *                                      *                                                  *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                                  *   U.S. ARMY CORPS OF ENGINEERS      *
 *           SEPTEMBER 1990              *                                                  *   HYDROLOGIC ENGINEERING CENTER     *
 *             VERSION 4.0               *                                                  *        609 SECOND STREET            *
 *                                      *                                                  *     DAVIS, CALIFORNIA 95616         *
 *  RUN DATE  12/21/2015  TIME  11:05:16 *                                                  *         (916) 756-1104              *
 *                                      *                                                  *                                     *
 ***************************************                                                  ***************************************


                          ***************************************************************************
                          *      Mitchell Clear Water Pond       File: MCWP.inp                     *
                          *      GA Project No. 01-269BA                                            *
                          *      Storm Routing for 1/2 6-Hour PMP                                   *
                          *      Crest Elevation = 675'                                             *
                          ***************************************************************************
                          *      Analyses by: Geo/Environmental Associates, Inc.                    *
                          *                   Knoxville, TN                                         *
                          *                   Seth W. Frank P.E.                                    *
                          *                   August 2014                                           *
                          ***************************************************************************

   13 IO          OUTPUT CONTROL VARIABLES
                        IPRNT           1  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE

      IT          HYDROGRAPH TIME DATA
                         NMIN          15  MINUTES IN COMPUTATION INTERVAL
                        IDATE      1    0  STARTING DATE
                        ITIME        0000  STARTING TIME
                           NQ         300  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE      4    0  ENDING DATE
                       NDTIME        0245  ENDING TIME
                        ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL     .25 HOURS
                       TOTAL TIME BASE   74.75 HOURS

           ENGLISH UNITS
                DRAINAGE AREA         SQUARE MILES
                PRECIPITATION DEPTH   INCHES
                LENGTH, ELEVATION     FEET
                FLOW                  CUBIC FEET PER SECOND
                STORAGE VOLUME        ACRE-FEET
                SURFACE AREA          ACRES
                TEMPERATURE           DEGREES FAHRENHEIT

                  USER-DEFINED OUTPUT SPECIFICATIONS

          TABLE 1
      VS       STATION     BASIN      BASE        IN       IMP       IMP       IMP
      VV VARIABLE CODE      2.11      2.11      2.11      2.11      6.11      7.11       .00       .00       .00       .00

      JP          MULTI-PLAN OPTION
                        NPLAN           1  NUMBER OF PLANS

      JR          MULTI-RATIO OPTION
                      RATIOS OF PRECIPITATION
                      .50


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

             **************
             *            *
   18 KK     *    BASIN   *
             *            *
             **************
                             COMPUTE INFLOW HYDROGRAPH FOR MITCHELL CLEAR WATER POND USING SCS METHOD

   17 IN          TIME DATA FOR INPUT TIME SERIES
                        JXMIN          15  TIME INTERVAL IN MINUTES
                       JXDATE      1    0  STARTING DATE
                       JXTIME           0  STARTING TIME
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             SUBBASIN RUNOFF DATA

   24 BA          SUBBASIN CHARACTERISTICS
                        TAREA         .01  SUBBASIN AREA

                  PRECIPITATION DATA

   20 PB                STORM       26.89  BASIN TOTAL PRECIPITATION

   21 PI            INCREMENTAL PRECIPITATION PATTERN
                          .26       .35       .42       .48       .52       .55       .62       .80       .79       .94
                         2.26      4.48      4.83      3.28      1.22       .80       .83       .74       .55       .53
                          .50       .45       .39       .31

   25 LU          UNIFORM LOSS RATE
                        STRTL         .00  INITIAL LOSS
                        CNSTL         .05  UNIFORM LOSS RATE
                        RTIMP       45.50  PERCENT IMPERVIOUS AREA

   26 UD          SCS DIMENSIONLESS UNITGRAPH
                         TLAG         .00  LAG

                                                                        ***

 W
  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR       24-HR       72-HR     74.75-HR
+   (CFS)       (HR)
                              (CFS)
+      45.      3.75                    33.         26.         25.          24.
                           (INCHES)   19.054      60.757     171.538      175.055
                            (AC-FT)      16.         52.        146.         149.

 PEAK STORAGE   TIME                         MAXIMUM AVERAGE STORAGE
                                        6-HR       24-HR       72-HR     74.75-HR
+  (AC-FT)      (HR)
        6.      3.75                      4.          4.          4.           4.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                        6-HR       24-HR       72-HR     74.75-HR
+   (FEET)      (HR)
    666.50      3.75                  665.99      665.68      665.60      665.58

                             CUMULATIVE AREA =     .02 SQ MI
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                PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
                                  FLOWS IN CUBIC FEET PER SECOND,  AREA IN SQUARE MILES
                                                  TIME TO PEAK IN HOURS


                                                               RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION     AREA    PLAN           RATIO 1
                                                        .50

 HYDROGRAPH AT
+                  BASIN       .01     1   FLOW          48.
                                           TIME        3.25

 HYDROGRAPH AT
+                   BASE       .01     1   FLOW          24.
                                           TIME         .25

  2 COMBINED AT
+                     IN       .02     1   FLOW          71.
                                           TIME        3.25

 ROUTED TO
+                    IMP       .02     1   FLOW          45.
                                           TIME        3.75

                                      ** PEAK STAGES IN FEET **
                                       1   STAGE      666.50
                                           TIME        3.75
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1TABLE 1			STATION	BASIN FLOW	BASE FLOW	IN FLOW	IMP FLOW	IMP STORAGE	IMP STAGE	
			PLAN	1	1	1	1	1	1	
			RATIO	.50	.50	.50	.50	.50	.50	
PER	DAY	MON	HRMN							
1	1		0000	.00	23.83	23.83	.00	.00	664.00	
2	1		0015	1.87	23.83	25.70	2.66	.48	664.22	
3	1		0030	3.08	23.83	26.91	5.20	.95	664.43	
4	1		0045	3.94	23.83	27.77	7.58	1.38	664.62	
5	1		0100	4.60	23.83	28.43	9.79	1.78	664.81	
6	1		0115	5.08	23.83	28.91	11.82	2.15	664.97	
7	1		0130	5.40	23.83	29.23	14.57	2.48	665.12	
8	1		0145	6.08	23.83	29.91	17.13	2.76	665.24	
9	1		0200	7.64	23.83	31.47	19.45	3.02	665.36	
10	1		0215	7.96	23.83	31.79	21.53	3.25	665.46	
11	1		0230	9.15	23.83	32.98	23.38	3.45	665.55	
12	1		0245	19.64	23.83	43.47	25.92	3.73	665.67	
13	1		0300	39.57	23.83	63.40	30.62	4.25	665.90	
14	1		0315	47.61	23.83	71.44	37.46	4.94	666.20	
15	1		0330	37.46	23.83	61.29	43.05	5.48	666.43	
16	1		0345	18.64	23.83	42.47	44.76	**5.65**	**666.50**	**Maximum impoundment stage/storage**
17	1		0400	10.37	23.83	34.20	43.51	5.53	666.45	
18	1		0415	8.74	23.83	32.57	41.56	5.34	666.37	
19	1		0430	7.72	23.83	31.55	39.72	5.16	666.29	
20	1		0445	6.10	23.83	29.93	37.99	4.99	666.22	
21	1		0500	5.53	23.83	29.36	36.37	4.84	666.15	
22	1		0515	5.15	23.83	28.98	34.98	4.70	666.10	
23	1		0530	4.67	23.83	28.50	33.77	4.59	666.05	
24	1		0545	4.05	23.83	27.88	32.69	4.48	666.00	
25	1		0600	3.26	23.83	27.09	31.80	4.38	665.96	
26	1		0615	.82	23.83	24.65	30.79	4.27	665.91	
27	1		0630	.15	23.83	23.98	29.68	4.15	665.85	
28	1		0645	.02	23.83	23.85	28.70	4.04	665.81	
29	1		0700	.00	23.83	23.83	27.87	3.95	665.77	
30	1		0715	.00	23.83	23.83	27.18	3.87	665.73	
31	1		0730	.00	23.83	23.83	26.61	3.81	665.70	
32	1		0745	.00	23.83	23.83	26.13	3.76	665.68	
33	1		0800	.00	23.83	23.83	25.74	3.71	665.66	
34	1		0815	.00	23.83	23.83	25.41	3.68	665.65	
35	1		0830	.00	23.83	23.83	25.14	3.65	665.63	
36	1		0845	.00	23.83	23.83	24.92	3.62	665.62	
37	1		0900	.00	23.83	23.83	24.73	3.60	665.61	
38	1		0915	.00	23.83	23.83	24.58	3.58	665.61	
39	1		0930	.00	23.83	23.83	24.45	3.57	665.60	
40	1		0945	.00	23.83	23.83	24.34	3.56	665.59	
41	1		1000	.00	23.83	23.83	24.26	3.55	665.59	
42	1		1015	.00	23.83	23.83	24.18	3.54	665.59	
43	1		1030	.00	23.83	23.83	24.12	3.53	665.58	
44	1		1045	.00	23.83	23.83	24.07	3.53	665.58	
45	1		1100	.00	23.83	23.83	24.03	3.52	665.58	
46	1		1115	.00	23.83	23.83	24.00	3.52	665.58	
47	1		1130	.00	23.83	23.83	23.97	3.52	665.58	
48	1		1145	.00	23.83	23.83	23.94	3.51	665.57	
49	1		1200	.00	23.83	23.83	23.93	3.51	665.57	
50	1		1215	.00	23.83	23.83	23.91	3.51	665.57	

1TABLE 1 (CONT.)		STATION	BASIN FLOW	BASE FLOW	IN FLOW	IMP FLOW	IMP STORAGE	IMP STAGE
		PLAN	1	1	1	1	1	1
		RATIO	.50	.50	.50	.50	.50	.50
PER	DAY MON	HRMN						
51	1	1230	.00	23.83	23.83	23.90	3.51	665.57
52	1	1245	.00	23.83	23.83	23.88	3.51	665.57
53	1	1300	.00	23.83	23.83	23.88	3.51	665.57
54	1	1315	.00	23.83	23.83	23.87	3.51	665.57
55	1	1330	.00	23.83	23.83	23.86	3.51	665.57
56	1	1345	.00	23.83	23.83	23.86	3.50	665.57
57	1	1400	.00	23.83	23.83	23.85	3.50	665.57
58	1	1415	.00	23.83	23.83	23.85	3.50	665.57
59	1	1430	.00	23.83	23.83	23.84	3.50	665.57
60	1	1445	.00	23.83	23.83	23.84	3.50	665.57
61	1	1500	.00	23.83	23.83	23.84	3.50	665.57
62	1	1515	.00	23.83	23.83	23.84	3.50	665.57
63	1	1530	.00	23.83	23.83	23.84	3.50	665.57
64	1	1545	.00	23.83	23.83	23.84	3.50	665.57
65	1	1600	.00	23.83	23.83	23.83	3.50	665.57
66	1	1615	.00	23.83	23.83	23.83	3.50	665.57
67	1	1630	.00	23.83	23.83	23.83	3.50	665.57
68	1	1645	.00	23.83	23.83	23.83	3.50	665.57
69	1	1700	.00	23.83	23.83	23.83	3.50	665.57
70	1	1715	.00	23.83	23.83	23.83	3.50	665.57
71	1	1730	.00	23.83	23.83	23.83	3.50	665.57
72	1	1745	.00	23.83	23.83	23.83	3.50	665.57
73	1	1800	.00	23.83	23.83	23.83	3.50	665.57
74	1	1815	.00	23.83	23.83	23.83	3.50	665.57
75	1	1830	.00	23.83	23.83	23.83	3.50	665.57
76	1	1845	.00	23.83	23.83	23.83	3.50	665.57
77	1	1900	.00	23.83	23.83	23.83	3.50	665.57
78	1	1915	.00	23.83	23.83	23.83	3.50	665.57
79	1	1930	.00	23.83	23.83	23.83	3.50	665.57
80	1	1945	.00	23.83	23.83	23.83	3.50	665.57
81	1	2000	.00	23.83	23.83	23.83	3.50	665.57
82	1	2015	.00	23.83	23.83	23.83	3.50	665.57
83	1	2030	.00	23.83	23.83	23.83	3.50	665.57
84	1	2045	.00	23.83	23.83	23.83	3.50	665.57
85	1	2100	.00	23.83	23.83	23.83	3.50	665.57
86	1	2115	.00	23.83	23.83	23.83	3.50	665.57
87	1	2130	.00	23.83	23.83	23.83	3.50	665.57
88	1	2145	.00	23.83	23.83	23.83	3.50	665.57
89	1	2200	.00	23.83	23.83	23.83	3.50	665.57
90	1	2215	.00	23.83	23.83	23.83	3.50	665.57
91	1	2230	.00	23.83	23.83	23.83	3.50	665.57
92	1	2245	.00	23.83	23.83	23.83	3.50	665.57
93	1	2300	.00	23.83	23.83	23.83	3.50	665.57
94	1	2315	.00	23.83	23.83	23.83	3.50	665.57
95	1	2330	.00	23.83	23.83	23.83	3.50	665.57
96	1	2345	.00	23.83	23.83	23.83	3.50	665.57
97	2	0000	.00	23.83	23.83	23.83	3.50	665.57
98	2	0015	.00	23.83	23.83	23.83	3.50	665.57
99	2	0030	.00	23.83	23.83	23.83	3.50	665.57
100	2	0045	.00	23.83	23.83	23.83	3.50	665.57

1TABLE 1 (CONT.)			STATION PLAN RATIO	BASIN FLOW 1 .50	BASE FLOW 1 .50	IN FLOW 1 .50	IMP FLOW 1 .50	IMP STORAGE 1 .50	IMP STAGE 1 .50
PER	DAY	MON	HRMN						
101	2		0100	.00	23.83	23.83	23.83	3.50	665.57
102	2		0115	.00	23.83	23.83	23.83	3.50	665.57
103	2		0130	.00	23.83	23.83	23.83	3.50	665.57
104	2		0145	.00	23.83	23.83	23.83	3.50	665.57
105	2		0200	.00	23.83	23.83	23.83	3.50	665.57
106	2		0215	.00	23.83	23.83	23.83	3.50	665.57
107	2		0230	.00	23.83	23.83	23.83	3.50	665.57
108	2		0245	.00	23.83	23.83	23.83	3.50	665.57
109	2		0300	.00	23.83	23.83	23.83	3.50	665.57
110	2		0315	.00	23.83	23.83	23.83	3.50	665.57
111	2		0330	.00	23.83	23.83	23.83	3.50	665.57
112	2		0345	.00	23.83	23.83	23.83	3.50	665.57
113	2		0400	.00	23.83	23.83	23.83	3.50	665.57
114	2		0415	.00	23.83	23.83	23.83	3.50	665.57
115	2		0430	.00	23.83	23.83	23.83	3.50	665.57
116	2		0445	.00	23.83	23.83	23.83	3.50	665.57
117	2		0500	.00	23.83	23.83	23.83	3.50	665.57
118	2		0515	.00	23.83	23.83	23.83	3.50	665.57
119	2		0530	.00	23.83	23.83	23.83	3.50	665.57
120	2		0545	.00	23.83	23.83	23.83	3.50	665.57
121	2		0600	.00	23.83	23.83	23.83	3.50	665.57
122	2		0615	.00	23.83	23.83	23.83	3.50	665.57
123	2		0630	.00	23.83	23.83	23.83	3.50	665.57
124	2		0645	.00	23.83	23.83	23.83	3.50	665.57
125	2		0700	.00	23.83	23.83	23.83	3.50	665.57
126	2		0715	.00	23.83	23.83	23.83	3.50	665.57
127	2		0730	.00	23.83	23.83	23.83	3.50	665.57
128	2		0745	.00	23.83	23.83	23.83	3.50	665.57
129	2		0800	.00	23.83	23.83	23.83	3.50	665.57
130	2		0815	.00	23.83	23.83	23.83	3.50	665.57
131	2		0830	.00	23.83	23.83	23.83	3.50	665.57
132	2		0845	.00	23.83	23.83	23.83	3.50	665.57
133	2		0900	.00	23.83	23.83	23.83	3.50	665.57
134	2		0915	.00	23.83	23.83	23.83	3.50	665.57
135	2		0930	.00	23.83	23.83	23.83	3.50	665.57
136	2		0945	.00	23.83	23.83	23.83	3.50	665.57
137	2		1000	.00	23.83	23.83	23.83	3.50	665.57
138	2		1015	.00	23.83	23.83	23.83	3.50	665.57
139	2		1030	.00	23.83	23.83	23.83	3.50	665.57
140	2		1045	.00	23.83	23.83	23.83	3.50	665.57
141	2		1100	.00	23.83	23.83	23.83	3.50	665.57
142	2		1115	.00	23.83	23.83	23.83	3.50	665.57
143	2		1130	.00	23.83	23.83	23.83	3.50	665.57
144	2		1145	.00	23.83	23.83	23.83	3.50	665.57
145	2		1200	.00	23.83	23.83	23.83	3.50	665.57
146	2		1215	.00	23.83	23.83	23.83	3.50	665.57
147	2		1230	.00	23.83	23.83	23.83	3.50	665.57
148	2		1245	.00	23.83	23.83	23.83	3.50	665.57
149	2		1300	.00	23.83	23.83	23.83	3.50	665.57
150	2		1315	.00	23.83	23.83	23.83	3.50	665.57

1TABLE 1 (CONT.)		STATION	BASIN FLOW	BASE FLOW	IN FLOW	IMP FLOW	IMP STORAGE	IMP STAGE
		PLAN	1	1	1	1	1	1
		RATIO	.50	.50	.50	.50	.50	.50
PER	DAY MON	HRMN						
151	2	1330	.00	23.83	23.83	23.83	3.50	665.57
152	2	1345	.00	23.83	23.83	23.83	3.50	665.57
153	2	1400	.00	23.83	23.83	23.83	3.50	665.57
154	2	1415	.00	23.83	23.83	23.83	3.50	665.57
155	2	1430	.00	23.83	23.83	23.83	3.50	665.57
156	2	1445	.00	23.83	23.83	23.83	3.50	665.57
157	2	1500	.00	23.83	23.83	23.83	3.50	665.57
158	2	1515	.00	23.83	23.83	23.83	3.50	665.57
159	2	1530	.00	23.83	23.83	23.83	3.50	665.57
160	2	1545	.00	23.83	23.83	23.83	3.50	665.57
161	2	1600	.00	23.83	23.83	23.83	3.50	665.57
162	2	1615	.00	23.83	23.83	23.83	3.50	665.57
163	2	1630	.00	23.83	23.83	23.83	3.50	665.57
164	2	1645	.00	23.83	23.83	23.83	3.50	665.57
165	2	1700	.00	23.83	23.83	23.83	3.50	665.57
166	2	1715	.00	23.83	23.83	23.83	3.50	665.57
167	2	1730	.00	23.83	23.83	23.83	3.50	665.57
168	2	1745	.00	23.83	23.83	23.83	3.50	665.57
169	2	1800	.00	23.83	23.83	23.83	3.50	665.57
170	2	1815	.00	23.83	23.83	23.83	3.50	665.57
171	2	1830	.00	23.83	23.83	23.83	3.50	665.57
172	2	1845	.00	23.83	23.83	23.83	3.50	665.57
173	2	1900	.00	23.83	23.83	23.83	3.50	665.57
174	2	1915	.00	23.83	23.83	23.83	3.50	665.57
175	2	1930	.00	23.83	23.83	23.83	3.50	665.57
176	2	1945	.00	23.83	23.83	23.83	3.50	665.57
177	2	2000	.00	23.83	23.83	23.83	3.50	665.57
178	2	2015	.00	23.83	23.83	23.83	3.50	665.57
179	2	2030	.00	23.83	23.83	23.83	3.50	665.57
180	2	2045	.00	23.83	23.83	23.83	3.50	665.57
181	2	2100	.00	23.83	23.83	23.83	3.50	665.57
182	2	2115	.00	23.83	23.83	23.83	3.50	665.57
183	2	2130	.00	23.83	23.83	23.83	3.50	665.57
184	2	2145	.00	23.83	23.83	23.83	3.50	665.57
185	2	2200	.00	23.83	23.83	23.83	3.50	665.57
186	2	2215	.00	23.83	23.83	23.83	3.50	665.57
187	2	2230	.00	23.83	23.83	23.83	3.50	665.57
188	2	2245	.00	23.83	23.83	23.83	3.50	665.57
189	2	2300	.00	23.83	23.83	23.83	3.50	665.57
190	2	2315	.00	23.83	23.83	23.83	3.50	665.57
191	2	2330	.00	23.83	23.83	23.83	3.50	665.57
192	2	2345	.00	23.83	23.83	23.83	3.50	665.57
193	3	0000	.00	23.83	23.83	23.83	3.50	665.57
194	3	0015	.00	23.83	23.83	23.83	3.50	665.57
195	3	0030	.00	23.83	23.83	23.83	3.50	665.57
196	3	0045	.00	23.83	23.83	23.83	3.50	665.57
197	3	0100	.00	23.83	23.83	23.83	3.50	665.57
198	3	0115	.00	23.83	23.83	23.83	3.50	665.57
199	3	0130	.00	23.83	23.83	23.83	3.50	665.57
200	3	0145	.00	23.83	23.83	23.83	3.50	665.57

1TABLE 1 (CONT.)			STATION	BASIN FLOW	BASE FLOW	IN FLOW	IMP FLOW	IMP STORAGE	IMP STAGE
			PLAN	1	1	1	1	1	1
			RATIO	.50	.50	.50	.50	.50	.50
PER	DAY	MON	HRMN						
201	3		0200	.00	23.83	23.83	23.83	3.50	665.57
202	3		0215	.00	23.83	23.83	23.83	3.50	665.57
203	3		0230	.00	23.83	23.83	23.83	3.50	665.57
204	3		0245	.00	23.83	23.83	23.83	3.50	665.57
205	3		0300	.00	23.83	23.83	23.83	3.50	665.57
206	3		0315	.00	23.83	23.83	23.83	3.50	665.57
207	3		0330	.00	23.83	23.83	23.83	3.50	665.57
208	3		0345	.00	23.83	23.83	23.83	3.50	665.57
209	3		0400	.00	23.83	23.83	23.83	3.50	665.57
210	3		0415	.00	23.83	23.83	23.83	3.50	665.57
211	3		0430	.00	23.83	23.83	23.83	3.50	665.57
212	3		0445	.00	23.83	23.83	23.83	3.50	665.57
213	3		0500	.00	23.83	23.83	23.83	3.50	665.57
214	3		0515	.00	23.83	23.83	23.83	3.50	665.57
215	3		0530	.00	23.83	23.83	23.83	3.50	665.57
216	3		0545	.00	23.83	23.83	23.83	3.50	665.57
217	3		0600	.00	23.83	23.83	23.83	3.50	665.57
218	3		0615	.00	23.83	23.83	23.83	3.50	665.57
219	3		0630	.00	23.83	23.83	23.83	3.50	665.57
220	3		0645	.00	23.83	23.83	23.83	3.50	665.57
221	3		0700	.00	23.83	23.83	23.83	3.50	665.57
222	3		0715	.00	23.83	23.83	23.83	3.50	665.57
223	3		0730	.00	23.83	23.83	23.83	3.50	665.57
224	3		0745	.00	23.83	23.83	23.83	3.50	665.57
225	3		0800	.00	23.83	23.83	23.83	3.50	665.57
226	3		0815	.00	23.83	23.83	23.83	3.50	665.57
227	3		0830	.00	23.83	23.83	23.83	3.50	665.57
228	3		0845	.00	23.83	23.83	23.83	3.50	665.57
229	3		0900	.00	23.83	23.83	23.83	3.50	665.57
230	3		0915	.00	23.83	23.83	23.83	3.50	665.57
231	3		0930	.00	23.83	23.83	23.83	3.50	665.57
232	3		0945	.00	23.83	23.83	23.83	3.50	665.57
233	3		1000	.00	23.83	23.83	23.83	3.50	665.57
234	3		1015	.00	23.83	23.83	23.83	3.50	665.57
235	3		1030	.00	23.83	23.83	23.83	3.50	665.57
236	3		1045	.00	23.83	23.83	23.83	3.50	665.57
237	3		1100	.00	23.83	23.83	23.83	3.50	665.57
238	3		1115	.00	23.83	23.83	23.83	3.50	665.57
239	3		1130	.00	23.83	23.83	23.83	3.50	665.57
240	3		1145	.00	23.83	23.83	23.83	3.50	665.57
241	3		1200	.00	23.83	23.83	23.83	3.50	665.57
242	3		1215	.00	23.83	23.83	23.83	3.50	665.57
243	3		1230	.00	23.83	23.83	23.83	3.50	665.57
244	3		1245	.00	23.83	23.83	23.83	3.50	665.57
245	3		1300	.00	23.83	23.83	23.83	3.50	665.57
246	3		1315	.00	23.83	23.83	23.83	3.50	665.57
247	3		1330	.00	23.83	23.83	23.83	3.50	665.57
248	3		1345	.00	23.83	23.83	23.83	3.50	665.57
249	3		1400	.00	23.83	23.83	23.83	3.50	665.57
250	3		1415	.00	23.83	23.83	23.83	3.50	665.57

1TABLE 1 (CONT.)		STATION	BASIN FLOW	BASE FLOW	IN FLOW	IMP FLOW	IMP STORAGE	IMP STAGE
		PLAN	1	1	1	1	1	1
		RATIO	.50	.50	.50	.50	.50	.50
PER	DAY MON	HRMN						
251	3	1430	.00	23.83	23.83	23.83	3.50	665.57
252	3	1445	.00	23.83	23.83	23.83	3.50	665.57
253	3	1500	.00	23.83	23.83	23.83	3.50	665.57
254	3	1515	.00	23.83	23.83	23.83	3.50	665.57
255	3	1530	.00	23.83	23.83	23.83	3.50	665.57
256	3	1545	.00	23.83	23.83	23.83	3.50	665.57
257	3	1600	.00	23.83	23.83	23.83	3.50	665.57
258	3	1615	.00	23.83	23.83	23.83	3.50	665.57
259	3	1630	.00	23.83	23.83	23.83	3.50	665.57
260	3	1645	.00	23.83	23.83	23.83	3.50	665.57
261	3	1700	.00	23.83	23.83	23.83	3.50	665.57
262	3	1715	.00	23.83	23.83	23.83	3.50	665.57
263	3	1730	.00	23.83	23.83	23.83	3.50	665.57
264	3	1745	.00	23.83	23.83	23.83	3.50	665.57
265	3	1800	.00	23.83	23.83	23.83	3.50	665.57
266	3	1815	.00	23.83	23.83	23.83	3.50	665.57
267	3	1830	.00	23.83	23.83	23.83	3.50	665.57
268	3	1845	.00	23.83	23.83	23.83	3.50	665.57
269	3	1900	.00	23.83	23.83	23.83	3.50	665.57
270	3	1915	.00	23.83	23.83	23.83	3.50	665.57
271	3	1930	.00	23.83	23.83	23.83	3.50	665.57
272	3	1945	.00	23.83	23.83	23.83	3.50	665.57
273	3	2000	.00	23.83	23.83	23.83	3.50	665.57
274	3	2015	.00	23.83	23.83	23.83	3.50	665.57
275	3	2030	.00	23.83	23.83	23.83	3.50	665.57
276	3	2045	.00	23.83	23.83	23.83	3.50	665.57
277	3	2100	.00	23.83	23.83	23.83	3.50	665.57
278	3	2115	.00	23.83	23.83	23.83	3.50	665.57
279	3	2130	.00	23.83	23.83	23.83	3.50	665.57
280	3	2145	.00	23.83	23.83	23.83	3.50	665.57
281	3	2200	.00	23.83	23.83	23.83	3.50	665.57
282	3	2215	.00	23.83	23.83	23.83	3.50	665.57
283	3	2230	.00	23.83	23.83	23.83	3.50	665.57
284	3	2245	.00	23.83	23.83	23.83	3.50	665.57
285	3	2300	.00	23.83	23.83	23.83	3.50	665.57
286	3	2315	.00	23.83	23.83	23.83	3.50	665.57
287	3	2330	.00	23.83	23.83	23.83	3.50	665.57
288	3	2345	.00	23.83	23.83	23.83	3.50	665.57
289	4	0000	.00	23.83	23.83	23.83	3.50	665.57
290	4	0015	.00	23.83	23.83	23.83	3.50	665.57
291	4	0030	.00	23.83	23.83	23.83	3.50	665.57
292	4	0045	.00	23.83	23.83	23.83	3.50	665.57
293	4	0100	.00	23.83	23.83	23.83	3.50	665.57
294	4	0115	.00	23.83	23.83	23.83	3.50	665.57
295	4	0130	.00	23.83	23.83	23.83	3.50	665.57
296	4	0145	.00	23.83	23.83	23.83	3.50	665.57
297	4	0200	.00	23.83	23.83	23.83	3.50	665.57
298	4	0215	.00	23.83	23.83	23.83	3.50	665.57
299	4	0230	.00	23.83	23.83	23.83	3.50	665.57
300	4	0245	.00	23.83	23.83	23.83	3.50	665.57
		MAX	47.61	23.83	71.44	44.76	5.65	666.50
		MIN	.00	23.83	23.83	.00	.00	664.00
		AVE	.91	23.83	24.74	24.14	3.52	665.58

*** NORMAL END OF HEC-1 ***

Appendix III

Stability Analyses

Summary of Material Parameters Used in Slope Stability and Liquefaction Analyses

Material Strength Parameters

Material	Moist Unit Weight (pcf)	Saturated Unit Weight (pcf)	Effective Strength Parameters	
			Cohesion, c' (psf)	Friction Angle, φ' (degrees)
Soil Dike	124	134	300	29
Original Soil	120	130	0	34
Cohesive Liner	121	131	900	0

Material Parameters Used in Liquefaction Assessment

	Soil Dike (Clayey, Silty, Sand)	Original Ground (Silty Sand)	Cohesive Liner (Clay)
Damping Ratio Function(1)	Seed – Idriss	Seed – Idriss	Clay – Sun
Small Strain Shear Modulus G_{max} (psf)	121,540	166,540	QUAKE/W Function
Source(2)	GA – Triaxial Estimate	GA – Triaxial Estimate	QUAKE/W
Poisson's Ratio	0.28	0.28	0.3
Source(3)	Bowles	Bowles	Bowles
Cyclic Number Function(4)	QUAKE/W	QUAKE/W	None

Notes: (1) Damping Ratios from:
- Seed – Idriss (SHAKE91 User's Manual)
- Clay – Sun, et.al.

(2) G_{max} values estimated from results of triaxial tests performed by GA and built-in QUAKE/W function based on work by Hardin, Drnevich, Mayne, and Rix.

(3) Poisson's Ratio based on typical values described in Foundation Analysis and Design, 4th Ed., Joseph E. Bowles, P.E., S.E.

(4) Cyclic Number Function is a QUAKE/W built-in function based on work by Seed and Lee.

Summary of Stability Analysis Results

Stability Analysis Results

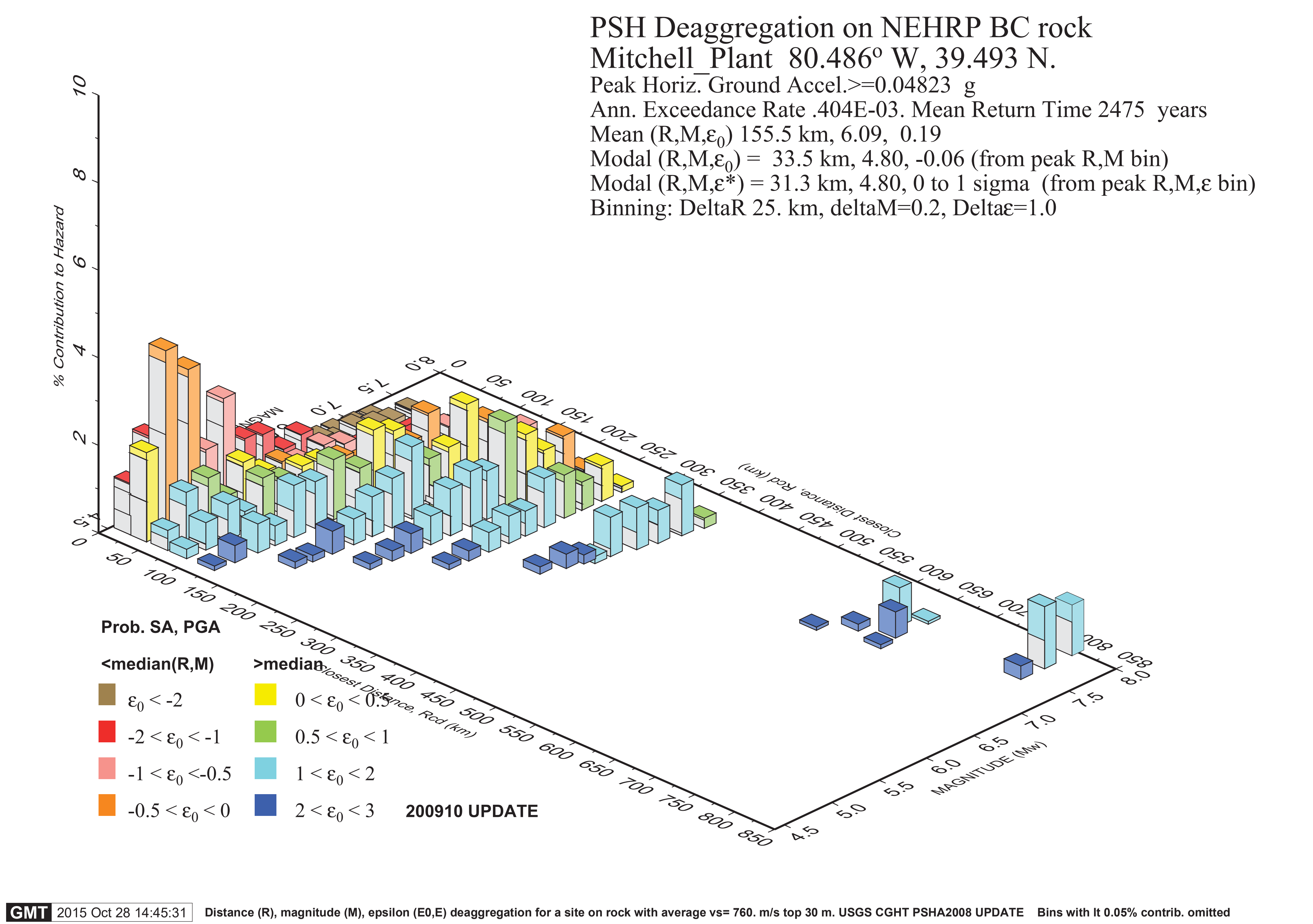
Profile	Downstream Static Long-Term Maximum Storage Pool	Downstream Static Maximum Surcharge Pool	Downstream Seismic	Upstream Seismic	Downstream Liquefaction Assessment	Upstream Liquefaction Assessment
SP1-SP1	2.09	2.05	1.80	2.08	2.02	1.20
SP2-SP2	1.87	1.86	1.53	2.01	1.21	1.24

Summary of Piezometric Levels Used

Profile	Piezometric Surface Elevation at Piezometer Location (Feet, NAVD)			
	Downstream Static Long-Term Maximum Storage Pool	Downstream Static Maximum Surcharge Pool	Seismic	Liquefaction Assessment
SP1-SP1	675	677	675	669 (2) (maximum measured)
SP2-SP2 (1)	675	676.5	675	669 (2) (maximum measured)
	690 (FS = 1.35)			
	682 (FS = 1.5)			

(1) For reference, given that section SP2 is the critical section for static stability, we included hypothetical elevated phreatic levels at the crest (690 feet NAVD) and corresponding to a Factor of Safety (FS) of 1.5.

(2) 669 is approximately the maximum measured piezometer level for Sections SP1 and SP2, since piezometers were installed in March of 2009.


PSH Deaggregation on NEHRP BC rock
Mitchell_Plant 80.486° W, 39.493 N.
Peak Horiz. Ground Accel.>=0.04823 g
Ann. Exceedance Rate .404E-03. Mean Return Time 2475 years
Mean (R,M,ε_0) 155.5 km, 6.09, 0.19
Modal (R,M,ε_0) = 33.5 km, 4.80, -0.06 (from peak R,M bin)
Modal (R,M,ε*) = 31.3 km, 4.80, 0 to 1 sigma (from peak R,M,ε bin)
Binning: DeltaR 25. km, deltaM=0.2, Deltaε=1.0
% Contribution to Hazard
Closest Distance, Rcd (km)
MAGNITUDE (Mw)
Prob. SA, PGA
<median(R,M)
>median
ε_0 < -2
-2 < ε_0 < -1
-1 < ε_0 <-0.5
-0.5 < ε_0 < 0
0 < ε_0 < 0.5
0.5 < ε_0 < 1
1 < ε_0 < 2
2 < ε_0 < 3
200910 UPDATE
GMT 2015 Oct 28 14:45:31
Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on rock with average vs= 760. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

Geo/Environmental Associates, Inc.

Job Name: MITCHELL PLANT - CCR RULES A & C

Job Number: 15055013.00

Title: HORIZONTAL SEISMIC COEFFICIENT DETERMINATION FOR CONNER RUN DAM

Computed by: RWC Checked by:

Date: 11/6/15 Sheet: 1 Of: 2

GIVEN: - FIGURE 20.4 FROM "GEOTECHNICAL ENGINEERING - PRINCIPLES AND PRACTICES," (CODUTO, 1999)

- PEAK HORIZONAL GROUND ACCELERATION = 0.04609 (ROCK) FOR ANNUAL EXCEEDANCE RATE = 0.401E-3; MEAN RETURN TIME = 2,475 YRS FROM "PSH DEAGGREGATION ON NEHRP BC ROCK - CONNER RUN DAM 80.805°W, 39.825N," USGS INTERACTIVE DEAGGREGATION WEBSITE

REQ'D: DETERMINE HORIZONTAL SEISMIC COEFFICIENT FOR CONNER RUN DAM.

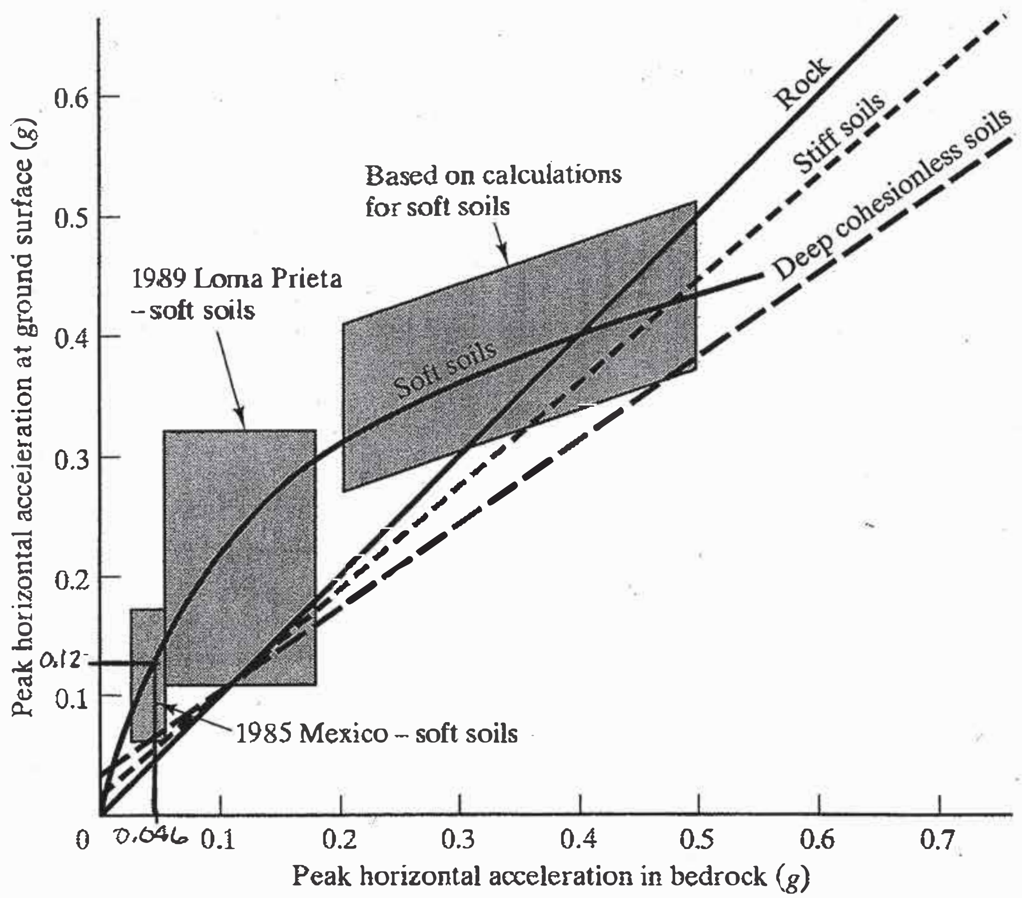


Figure 20.4 Approximate adjustment to convert peak rock acceleration to peak acceleration at the ground surface. The shaded boxes indicate observed relationships for soft soil sites during the 1989 Loma Prieta and 1985 Mexico earthquakes, along with a predicted relationship (Seed, et al., 1976, and Idriss, 1990).

GA

Geo/Environmental Associates, Inc.

Job Name: MITCHELL PLANT - CCR RULES A&C

Job Number: 15055013.00

Title: HORIZONTAL SEISMIC COEFFICIENT DETERMINATION FOR CONNER RUN DAM

Computed by: RWC Checked by: ______

Date: 11/16/15 Sheet: 2 Of: 2

SOLUTION: - USING FIGURE 20.4 AND DEAGGREGATION CHART, DETERMINE PEAK ACCELERATION AT GROUND SURFACE CONSERVATIVELY ASSUMING SOFT SOILS ARE PRESENT.

→ PEAK HORIZONTAL ACCELERATION AT GROUND SURFACE = 0.12g (FOR SOFT SOILS)

- USING A COMMONLY APPLIED FACTOR OF 0.5 * PGA:

$\boxed{\text{HORIZONTAL SEISMIC COEFFICIENT} = (0.5)(1.2) = 0.06g}$

Geo/Environmental Associates, Inc.

Job Name: CCR Rules - Bottom Ash Ponds

Job Number: 15055013

Title: Estimation of Shear Modulus G'

Computed by: SWF Checked by: ________

Date: 10-30-15 Sheet: 1 Of: 1

- From triaxial test results estimate shear modulus for
  1) clayey/silty sand embankment soil and
  2) silty sand foundation soil

1) clayey/silty sand embankment soil

* - shear modulus G' = ratio of shear stress to shear strain

$$G' = \frac{E_s}{2(1+\nu)}$$ where E = stress-strain Modulus and ν = Poison's Ratio

See estimation of E from triaxial testing of B-1, B-3, + B-4 Shelby tube samples (remolded).

E = 316 ksf = 316000 psf

ν (from Bowles *) = 0.3

$$G' = \frac{316000}{2(1+0.3)} = \underline{\underline{121540 \text{ psf}}}$$

2) silty sand foundation soil

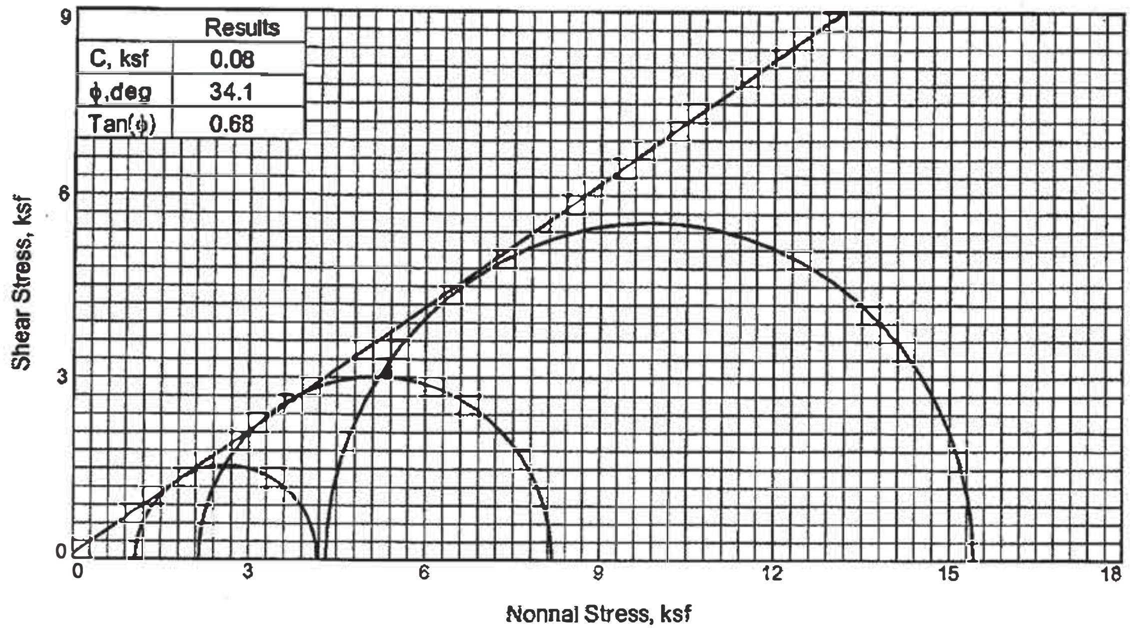
See estimation of E from triaxial testing of B-2, ST-2 shelby tube sample.

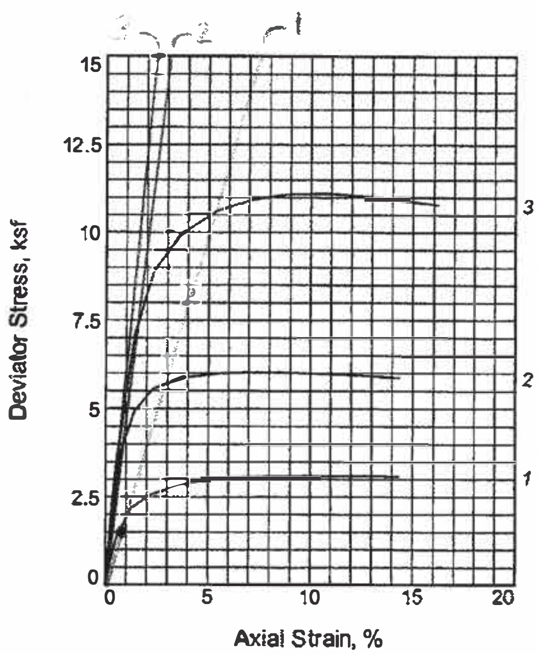
E = 433 ksf = 433000 psf

ν (from Bowles*) = 0.3

$$G' = \frac{433000}{2(1+0.3)} = \underline{\underline{166540 \text{ psf}}}$$

* Foundation Analysis and Design, 4th Edition, Joseph E. Bowles, P.E., S.E.





Modulus E (ksi) 200 400 600 Avg 433

Sample No.		1	2	3
Initial	Water Content, %	8.6	9.0	8.7
	Dry Density, pcf	105.3	105.8	105.5
	Saturation, %	38.7	40.9	39.3
	Void Ratio	0.6009	0.5926	0.5976
	Diameter, in.	2.80	2.80	2.80
	Height, in.	5.60	5.60	5.60
At Test	Water Content, %	21.6	21.0	20.8
	Dry Density, pcf	106.4	107.6	107.9
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.5838	0.5670	0.5618
	Diameter, in.	2.79	2.78	2.78
	Height, in.	5.58	5.57	5.56
Strain rate, in./min.		0.00	0.00	0.00
Back Pressure, psi		0.00	0.00	0.00
Cell Pressure, psi		7.50	15.00	30.00
Fail. Stress, ksf		3.1	6.0	11.1
Ult. Stress, ksf				
σ_1 Failure, ksf		4.2	8.2	15.4
σ_3 Failure, ksf		1.1	2.2	4.3

Type of Test:
Consolidated Drained

Sample Type: Shelby Tube

Description: Sand, brown, light brown

LL= nv **PI=** np

Specific Gravity= 2.70

Remarks:

Client: American Electric Power

Project: Mitchell Bottom Ash Pond

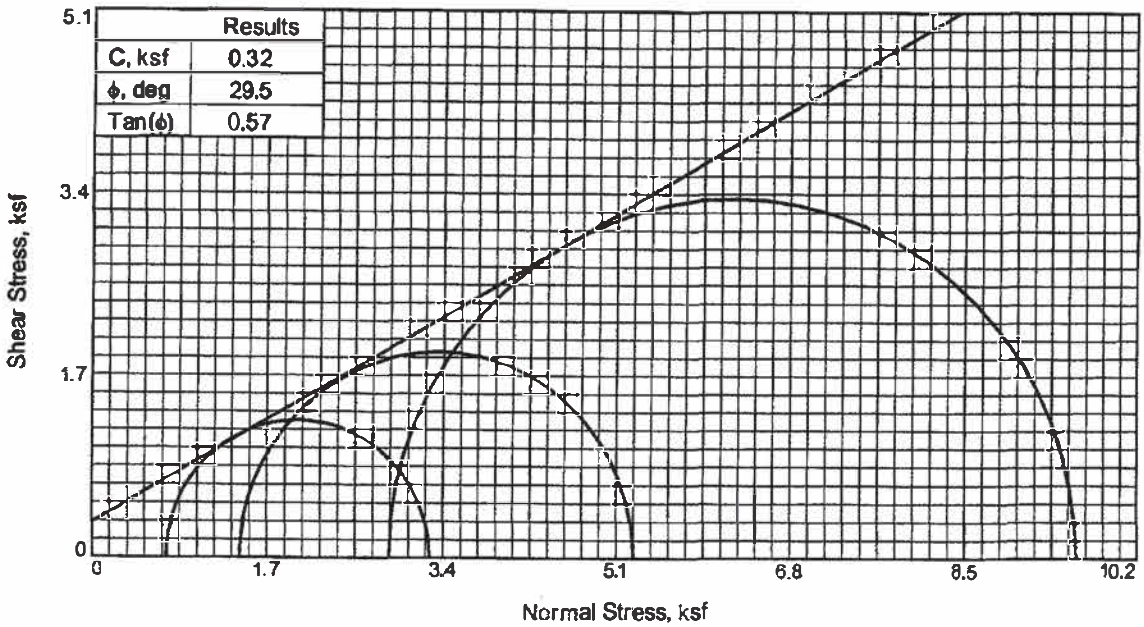
Sample Number: B-2 ST-2 **Depth:** 34.5'-36.5'

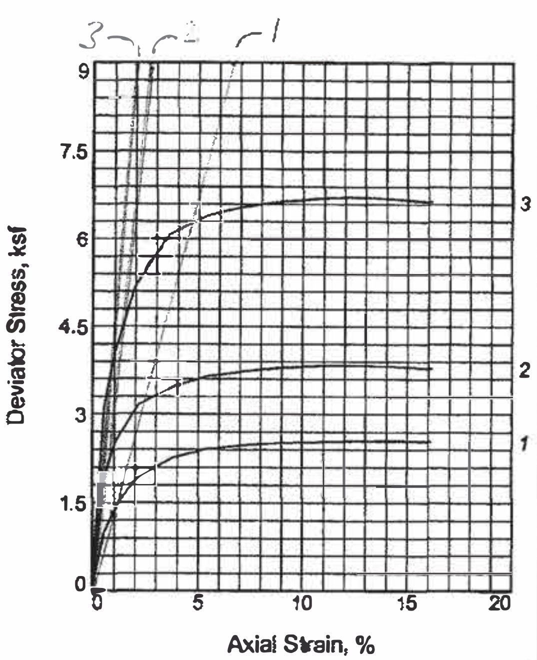
Proj. No.: 09-379 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT

Geo/Environmental Associates, Inc.

Figure 1





Modulus E (ksf) 138 360 450 Avg. 316

Sample No.		1	2	3
Initial	Water Content, %	9.2	9.3	9.3
	Dry Density, pcf	114.3	114.5	113.2
	Saturation, %	53.1	53.8	52.0
	Void Ratio	0.4632	0.4617	0.4774
	Diameter, in.	2.80	2.80	2.80
	Height, in.	5.60	5.60	5.60
At Test	Water Content, %	16.8	16.2	16.9
	Dry Density, pcf	115.5	116.6	115.1
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.4491	0.4344	0.4538
	Diameter, in.	2.79	2.78	2.78
	Height, in.	5.58	5.56	5.57
Strain rate, in./min.		0.00	0.00	0.00
Back Pressure, psi		0.00	0.00	0.00
Cell Pressure, psi		5.00	10.00	20.00
Fail. Stress, ksf		2.55	3.83	6.72
Ult. Stress, ksf				
σ_1 Failure, ksf		3.27	5.27	9.60
σ_3 Failure, ksf		0.72	1.44	2.88

Type of Test:
Consolidated Drained

Sample Type: Shelby Tubes

Description: Sand, clayey, silty, brown w/rock

LL= 16 **PL=** 12 **PI=** 4

Specific Gravity= 2.68

Remarks: Remolded specimens from B-1 ST-1, B-3 ST-1 & B-4 ST-1

Client: American Electric Power

Project: Mitchell Bottom Ash Pond

Sample Number: B-1,B-3,B-4 ST-1 **Depth:** 9.5'-10.0'

Proj. No.: 09-379 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT

Geo/Environmental Associates, Inc.

Figure 1

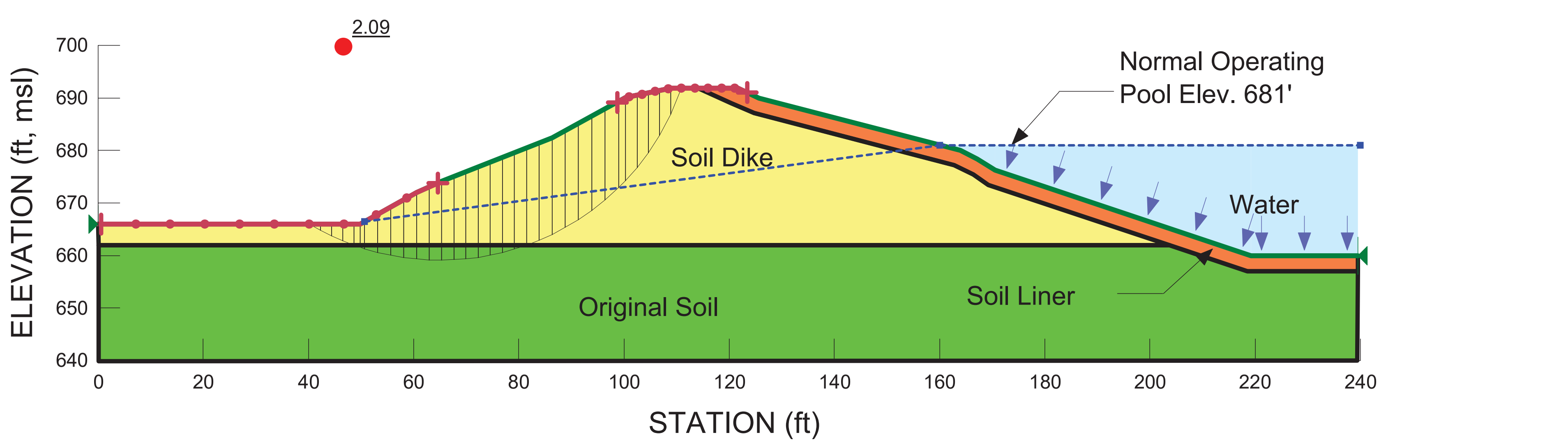
Section SP1 Stability Analyses

Title: Mitchell Bottom Ash Pond
Comments: Profile SP1-SP1 Downstream Static Stability Analysis
Maximum Longterm Pool
Name: MBAP_SP1_DS Stability Max Longterm Pool.gsz
Date: 11/4/2015
Method: Morgenstern-Price

Name: Original
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 0 psf
Phi': 34 °
Constant Unit Wt. Above Water Table: 120 pcf

Name: Soil Dike
Model: Mohr-Coulomb
Unit Weight: 134 pcf
Cohesion': 300 psf
Phi': 29 °
Constant Unit Wt. Above Water Table: 124 pcf

Name: Liner
Model: Mohr-Coulomb
Unit Weight: 131 pcf
Cohesion': 900 psf
Phi': 0 °
Constant Unit Wt. Above Water Table: 121 pcf

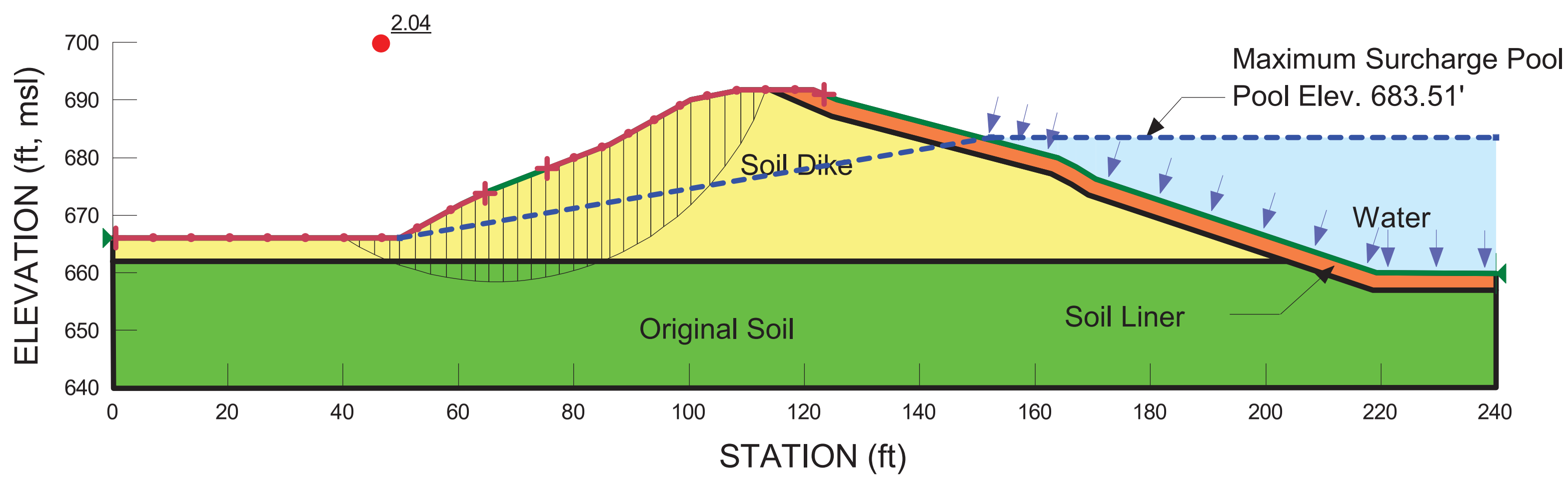


Title: Mitchell Bottom Ash Pond
Comments: Profile SP1-SP1 Downstream Static Stability Analysis
Maximum Surcharge Pool
Name: MBAP_SP1_DS Static Stability Max Surcharge Pool.gsz
Date: 12/21/2015
Method: Morgenstern-Price

Name: Original
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 0 psf
Phi': 34 °
Constant Unit Wt. Above Water Table: 120 pcf

Name: Soil Dike
Model: Mohr-Coulomb
Unit Weight: 134 pcf
Cohesion': 300 psf
Phi': 29 °
Constant Unit Wt. Above Water Table: 124 pcf

Name: Liner
Model: Mohr-Coulomb
Unit Weight: 131 pcf
Cohesion': 900 psf
Phi': 0 °
Constant Unit Wt. Above Water Table: 121 pcf

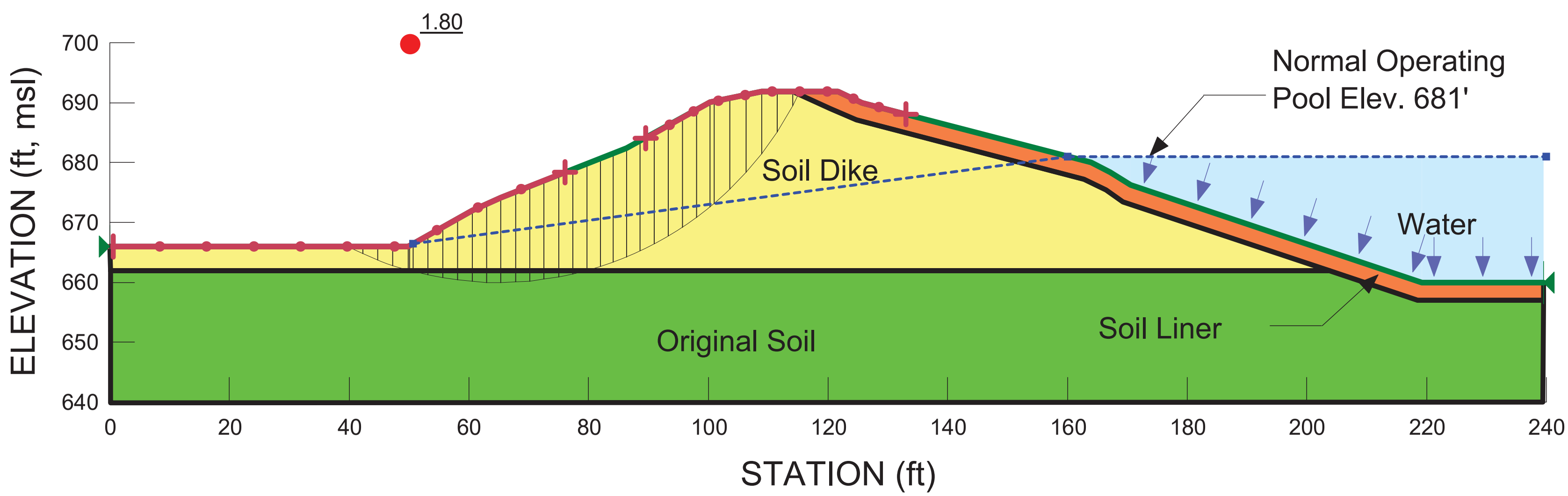


Title: Mitchell Bottom Ash Pond
Comments: Profile SP1-SP1 Downstream Pseudo-Static Stability Analysis
Maximum Longterm Pool
Name: MBAP_SP1_DS Pseudo-Static Stability Max Long-term Pool.gsz
Date: 11/6/2015
Method: Morgenstern-Price
Horz Seismic Coef.: 0.06

Name: Original
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 0 psf
Phi': 34 °
Constant Unit Wt. Above Water Table: 120 pcf

Name: Soil Dike
Model: Mohr-Coulomb
Unit Weight: 134 pcf
Cohesion': 300 psf
Phi': 29 °
Constant Unit Wt. Above Water Table: 124 pcf

Name: Liner
Model: Mohr-Coulomb
Unit Weight: 131 pcf
Cohesion': 900 psf
Phi': 0 °
Constant Unit Wt. Above Water Table: 121 pcf

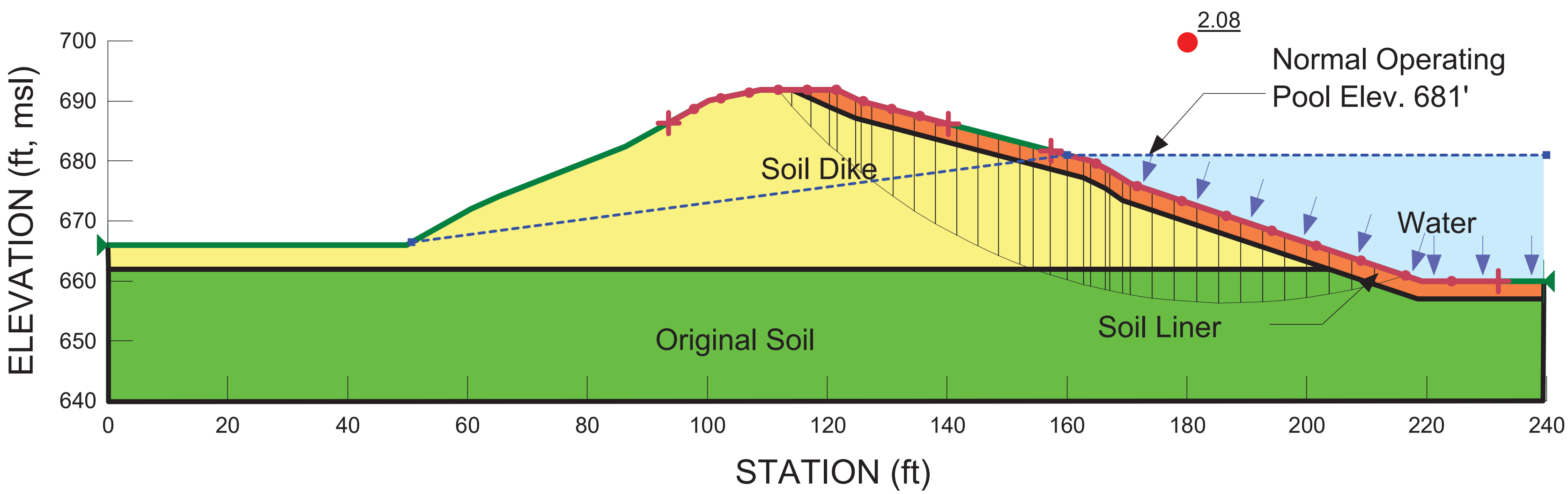


Title: Mitchell Bottom Ash Pond
Comments: Profile SP1-SP1 Upstream Pseudo-Static Stability Analysis
Maximum Longterm Pool
Name: MBAP_SP1_US Pseudo-Static Stability Max Long-term Pool.gsz
Date: 11/6/2015
Method: Morgenstern-Price
Horz Seismic Coef.: 0.06

Name: Original
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 0 psf
Phi': 34 °
Constant Unit Wt. Above Water Table: 120 pcf

Name: Soil Dike
Model: Mohr-Coulomb
Unit Weight: 134 pcf
Cohesion': 300 psf
Phi': 29 °
Constant Unit Wt. Above Water Table: 124 pcf

Name: Liner
Model: Mohr-Coulomb
Unit Weight: 131 pcf
Cohesion': 900 psf
Phi': 0 °
Constant Unit Wt. Above Water Table: 121 pcf

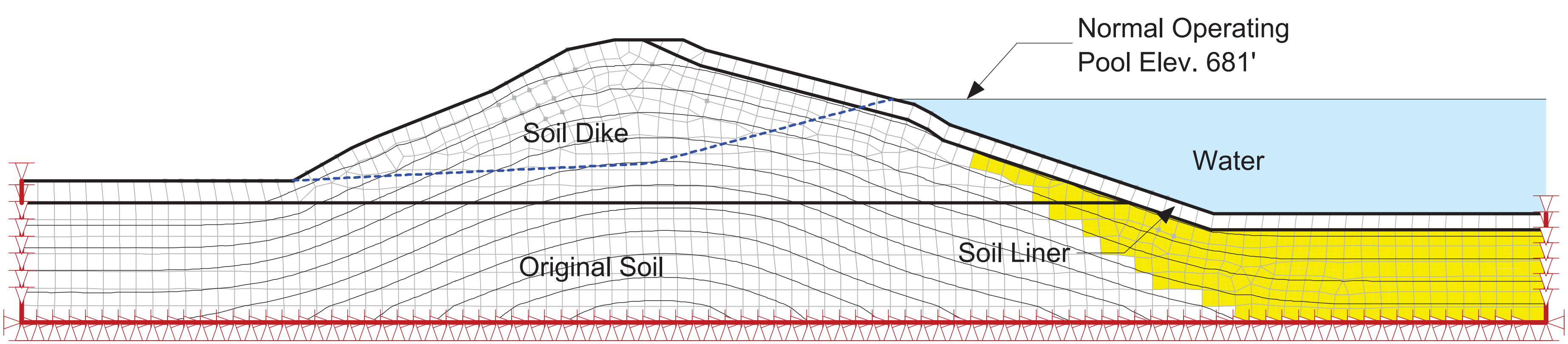


Title: Mitchell Bottom Ash Pond
Comments: Profile SP1-SP1 Upstream Liquefaction Analyis
Name: MBAP_SP1_US Liquefaction.gsz
Date: 11/9/2015
Method: Equivalent Linear Dynamic

Name: Soil Dike
Model: Equivalent Linear
Unit Weight: 124 pcf
Poisson's Ratio: 0.28
Dynamic G-Reduction Function: Seed-Idriss (sands)
Pore Water Pressure Function: Built-in Function
K-Alpha Function: Built-in Function (dense sand)
K-Sigma Function: Built-in Function (sand)
Cyclic Function: Built-in Function (dense sand)
Dynamic Damping Ratio Function: Seed-Idriss
G Modulus: 121540 psf

Name: Original
Model: Equivalent Linear
Unit Weight: 120 pcf
Poisson's Ratio: 0.28
Dynamic G-Reduction Function: Seed-Idriss (sands)
Pore Water Pressure Function: Built-in Function
K-Alpha Function: Built-in Function (med dense sand)
K-Sigma Function: Built-in Function (sand)
Cyclic Function: Built-in Function (med dense sand)
Dynamic Damping Ratio Function: Seed-Idriss
G Modulus: 166540 psf

Name: Liner
Model: Equivalent Linear
Unit Weight: 121 pcf
Poisson's Ratio: 0.3
Dynamic G-Reduction Function: Built-in Function
Pore Water Pressure Function: Built-in Function
Dynamic Damping Ratio Function: Clay-Sun, et. al.
GMax Function: Gmax Function 1

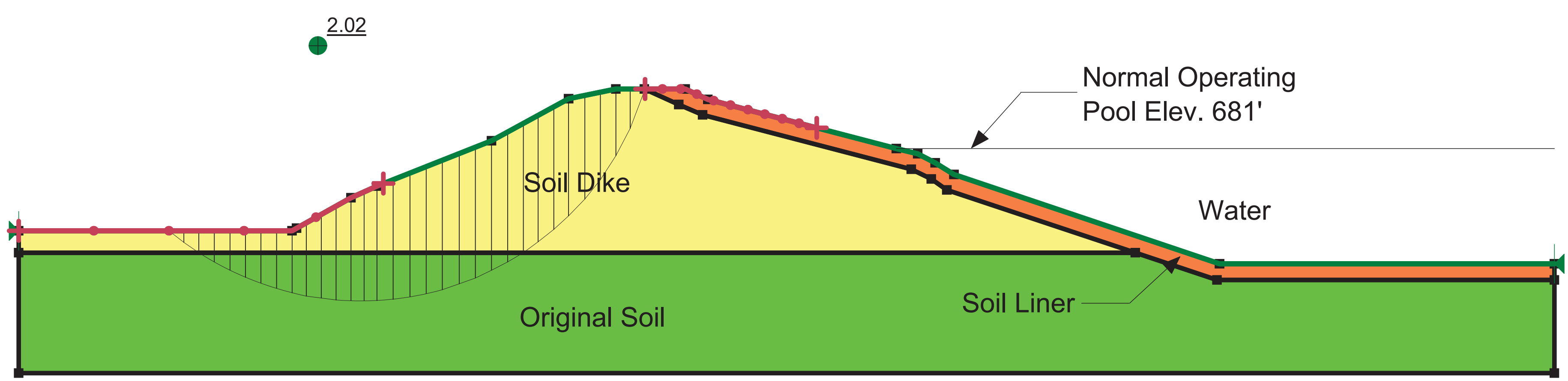


Title: Mitchell Bottom Ash Pond
Comments: Profile SP1-SP1 Downstream Liquefaction Analyis
Name: MBAP_SP1_DS Liquefaction.gsz
Date: 11/9/2015
Method: QUAKE/W Newmark Deformation

Name: Soil Dike
Model: Mohr-Coulomb
Unit Weight: 134 pcf
Unit Wt. Above Water Table: 124 pcf
Cohesion: 300 psf
Phi: 29 °

Name: Original
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Unit Wt. Above Water Table: 120 pcf
Cohesion: 0 psf
Phi: 34 °

Name: Liner
Model: Mohr-Coulomb
Unit Weight: 131 pcf
Unit Wt. Above Water Table: 121 pcf
Cohesion: 900 psf
Phi: 0 °

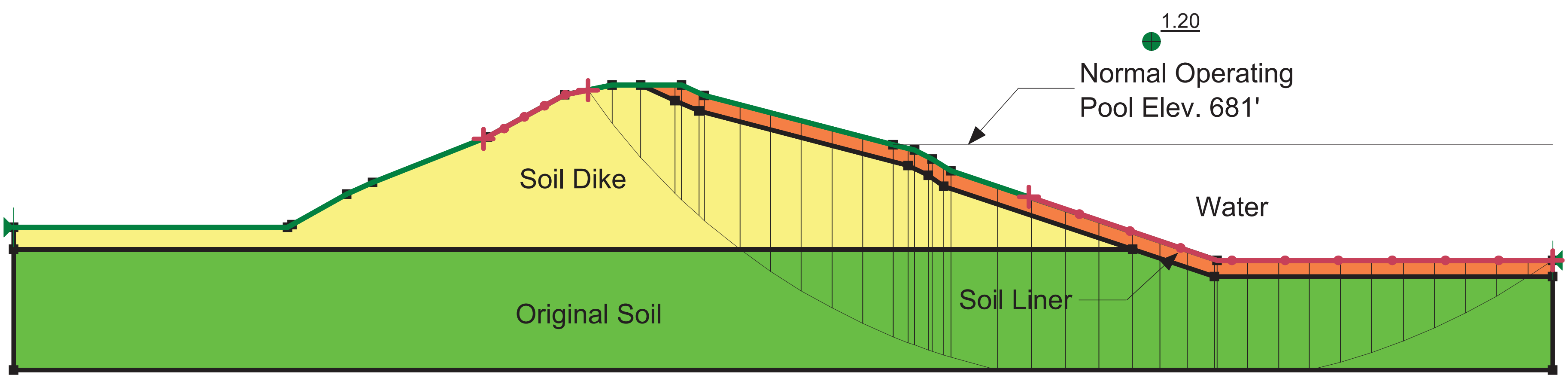


Title: Mitchell Bottom Ash Pond
Comments: Profile SP1-SP1 Upstream Liquefaction Analyis
Name: MBAP_SP1_US Liquefaction.gsz
Date: 11/9/2015
Method: QUAKE/W Newmark Deformation

Name: Soil Dike
Model: Mohr-Coulomb
Unit Weight: 134 pcf
Unit Wt. Above Water Table: 124 pcf
Cohesion: 300 psf
Phi: 29 °

Name: Original
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Unit Wt. Above Water Table: 120 pcf
Cohesion: 0 psf
Phi: 34 °

Name: Liner
Model: Mohr-Coulomb
Unit Weight: 131 pcf
Unit Wt. Above Water Table: 121 pcf
Cohesion: 900 psf
Phi: 0 °



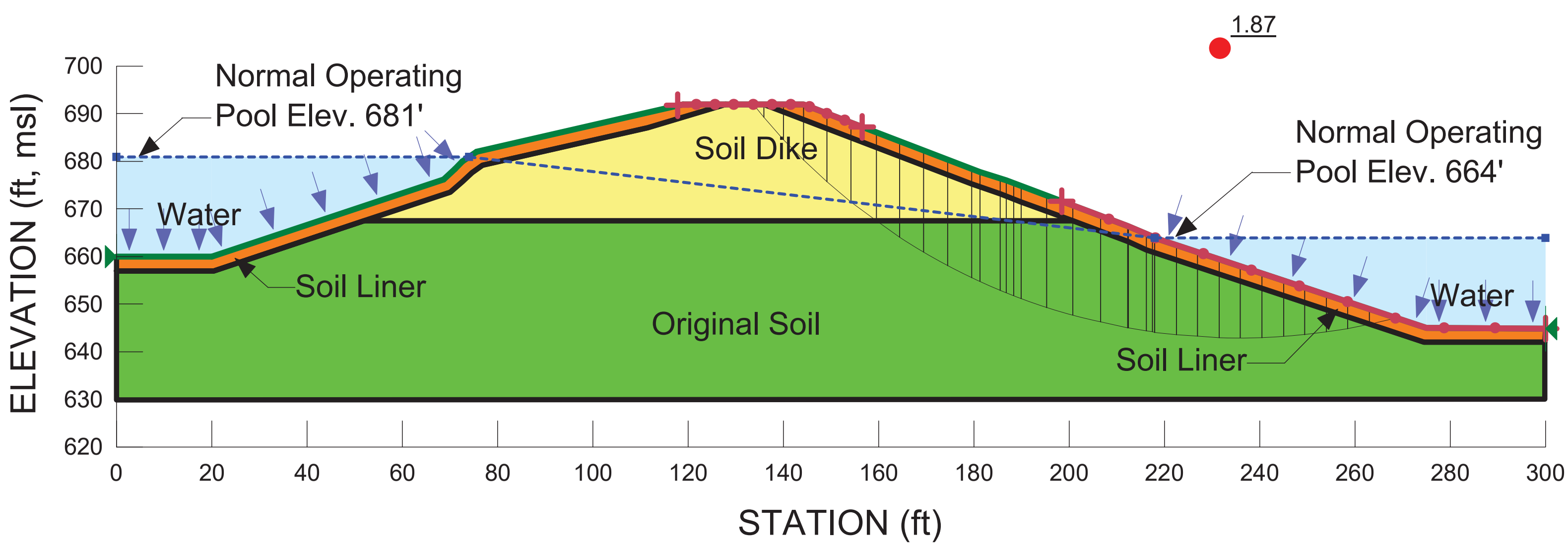
Section SP2 Stability Analyses

Title: Mitchell Bottom Ash Pond
Comments: Profile SP2-SP2 Downstream Static Stability Analysis
Name: MBAP_SP2_DS Stability Max Long-term Pool.gsz
Date: 11/4/2015
Method: Morgenstern-Price

Name: Original
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 0 psf
Phi': 34 °
Constant Unit Wt. Above Water Table: 120 pcf

Name: Liner
Model: Mohr-Coulomb
Unit Weight: 131 pcf
Cohesion': 900 psf
Phi': 0 °
Constant Unit Wt. Above Water Table: 121 pcf

Name: Soil Dike
Model: Mohr-Coulomb
Unit Weight: 134 pcf
Cohesion': 300 psf
Phi': 29 °
Constant Unit Wt. Above Water Table: 124 pcf

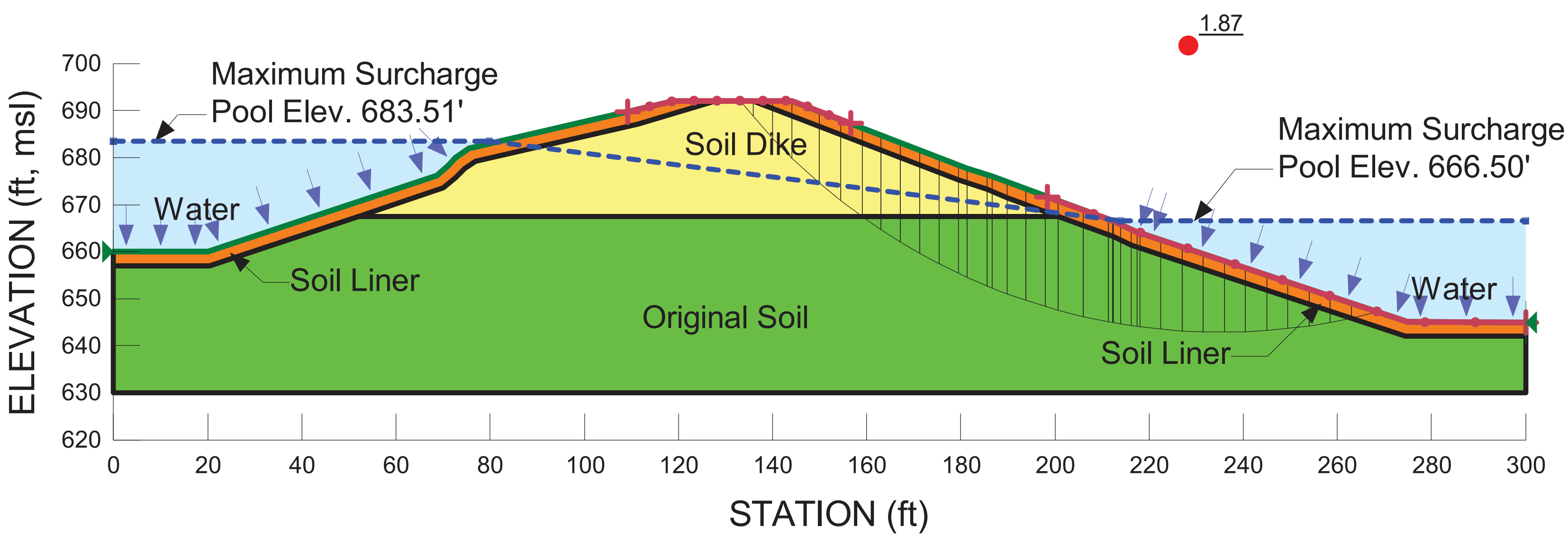


Title: Mitchell Bottom Ash Pond
Comments: Profile SP2-SP2 Downstream Static Stability Analysis
Maximum Surcharge Pool
Name: MBAP_SP2_DS Static Stability Max Surcharge Pool.gsz
Date: 12/21/2015
Method: Morgenstern-Price

Name: Original
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 0 psf
Phi': 34 °
Constant Unit Wt. Above Water Table: 120 pcf

Name: Liner
Model: Mohr-Coulomb
Unit Weight: 131 pcf
Cohesion': 900 psf
Phi': 0 °
Constant Unit Wt. Above Water Table: 121 pcf

Name: Soil Dike
Model: Mohr-Coulomb
Unit Weight: 134 pcf
Cohesion': 300 psf
Phi': 29 °
Constant Unit Wt. Above Water Table: 124 pcf

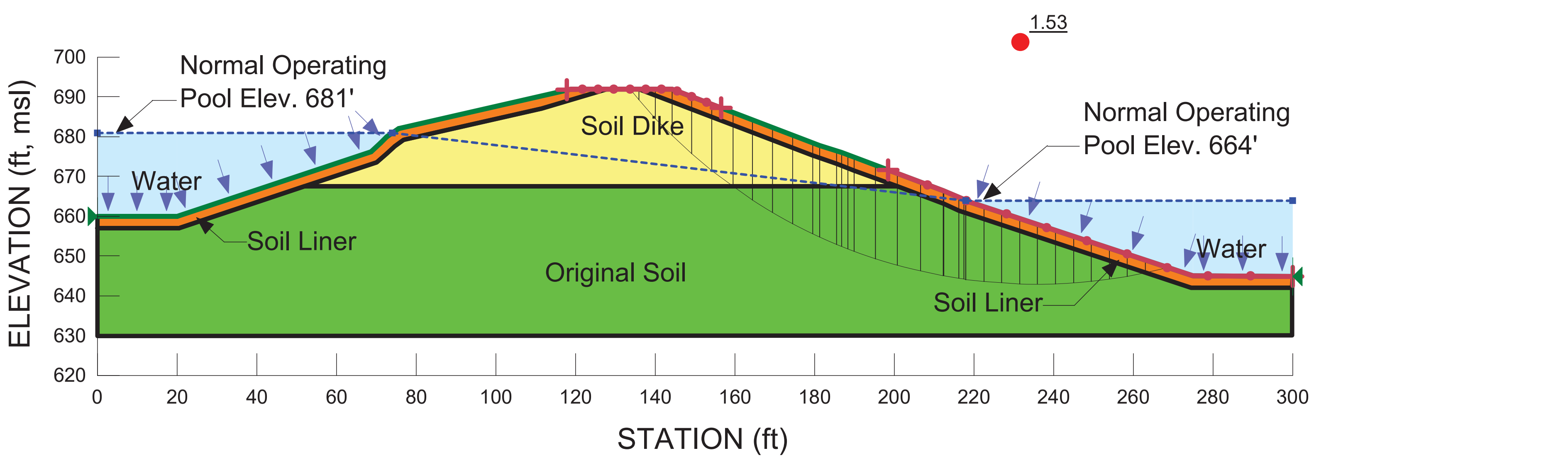


Title: Mitchell Bottom Ash Pond
Comments: Profile SP2-SP2 Downstream Pseudo-Static Stability Analysis
Name: MBAP_SP2_DS Pseudo-Static Stability Max Long-term Pool.gsz
Date: 11/6/2015
Method: Morgenstern-Price
Horz Seismic Coef.: 0.06

Name: Original
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 0 psf
Phi': 34 °
Constant Unit Wt. Above Water Table: 120 pcf

Name: Liner
Model: Mohr-Coulomb
Unit Weight: 131 pcf
Cohesion': 900 psf
Phi': 0 °
Constant Unit Wt. Above Water Table: 121 pcf

Name: Soil Dike
Model: Mohr-Coulomb
Unit Weight: 134 pcf
Cohesion': 300 psf
Phi': 29 °
Constant Unit Wt. Above Water Table: 124 pcf

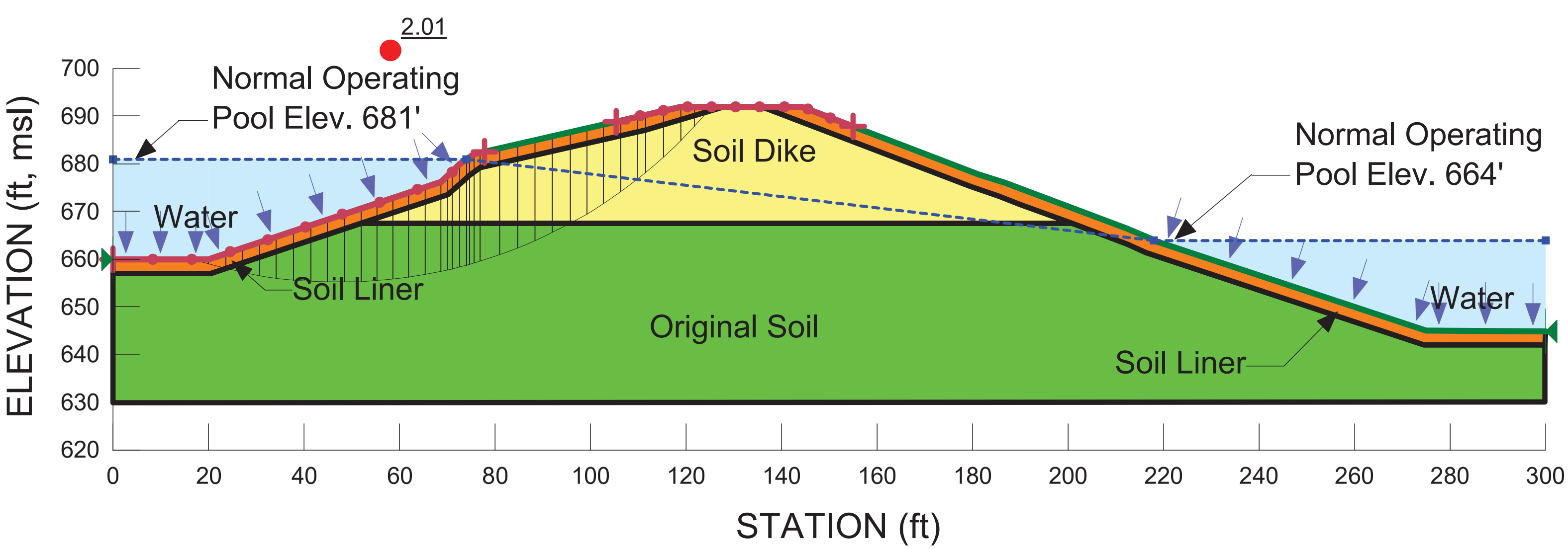


Title: Mitchell Bottom Ash Pond
Comments: Profile SP2-SP2 Upstream Pseudo-Static Stability Analysis
Name: MBAP_SP2_US Pseudo-Static Stability Max Long-term Pool.gsz
Date: 11/6/2015
Method: Morgenstern-Price
Horz Seismic Coef.: 0.06

Name: Original
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 0 psf
Phi': 34 °
Constant Unit Wt. Above Water Table: 120 pcf

Name: Liner
Model: Mohr-Coulomb
Unit Weight: 131 pcf
Cohesion': 900 psf
Phi': 0 °
Constant Unit Wt. Above Water Table: 121 pcf

Name: Soil Dike
Model: Mohr-Coulomb
Unit Weight: 134 pcf
Cohesion': 300 psf
Phi': 29 °
Constant Unit Wt. Above Water Table: 124 pcf

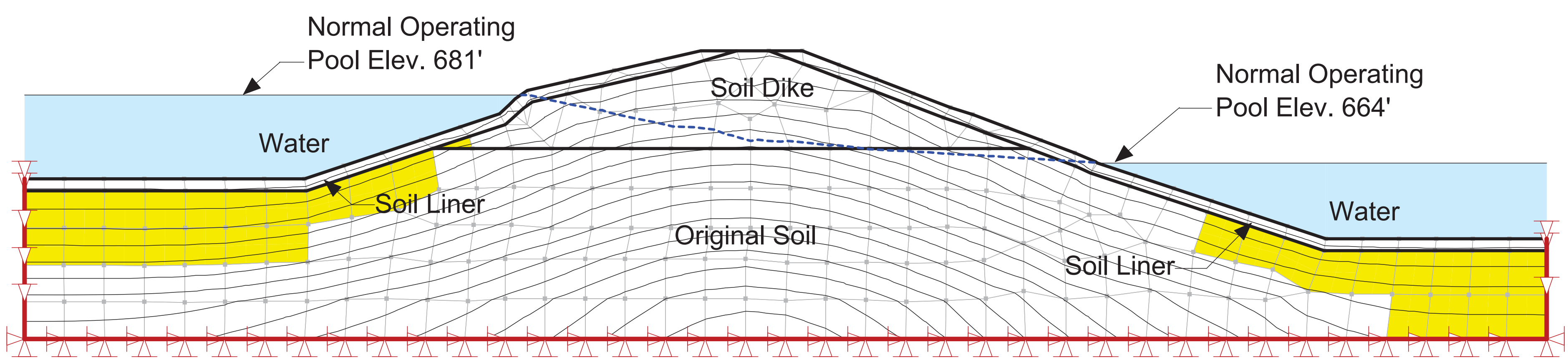


Title: Mitchell Bottom Ash Pond
Comments: Profile SP2-SP2 Downstream Liquefaction Analysis
Name: MBAP_SP2_DS Liquefaction.gsz
Date: 11/9/2015
Method: Equivalent Linear Dynamic

Name: Soil Dike
Model: Equivalent Linear
Unit Weight: 134 pcf
Poisson's Ratio: 0.28
Dynamic G-Reduction Function: Seed-Idriss (sands)
Pore Water Pressure Function: Built-in Function
K-Alpha Function: Built-in Funciton (dense sand)
K-Sigma Function: Built-in Function (sand)
Cyclic Function: Built-in Function (dense sand)
Dynamic Damping Ratio Function: Seed-Idriss
G Modulus: 121540 psf

Name: Original
Model: Equivalent Linear
Unit Weight: 120 pcf
Poisson's Ratio: 0.28
Dynamic G-Reduction Function: Seed-Idriss (sands)
Pore Water Pressure Function: Built-in Function
K-Alpha Function: Built-in Function (med dense sand)
K-Sigma Function: Built-in Function (sand)
Cyclic Function: Built-in Function (med dense sand)
Dynamic Damping Ratio Function: Seed-Idriss
G Modulus: 166540 psf

Name: Liner
Model: Equivalent Linear
Unit Weight: 121 pcf
Poisson's Ratio: 0.3
Dynamic G-Reduction Function: Built-in Function
Pore Water Pressure Function: Built-in Function
Dynamic Damping Ratio Function: Clay-Sun, et. al.
GMax Function: Gmax Function 1

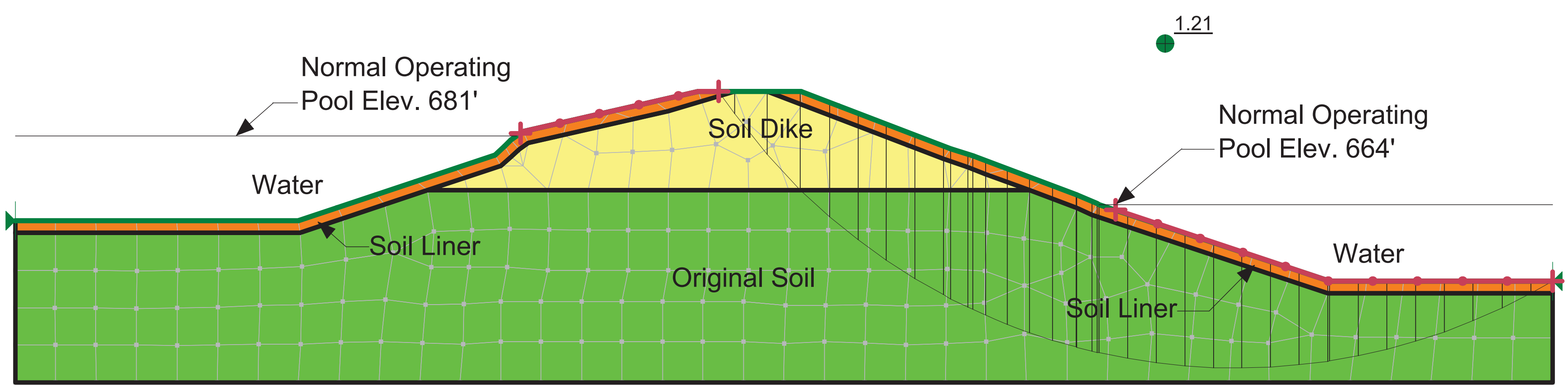


Title: Mitchell Bottom Ash Pond
Comments: Profile SP2-SP2 Downstream Liquefaction Analysis
Name: MBAP_SP2_DS Liquefaction.gsz
Date: 11/9/2015
Method: QUAKE/W Newmark Deformation

Name: Soil Dike
Model: Mohr-Coulomb
Unit Weight: 134 pcf
Unit Wt. Above Water Table: 124 pcf
Cohesion: 300 psf
Phi: 29 °

Name: Original
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Unit Wt. Above Water Table: 120 pcf
Cohesion: 0 psf
Phi: 34 °

Name: Liner
Model: Mohr-Coulomb
Unit Weight: 131 pcf
Unit Wt. Above Water Table: 121 pcf
Cohesion: 900 psf
Phi: 0 °

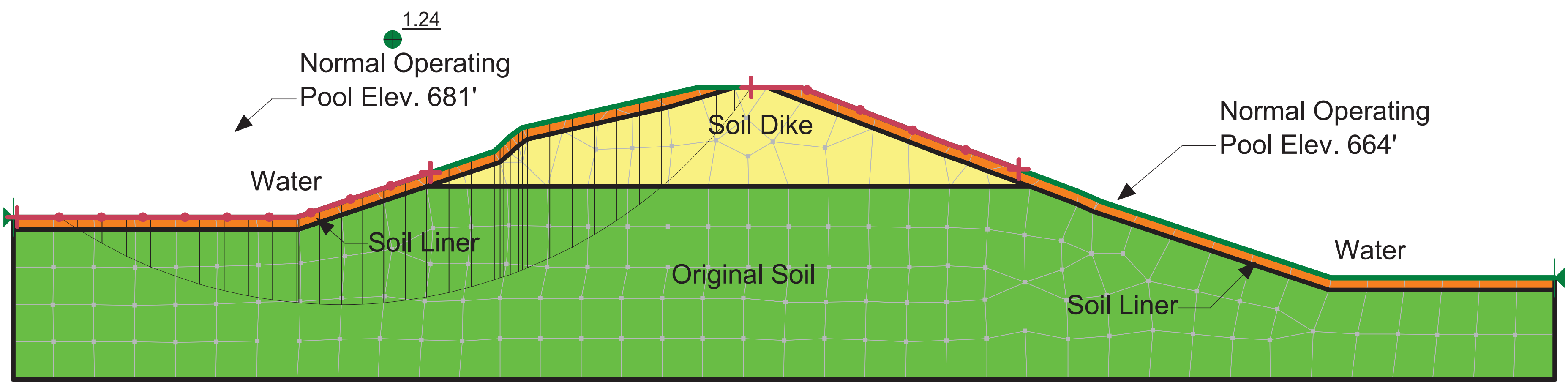


Title: Mitchell Bottom Ash Pond
Comments: Profile SP2-SP2 Downstream Liquefaction Analysis
Name: MBAP_SP2_US Liquefaction.gsz
Date: 11/6/2015
Method: QUAKE/W Newmark Deformation

Name: Soil Dike
Model: Mohr-Coulomb
Unit Weight: 134
Unit Wt. Above Water Table: 124
Cohesion: 300
Phi: 29
Phi-B: 0

Name: Original
Model: Mohr-Coulomb
Unit Weight: 130
Unit Wt. Above Water Table: 120
Cohesion: 0
Phi: 34
Phi-B: 0

Name: Liner
Model: Mohr-Coulomb
Unit Weight: 131
Unit Wt. Above Water Table: 121
Cohesion: 900
Phi: 0
Phi-B: 0



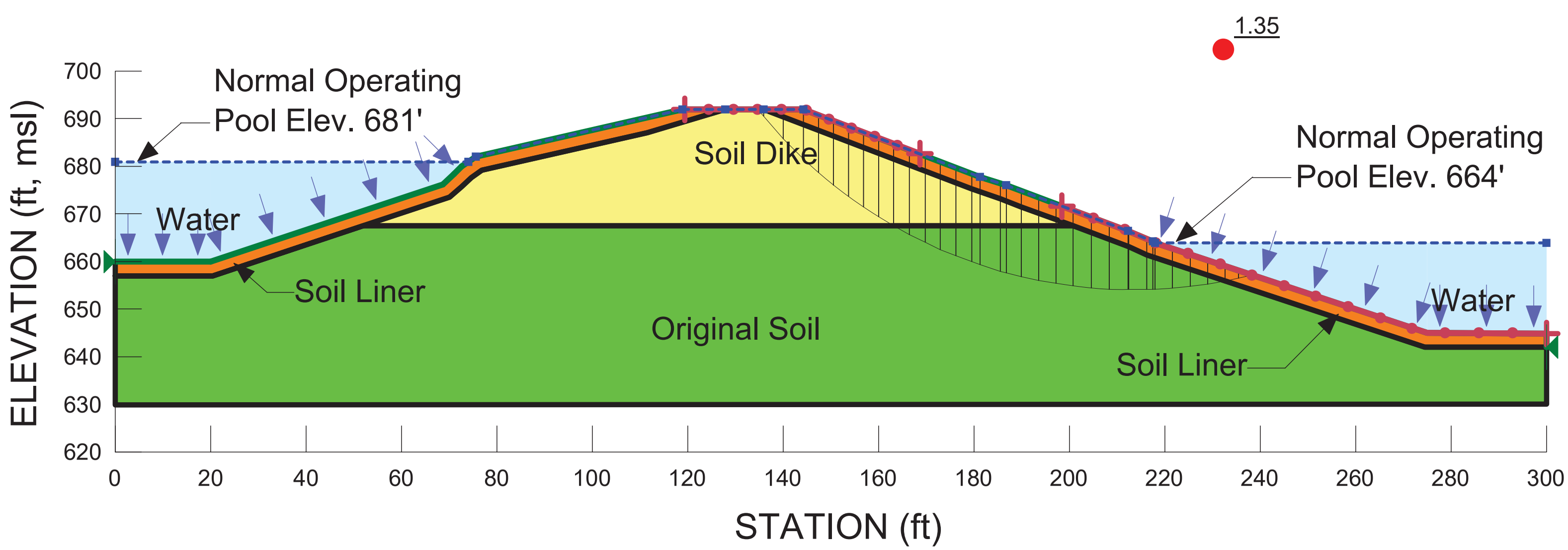
Section SP2 Stability Analyses with Elevated Phreatic Levels

Title: Mitchell Bottom Ash Pond
Comments: Profile SP2-SP2 Downstream Static Stability Analysis - Minimum FS
Name: MBAP_SP2_DS Stability Max Long-term Pool_Critical Piezometer.gsz
Date: 11/11/2015
Method: Morgenstern-Price

Name: Original
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 0 psf
Phi': 34 °
Constant Unit Wt. Above Water Table: 120 pcf

Name: Liner
Model: Mohr-Coulomb
Unit Weight: 131 pcf
Cohesion': 900 psf
Phi': 0 °
Constant Unit Wt. Above Water Table: 121 pcf

Name: Soil Dike
Model: Mohr-Coulomb
Unit Weight: 134 pcf
Cohesion': 300 psf
Phi': 29 °
Constant Unit Wt. Above Water Table: 124 pcf

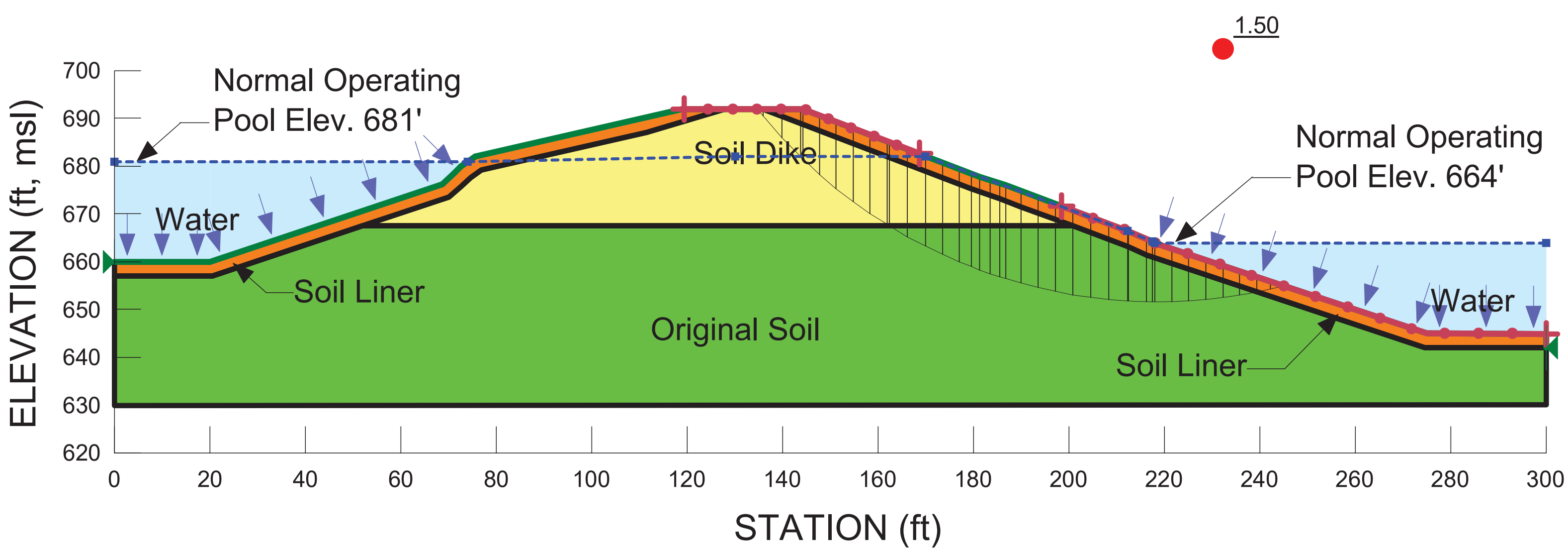


Title: Mitchell Bottom Ash Pond
Comments: Profile SP2-SP2 Downstream Static Stability Analysis - FS=1.5
Name: MBAP_SP2_DS Stability Max Long-term Pool_Critical Piezometer_1.5.gsz
Date: 11/11/2015
Method: Morgenstern-Price

Name: Original
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 0 psf
Phi': 34 °
Constant Unit Wt. Above Water Table: 120 pcf

Name: Liner
Model: Mohr-Coulomb
Unit Weight: 131 pcf
Cohesion': 900 psf
Phi': 0 °
Constant Unit Wt. Above Water Table: 121 pcf

Name: Soil Dike
Model: Mohr-Coulomb
Unit Weight: 134 pcf
Cohesion': 300 psf
Phi': 29 °
Constant Unit Wt. Above Water Table: 124 pcf



Appendix IV

Drawing

NOTES
1. PLAN ADAPTED FROM DRAWINGS PROVIDED BY AEPSC, DATED 11-10-10.

LEGEND

SP1 — SP1 (0+00): SECTION LIMITS

B-1: SAMPLED BOREHOLE LOCATION

B-2: SAMPLED BOREHOLE LOCATION WITH PIEZOMETER

THESE DRAWINGS ARE PART OF A SET OF DESIGN DOCUMENTS WHICH ALSO CONTAINS A WRITTEN TEXT. THAT TEXT EXPLAINS SOME OF THE DETAILS SHOWN HEREIN AND THEREFORE THESE DRAWINGS SHOULD ONLY BE USED IN CONJUNCTION WITH THE TEXT.

DATE	REVISIONS	BY

SITE PLAN VIEW
CCR RULES ASSESSMENT
MITCHELL PLANT
BOTTOM ASH COMPLEX
MARSHALL COUNTY, WEST VIRGINIA

SCALE: AS SHOWN | DR: RAK | CHK: RWC | REV: SMF

PREPARED FOR:
AEP SERVICE CORPORATION

PREPARED BY:
GA Geo/Environmental Associates, Inc.
3502 OVERLOOK CIRCLE • KNOXVILLE, TENNESSEE 37909 • (865) 584-0344

PROJ: 15055013.00 | DATE: 12-22-15 | SHEET 1 OF 1