APPENDICES

APPENDIX 1 -
TABLES AND FIGURES

MINE DRIFT AMD TREATMENT SYSTEM WATER QUALITY (10-23-2009 SNAPSHOT MEASUREMENTS)

Location	Flow (gpm)	Field pH	Temp (°C)	Lab pH	Lab Cond (µS/cm)	Hot Acidity (mg/L)	Alkalinity	TSS	TDS	Sulfate (mg/L)	Total Fe	Total Al	Total Mn
PA257A (Inflow)	1	1.73	11.54	2.6	2330	509	0	<5		898	55.7	40.3	17.8
PA257B (VFW Effluent)	1	2.35	10	3.1	1560	291	0	7		836	14.1	32.8	16.6

MINE DRIFT AMD TREATMENT SYSTEM WATER QUALITY (03-24-2010 SNAPSHOT MEASUREMENTS)

Location	Flow (gpm)	Field pH	Temp (°C)	Lab pH	Lab Cond (µS/cm)	Hot Acidity (mg/L)	Alkalinity	TSS	TDS	Sulfate (mg/L)	Total Fe	Total Al	Total Mn
PA257A (Inflow)	60	1.86	9	2.8	1460	290	0	<5	813	472	8.17	18.4	9.92
PA257B (VFW Effluent)	60	2.20	7	3.3	1040	188	0	5	717	453	5.67	21.1	9.53

MINE DRIFT AMD TREATMENT SYSTEM WATER QUALITY (05-17-2012 SNAPSHOT MEASUREMENTS)

Location	Flow (gpm)	Field pH	Temp (°C)	Lab pH	Lab Cond (µS/cm)	Hot Acidity (mg/L)	Alkalinity	TSS	TDS	Sulfate (mg/L)	Total Fe	Total Al	Total Mn
PA257A (Inflow)		2.7	9	2.9	1130	203	0	<5		415	6.98	13.59	6.4
PA257B (VFW Effluent)		2.82	18	3.3	941	107	0			433	3.71	10.05	8.32

	Percent Reduction (%)								
Date	Acidity	Total Fe	Total Al	Total Mn	Diss Fe	Diss Al	Diss Mn	Flow Rate	Outfall pH
10/23/2009	42.80%	74.70%	18.60%	6.70%				1	2.35
3/24/2010	35.20%	30.60%	-14.70%	3.90%				60	2.2
5/17/2012	47.30%	46.90%	26.10%	-30.00%					2.82
1/14/2014	69.10%	73.00%	54.10%	2.60%	89.10%	53.60%	-0.60%	5	*5.52
4/28/2014	46.20%	77.60%	28.80%	31.40%				5-10	*2.86

*pH is from settling pond outfall (final), all others are VFW outfall

	VFW Removal Amount (mg/L)								
Date	Acidity	Total Fe	Total Al	Total Mn	Diss Fe	Diss Al	Diss Mn	Flow Rate	Outfall pH
10/23/2009	218.00	41.60	7.50	1.20				1	2.35
3/24/2010	102.00	2.50	-2.70	0.39				60	2.20
5/17/2012	96.00	3.27	3.54	-1.92					2.82
1/14/2014	317.00	15.60	14.76	-2.00	18.58	16.07	-1.34	5	5.49

MINE DRIFT SEEP WATER QUALITY (01-14-14 FIELD MEASUREMENTS & LAB RESULTS)

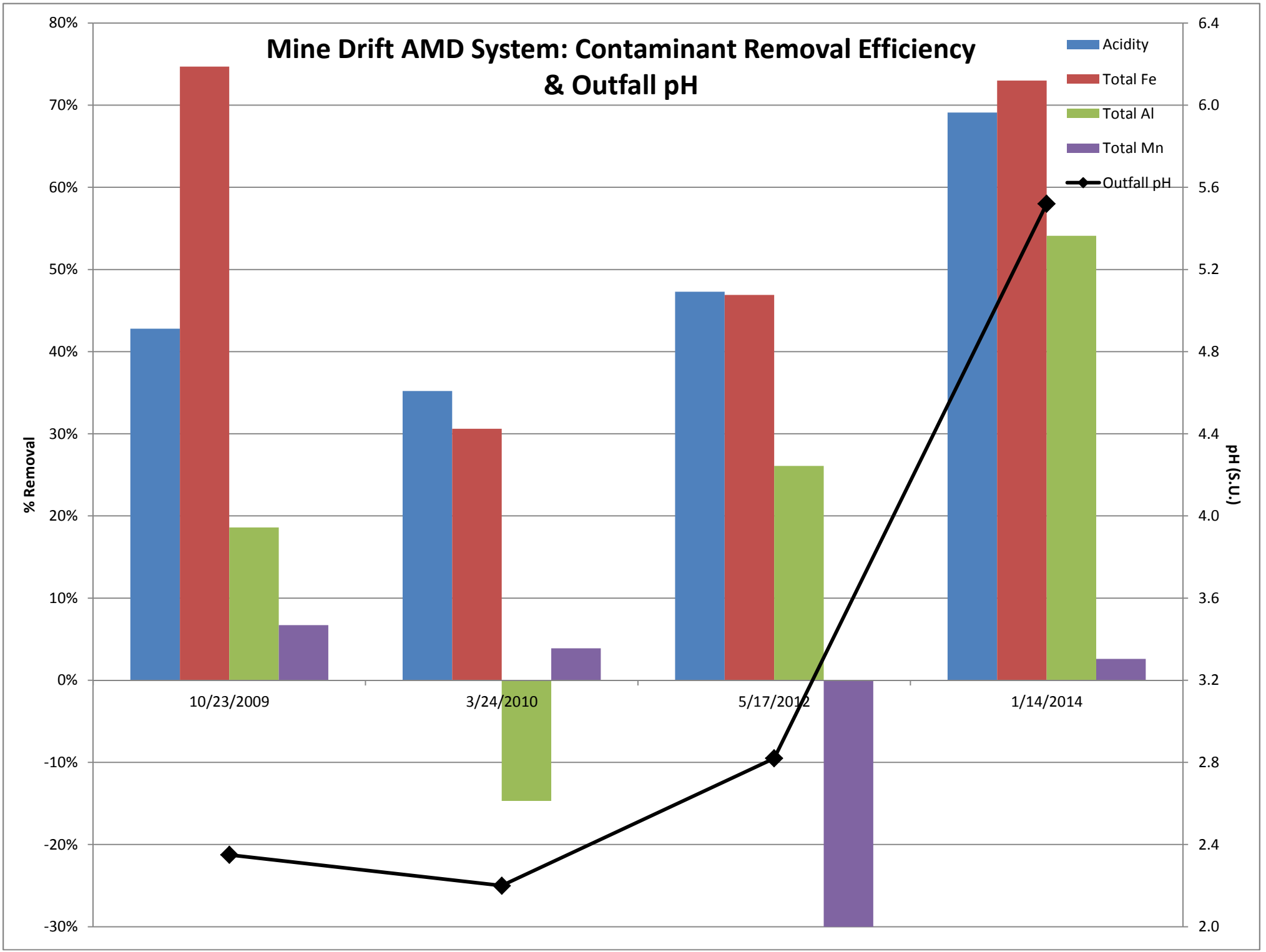
Location	Flow (gpm)	Field pH (s.u.)	Temp (°C)	Field Cond (µS/cm)	ORP (mV)	D.O. (mg/L)	Alkalinity (mg/L CaCO3)	Acidity (mg/L CaCO3)	Sulfate (mg/L)	Chloride (mg/L)	Lab pH (s.u.)	Ferrous Iron (mg/L)	Total Alum (mg/L)	Dissolved Al (mg/L)	Dissolved Ca (mg/L)	Total Fe (mg/L)	Dissolved Fe (mg/L)	Potassium (mg/L)	Dissolved Mg (mg/L)	Total Mn (mg/L)	Dissolved Mn (mg/L)	Dissolved Na (mg/L)	Total Inorganic Carbon (mg/L)
PA257A (Inflow)	5	2.99	6.34	2270	559	8.6	0	466	717	<2.0	2.6	0.31	30.2	29.58	43.13	25.56	24.66	1.86	51.89	12.56	12.41	0.77	1.5
PA257B (VFW Effluent)	9	5.49	3.63	1510	270	15.4	7	149	677	<2.0	4.4	2.11	15.44	13.51	146	9.96	6.08	1.94	57.92	14.56	13.75	0.9	5.3
FINAL OUTFALL	NM	5.52	3.79	109	269	12.9	0	144	579	-	3.6	-	13.85	13.72	112.99	6.9	2.7	-	-	12.23	12.49	-	-

MINE DRIFT SEEP WATER QUALITY (04-28-14 FIELD MEASUREMENTS & LAB RESULTS)

Location	Flow (gpm)	Field pH (s.u.)	Temp (°C)	Field Cond (µS/cm)	ORP (mV)	D.O. (mg/L)	Alkalinity (mg/L CaCO3)	Acidity (mg/L CaCO3)	Sulfate (mg/L)	Chloride (mg/L)	Lab pH (s.u.)	Ferrous Iron (mg/L)	Total Alum (mg/L)	Dissolved Al (mg/L)	Dissolved Ca (mg/L)	Total Fe (mg/L)	Dissolved Fe (mg/L)	Potassium (mg/L)	Dissolved Mg (mg/L)	Total Mn (mg/L)	Dissolved Mn (mg/L)	Dissolved Na (mg/L)
PA257A (Inflow) Avgs	21.6	2.10	9				0	355.3	606.5		2.75	1.25	26.49			25.83				14.09		
FINAL OUTFALL	5-10	2.86	12.4	1125			0	191	794	<2.0		-	18.87	17.84	57.6	5.78	5.41	-	-	9.67	9.19	-

MINE DRIFT RAW AMD HISTORIC AVERAGES WATER QUALITY (1998-2000)

Location	Flow (gpm)	Field pH	Temp (°C)	Lab pH	Lab Cond (µS/cm)	Hot Acidity (mg/L)	Alkalinity	TSS	Ferrous Fe	Sulfate (mg/L)	Total Fe	Total Al	Total Mn
PA257A	3.8	-	9	2.75	-	419.1	0	13.27	1.25	640.8	32.46	33.68	22.22


Mine Drift AMD System: Contaminant Removal Efficiency & Outfall pH
Acidity
Total Fe
Total Al
Total Mn
Outfall pH
% Removal
pH (S.U.)
80%
70%
60%
50%
40%
30%
20%
10%
0%
-10%
-20%
-30%
6.4
6.0
5.6
5.2
4.8
4.4
4.0
3.6
3.2
2.8
2.4
2.0
10/23/2009
3/24/2010
5/17/2012
1/14/2014

STUMP SEEP SYSTEM WATER QUALITY (01-15-14 FIELD MEASUREMENTS & LAB RESULTS)

Location	Flow (gpm)	Field pH (s.u.)	Temp (°C)	Cond (µS/cm)	ORP (mV)	D.O. (mg/L)	Alkalinity (mg/L CaCO3)	Acidity (mg/L CaCO3)	Sulfate (mg/L)	Chloride (mg/L)	Lab pH (s.u.)	Ferrous Fe (mg/L)	Total Al (mg/L)	Dissolved Al (mg/L)	Dissolved Ca (mg/L)	Total Fe (mg/L)	Dissolved Fe (mg/L)	Potassium (mg/L)	Dissolved Mg (mg/L)	Total Mn (mg/L)	Dissolved Mn (mg/L)	Dissolved Na (mg/L)	Total Inorganic Carbon (mg/L)
PA5A (RAW)	10	4.57	2.94	888	508	12.6	0	155	360	<2.0	3.7	-	17.43	17.21	34.11	0.19	0.24	1.82	42.19	10.1	9.9	0.84	1.3
PA5B1 (LS B1 Effluent)	30	4.96	2.42	896	455	11.5	3	142	348	<2.0	4.2	0.09	15.92	15.3	37.15	0.16	0.14	1.74	40.71	9.54	9.24	0.78	1.3
Stump & Stump Jr. Final Outfall	NM	5.39	1.86	850	336	11.76	0	113	433	-	4	-	14.85	14.19	69.16	1.12	0.9	-	-	10.41	10.55	-	-
PA5C (Stump & Mine Drift Combined Effluent)	16.5	4.7	2.9	1080	418	10.3	6	124	353	-	4.3	-	15.33	14.81	40.12	0.12	0.29	-	-	9.74	9.23	-	-

STUMP SEEP SYSTEM WATER QUALITY (04-28-14 FIELD MEASUREMENTS & LAB RESULTS)

Location	Flow (gpm)	Field pH (s.u.)	Temp (°C)	Cond (µS/cm)	ORP (mV)	D.O. (mg/L)	Alkalinity (mg/L CaCO3)	Acidity (mg/L CaCO3)	Sulfate (mg/L)	Chloride (mg/L)	Lab pH (s.u.)	Ferrous Fe (mg/L)	Total Al (mg/L)	Dissolved Al (mg/L)	Dissolved Ca (mg/L)	Total Fe (mg/L)	Dissolved Fe (mg/L)	Potassium (mg/L)	Dissolved Mg (mg/L)	Total Mn (mg/L)	Dissolved Mn (mg/L)	Dissolved Na (mg/L)	Total Inorganic Carbon (mg/L)
PA5A (RAW) Avgs	18.6	2.97	-	888	-	-	1.6	170.9	415.1	-	3.95	0.08	20.59	-	-	0.32	-	-	-	12.52	-	-	-
Stump & Stump Jr. Final Outfall	5	4.31	11.4	721	-	-	6	123	403	2.1	-	-	16.11	15.85	42.55	0.27	0.13	-	-	9.72	9.27	-	-

STUMP & JR. SEEP TREATMENT SYSTEM WATER QUALITY (10-23-2009 SNAPSHOT MEASUREMENTS)

Location	Flow (gpm)	Field pH	Temp (°C)	Lab pH	Lab Cond (µS/cm)	Hot Acidity (mg/L)	Alkalinity	TSS	TDS	Sulfate (mg/L)	Total Fe	Total Al	Total Mn
PA5A	24	3.07	11.3	3.9	911	166	0	<5	587	465	0.31	20.2	12.9
PA5C	60	2.54	12.2	3.3	1140	195	0	<5	645	543	1.95	20.5	11

STUMP & JR. SEEP TREATMENT SYSTEM WATER QUALITY (03-24-2010 SNAPSHOT MEASUREMENTS)

Location	Flow (gpm)	Field pH	Temp (°C)	Lab pH	Lab Cond (µS/cm)	Hot Acidity (mg/L)	Alkalinity	TSS	TDS	Sulfate (mg/L)	Total Fe	Total Al	Total Mn
PA5A	24	2.86	6.4	3.7	774	194	0	<5	587	373	0.26	18.5	9.72
PA5B1		3.01	4.7	3.9	747	154	0	<5	587	385	0.23	18.2	9.41
PA5C	60	2.41	6.5	3.4	884	172	0	<5	645	408	3.5	20.2	9.21

STUMP SEEP RAW HISTORIC AVERAGE WATER QUALITY (1998-2000)

Location	Flow (gpm)	Field pH	Temp (°C)	Lab pH	Lab Cond (µS/cm)	Hot Acidity (mg/L)	Alkalinity	TSS	Ferrous Fe	Sulfate (mg/L)	Total Fe	Total Al	Total Mn
PA5A	7.8	-	-	3.95	-	152.6	1.6	17.3	0.08	407.2	0.4	23.07	14.94

	Percent Reduction (%)								
Date	Acidity	Total Fe	Total Al	Total Mn	Diss Fe	Diss Al	Diss Mn	Flow Rate	Outfall pH
1/14/2014	27.10%	-4.90%	14.80%	-3.10%	-275.00%	17.50%	-6.60%	10-15	5.39
4/28/2014	28.00%	0.16%	21.80%	22.40%				5	4.31

*Stump Jr. raw AMD cannot be sampled so reduction is based on raw Stump seep only, but combined outfall of shared settling pond

	LS Pond Removal Amount (mg/L)								
Date	Acidity	Total Fe	Total Al	Total Mn	Diss Fe	Diss Al	Diss Mn	Flow Rate	Outfall pH
3/24/2010	40.00	0.03	0.30	0.31				24	3.01
1/14/2014	29.00	0.03	1.07	-0.87	-0.76	1.11	-1.31	10	4.96

CHILLER THEATER SEEP AMD TREATMENT SYSTEM WATER QUALITY (AVERAGE OF 2001 MEASUREMENTS)

Location	Flow (gpm)	Field pH (s.u.)	Temp (°C)	Lab pH (s.u.)	Lab Cond (µS/cm)	Acidity (mg/L CaCO3)	Alkalinity (mg/L CaCO3)	Total Suspended Solids	Total Dissolved Solids	Sulfate (mg/L)	Total Fe (mg/L)	Total Al (mg/L)	Total Mn (mg/L)
PA237A (Raw Seep at Weir)		4.5		2.78		414	0	24.2		679.7	16.22	41.27	24.9
PA237B (VFP Outfall)		6.50		5.87		13.3	62.1	25.3		657.1	1.83	6.41	16.7
15B (Settling Pond 1 Outfall)				4.20		210	42	14		549.6	8.88	21.51	12.8
PA237C (Settling Pond 2)				5.90		8.7		17		673.1	0.89	43.3	14.85
PA237D (Settling Pond 3)				6.60		0	55	13		670.5	0.58	1.84	13.59
PA237E (Wetland Effluent)				6.80		0	60	32		664.7	0.54	1.38	12.55
PA237F (Final Outfall)		7.50		6.20		6.7	46.3	15		545.15	0.42	1.4	11.08

	Percent Reduction (%)								
Date	Acidity	Total Fe	Total Al	Total Mn	Diss Fe	Diss Al	Diss Mn	Flow Rate	Outfall pH
2001 Avgs	98.40%	97.40%	96.60%	55.50%					6.2
10/23/2009	40.10%	84.80%	33.90%	32.30%					2.7
3/24/2010	38.60%	51.60%	25.20%	13.90%				30	2.3
5/17/2012	29.00%	8.40%	11.10%	-5.30%				100	3.1
1/15/2014	32.60%	56.60%	22.30%	10.95%	57.10%	20.00%	12.00%	14	4.6
4/28/2014	34.60%	51.50%	32.60%	39.00%				80	2.9

CHILLER THEATER SEEP AMD TREATMENT SYSTEM WATER QUALITY (10-23-2009 SNAPSHOT MEASUREMENTS)

Location	Flow (gpm)	Field pH (s.u.)	Temp (°C)	Lab pH (s.u.)	Lab Cond (µS/cm)	Acidity (mg/L CaCO3)	Alkalinity (mg/L CaCO3)	Total Suspended Solids	Total Dissolved Solids	Sulfate (mg/L)	Total Fe (mg/L)	Total Al (mg/L)	Total Mn (mg/L)
PA237A (Raw Seep at Weir)		1.83	11.3	2.70	2040	442	0	<5			15.2	48.1	19.8
PA237B (VFP Outfall)		2.17	10.6	3.00	1520	336	0	<5			5.87	42.3	17.5
PA237D (Settling Pond 3)		2.52	12.3	3.30	1300	279	0	<5			4.08	35.5	15
PA237E (Wetland Effluent)		2.60	12.2	3.40	1240	270	0	<5			2.91	36.5	15.2
PA237F (Final Outfall)		2.70	12.3	3.50	1210	265	0	<5			2.31	31.8	13.4

	VFW Removal Amount (mg/L)								
Date	Acidity	Total Fe	Total Al	Total Mn	Diss Fe	Diss Al	Diss Mn	Flow Rate	Outfall pH
10/23/2009	106.00	9.33	5.80	2.30					2.17
3/24/2010	-12.00	1.23	2.30	0.60				30	2.10
1/15/2014	66.00	3.01	-0.36	1.01	2.88	0.48	0.88	14	4.28

CHILLER THEATER SEEP AMD TREATMENT SYSTEM WATER QUALITY (03-24-2010 SNAPSHOT MEASUREMENTS)

Location	Flow (gpm)	Field pH	Temp (°C)	Lab pH	Lab Cond (µS/cm)	Hot Acidity (mg/L)	Alkalinity	TSS	TDS	Sulfate (mg/L)	Total Fe	Total Al	Total Mn
PA237A	30	1.94	5.8	2.8	1460	280	0	<5	856	498	7.23	27	10.7
PA237B	30	2.10	6.3	3	1260	292	0	<5	799	483	6	24.7	10.1
PA237C	90	2.18	7	3.1	1130	216	0	<5	725	451	4.88	23.3	9.56
PA237D	90	2.22	7.5	3.1	1100	257	0	<5	710	447	4.61	23.3	9.46
PA237E	90	2.26	7.7	3.10	1100	204	0	<5	715	451	4.35	22.7	9.1
PA5C	60	2.41	6.5	3.4	884	172	0	<5	645	408	3.5	20.2	9.21
PA237F	90	2.29	8.7	3.1	1100	254	0	<5	710	448	4.43	23	9.39

*Sample location "15B" not measured during 2010 snapshot. Includes effluent of first settling pond

CHILLER THEATER SEEP AMD TREATMENT SYSTEM WATER QUALITY (5-17-2012 SNAPSHOT MEASUREMENTS)

Location	Flow (gpm)	Field pH (s.u.)	Temp (°C)	Lab pH (s.u.)	Lab Cond (µS/cm)	Acidity (mg/L CaCO3)	Alkalinity (mg/L CaCO3)	Total Suspended Solids	Total Dissolved Solids	Sulfate (mg/L)	Total Fe (mg/L)	Total Al (mg/L)	Total Mn (mg/L)
PA237A (Raw Seep at Weir)	100	3.2	12	2.70	1320	221	0	<5		457	5.02	20.65	8.89
PA237C (Settling Pond 2)	100	3.00	18	3.10	1030	153	0	<5		430	3.88	17.08	8.79
PA237D (Settling Pond 3)		3.00	19	3.10	1030	162	0	<5		435	4.42	18.19	8.97
PA237E (Wetland Effluent)		3.00	20	3.10	1030	155	0	<5		434	4.84	17.76	9.22
PA237F (Final Outfall)		3.10	19	3.10	999	157	0	<5		440	4.6	18.36	9.36

CHILLER THEATER SEEP SYSTEM WATER QUALITY (01-15-14 FIELD MEASUREMENTS & LAB RESULTS)

Location	Flow (gpm)	Field pH (s.u.)	Temp (°C)	Cond (µS/cm)	ORP (mV)	D.O. (mg/L)	Alkalinity (mg/L CaCO3)	Acidity (mg/L CaCO3)	Sulfate (mg/L)	Chloride (mg/L)	Lab pH (s.u.)	Ferrous Fe (mg/L)	Total Alum (mg/L)	Dissolved Al (mg/L)	Dissolved Ca (mg/L)	Total Fe (mg/L)	Dissolved Fe (mg/L)	Potassium (mg/L)	Dissolved Mg (mg/L)	Total Mn (mg/L)	Dissolved Mn (mg/L)	Dissolved Na (mg/L)	Total Inorganic Carbon (mg/L)
PA237A (Raw Seep at Weir)	13.9	3.85	2.4	1970	523	10.4	0	368	652	<2.0	2.8	0.26	33.99	31.56	40.08	7.38	7	1.81	51.65	13.61	13.07	0.89	ND
PA237B (VFP Outfall)	225*	4.28	1.91	1690	475	8.76	0	302	623	<2.0	3.1	0.43	34.35	31.08	57.88	4.37	4.12	1.78	50.23	12.6	12.19	0.81	4.4
15B (Settling Pond 1 Outfall)	36	4.55	1.24	1420	452	7.94	0	256	569	-	3.3	-	26.67	25.22	59.81	3.4	3.23	-	-	12.14	11.61	-	-
PA237F (Final Outfall)	45	4.62	0.45	1430	426	9.8	0	248	565	-	3.4	-	26.41	25.25	58.58	3.2	3	-	-	12.12	11.5	-	-

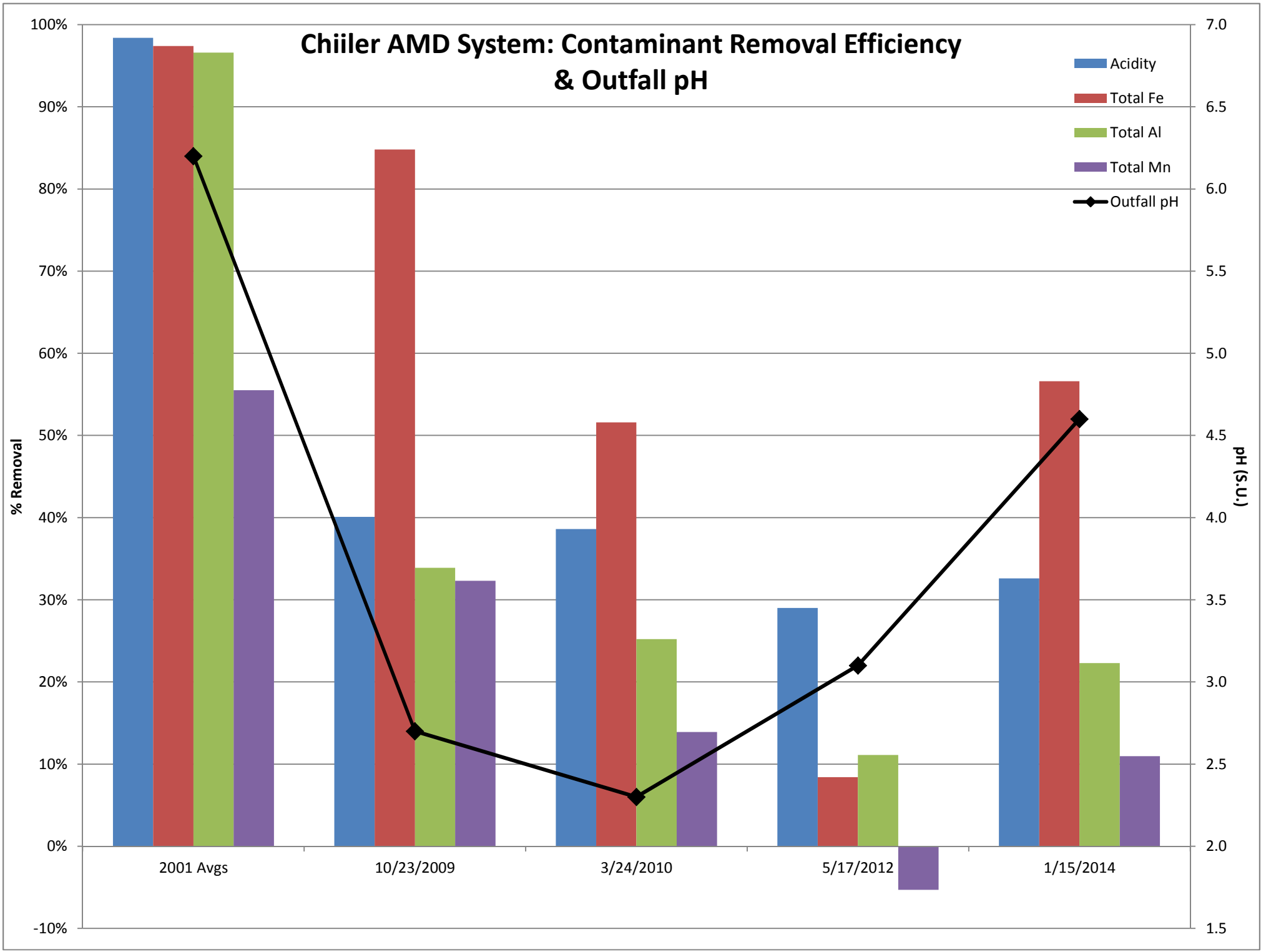
*DOSING SIPHON OBSERVED

CHILLER THEATER SEEP SYSTEM WATER QUALITY (04-28-14 FIELD MEASUREMENTS & LAB RESULTS)

Location	Flow (gpm)	Field pH (s.u.)	Temp (°C)	Cond (µS/cm)	ORP (mV)	D.O. (mg/L)	Alkalinity (mg/L CaCO3)	Acidity (mg/L CaCO3)	Sulfate (mg/L)	Chloride (mg/L)	Lab pH (s.u.)	Ferrous Fe (mg/L)	Total Alum (mg/L)	Dissolved Al (mg/L)	Dissolved Ca (mg/L)	Total Fe (mg/L)	Dissolved Fe (mg/L)	Total Mn (mg/L)	Dissolved Mn (mg/L)
PA237A (Raw Seep at Weir) Avgs	65	2.32					0	339.3	544.9		2.78		34.26			10.92		16.07	
PA237B (VFP Outfall)		2.81	14.1	1164															
PA237F (Final Outfall)	80	2.85	14.2	1150			0	222	516	<2.0			23.09	21.8	49.62	5.3	4.9	9.8	9.03

CHILLER THEATER SEEP SYSTEM AVERAGE HISTORICAL WATER QUALITY DATA (1998-2010: System Built in 2000)

Location	Field pH	Lab pH	Hot Acidity	Alkalinity	TSS	Sulfate	Total Fe	Total Al	Total Mn
PA237A (Raw Seep at Weir)	2.73	2.78	411.00	0.00	22.80	680.80	15.84	40.83	24.36
PA237B (VFP Outfall)	3.59	4.72	133.60	37.30	15.20	634.40	3.47	17.25	15.52
15B (Settling Pond 1 Outfall)	-	4.20	210.00	-	14.00	549.57	8.88	21.51	12.80
PA237C (Settling Pond 2)	2.18	4.97	77.80	0.00	11.33	599.00	2.22	28.87	13.09
PA237D (Settling Pond 3)	2.37	4.90	134.00	27.50	6.50	608.50	2.46	15.62	12.91
PA237E (Wetland Effluent)	2.43	5.03	118.50	30.00	16.00	610.35	2.08	15.49	12.35
PA237F (Final Outfall)	4.84	5.22	109.08	25.80	6.80	552.52	1.62	11.62	10.63


Chiiler AMD System: Contaminant Removal Efficiency & Outfall pH
Acidity
Total Fe
Total Al
Total Mn
Outfall pH
% Removal
pH (S.U.)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
-10%
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
2001 Avgs
10/23/2009
3/24/2010
5/17/2012
1/15/2014

FOSSIL ROCK SEEP SYS WATER QUALITY (01-15-14 FIELD MEASUREMENTS)

Location	Flow (gpm)	Field pH (s.u.)	Temp (°C)	Cond (µS/cm)	ORP (mV)	D.O. (mg/L)	Acidity (mg/L CaCO3)	Alkalinity (CaCO3)	Lab pH (s.u.)	Sulfate (mg/L)	Total Al (mg/L)	Dissolved Al (mg/L)	Dissolved Ca (mg/L)	Total Fe (mg/L)	Dissolved Fe (mg/L)	Total Mn (mg/L)	Dissolved Mn (mg/L)
PA4A (RAW) Historic Avgs	23	2.91					109.7	1.27	4.1	220.5	11.18			0.11		7.22	
PA4C (Settling Pond/Final Effluent)	2.5	4.57	2.58	1030	410	9.5	57	14	4.5	169	5.13	4.8	19.87	<0.05	<0.05	4.61	4.35

FOSSIL ROCK AMD TREATMENT SYSTEM WATER QUALITY (10-29-2009 SNAPSHOT MEASUREMENTS)

Location	Flow (gpm)	Field pH	Temp (°C)	Lab pH	Lab Cond (µS/cm)	Hot Acidity (mg/L)	Alkalinity	TSS	TDS	Sulfate (mg/L)	Total Fe	Total Al	Total Mn
PA4A		2.97	10.8	3.6	591	123	0	<5	428	299	0.08	13.9	8.39
PA4B		4.46	11	4.6	398	40	5	12	261	165	0.07	5.1	4.31

FOSSIL ROCK AMD TREATMENT SYSTEM WATER QUALITY (03-24-2010 SNAPSHOT MEASUREMENTS)

Location	Flow (gpm)	Field pH	Temp (°C)	Lab pH	Lab Cond (µS/cm)	Hot Acidity (mg/L)	Alkalinity	TSS	TDS	Sulfate (mg/L)	Total Fe	Total Al	Total Mn
PA4A	45	2.85	8.8	3.8	513	141	0	<5	340	212	<0.05	10.6	6.83
PA4B	45	3.20	8.3	4.0	452	88	1	<5	308	192	<0.05	9.57	6.05
PA4C	45	3.19	8.0	4.0	430	99	0	<5	300	184	<0.05	9.33	6.07

FOSSIL ROCK SEEP RAW HISTORIC AVERAGE WATER QUALITY (1998-2000)

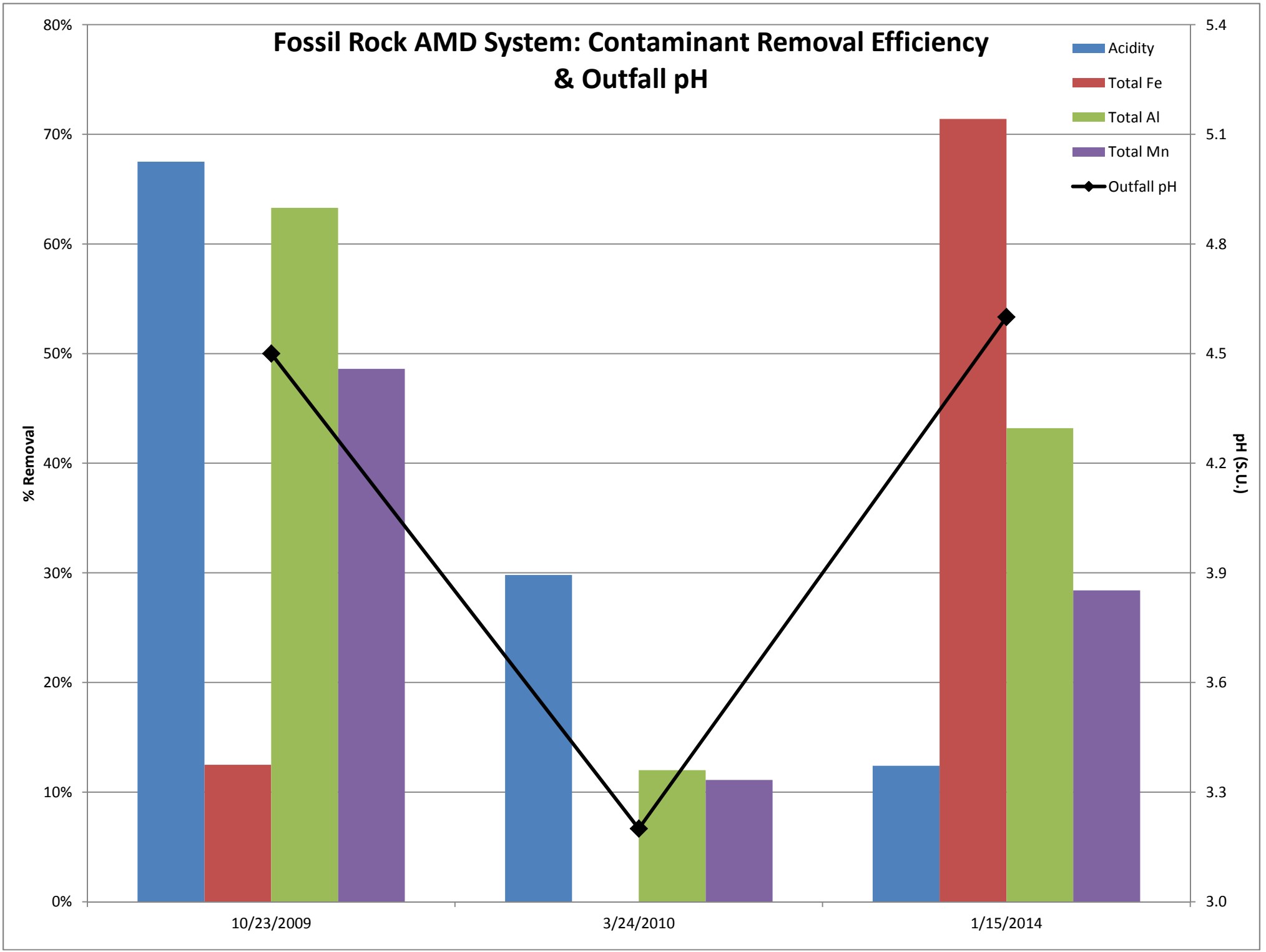
Location	Flow (gpm)	Field pH	Temp (°C)	Lab pH	Lab Cond (µS/cm)	Hot Acidity (mg/L)	Alkalinity	TSS	Ferrous Fe	Sulfate (mg/L)	Total Fe	Total Al	Total Mn
PA4A	<1	-	-	4.1	-	65.1	3.8	15.5	0.07	150.5	0.14	9.03	6.44

	Percent Reduction (%)								
Date	Acidity	Total Fe	Total Al	Total Mn	Diss Fe	Diss Al	Diss Mn	Flow Rate	Outfall pH
10/23/2009	67.50%	12.50%	63.30%	48.60%					4.5
3/24/2010	29.80%	N.D.	12.00%	11.10%				45	3.2
1/15/2014	48.00%	63.60%	54.10%	36.20%				2.5	4.6

Raw vs LS Pond Outfall (Final outfall not measured)

*Data from 10/23/09 sampling event uses raw AMD versus the limestone pond outfall (final outfall not sampled), all others compare raw versus final outfall

	LS Pond Removal Amount (mg/L)								
Date	Acidity	Total Fe	Total Al	Total Mn	Diss Fe	Diss Al	Diss Mn	Flow Rate	Outfall pH
10/23/2009	83.00	0.01	8.80	4.08					4.46
3/24/2010	53.00	<0.05	1.03	0.78				45	3.20


Fossil Rock AMD System: Contaminant Removal Efficiency & Outfall pH
Acidity
Total Fe
Total Al
Total Mn
Outfall pH
% Removal
pH (S.U.)
80%
70%
60%
50%
40%
30%
20%
10%
0%
5.4
5.1
4.8
4.5
4.2
3.9
3.6
3.3
3.0
10/23/2009
3/24/2010
1/15/2014

SHOTGUN/PennDOT WETLAND SYS. LS POND OUTFALL WATER QUALITY (01-15-14 FIELD MEASUREMENTS)

Location	Flow (gpm)	Field pH (s.u.)	Temp (°C)	Cond (µS/cm)	ORP (mV)	D.O. (mg/L)	Total Inorganic Carbon (mg/L)	Alkalinity (mg/L CaCO3)	Acidity (mg/L CaCO3)	Sulfate (mg/L)	Total Cl (mg/L)	Lab pH (mg/L)	Ferrous Fe (mg/L)	Total Al (mg/L)	Dissolved Al (mg/L)	Dissolved Ca (mg/L)	Total Fe (mg/L)	Disolved Fe (mg/L)	Potassium (mg/L)	Dissolved Mg (mg/L)	Total Mn (mg/L)	Dissolved Mn (mg/L)	Dissolved Na (mg/L)
PennDOT Wetland Sys. LS Pond Outfall (Spillway)	4.04	3.73	4.11	2220	479	6.70	1.70	0.00	511.00	905.00	5.10	2.90	0.97	50.74	49.75	68.76	24.87	23.66	1.59	79.31	10.93	10.38	4.83
PA256D (LS Ditch to Wetland)	NM	4.00	3.55	2200	494	8.64	-	0	474	973	-	2.9	-	50.44	47.14	74.36	22.59	21.51	-	-	11.63	11	-

*these sample locations are not the same as those in the above table

SHOTGUN/PennDOT WETLAND SYS. LS POND OUTFALL WATER QUALITY (04-28-14 FIELD MEASUREMENTS)

Location	Flow (gpm)	Field pH (s.u.)	Temp (°C)	Cond (µS/cm)	ORP (mV)	D.O. (mg/L)	Total Inorganic Carbon (mg/L)	Alkalinity (mg/L CaCO3)	Acidity (mg/L CaCO3)	Sulfate (mg/L)	Total Cl (mg/L)	Lab pH (mg/L)	Ferrous Fe (mg/L)	Total Al (mg/L)	Dissolved Al (mg/L)	Dissolved Ca (mg/L)	Total Fe (mg/L)	Disolved Fe (mg/L)	Potassium (mg/L)	Dissolved Mg (mg/L)	Total Mn (mg/L)	Dissolved Mn (mg/L)	Dissolved Na (mg/L)
Shotgun Raw AMD Source	<1	2.41	8.8	959			N.D.	0.00	431.00	809.00	16.20			39.58	37.37	45.99	24.54	19.17	1.45	57.58	8.21	8.00	11.73
PA256D (LS Ditch to Wetland)	NM	2.59	9.7	1723			-	0	374	777	16.2			38.14	35.55	59.54	19.97	18.7			8.95	8.65	-

SHOTGUN AMD SEEP TREATMENT SYSTEM WATER QUALITY (10-23-2009 SNAPSHOT MEASUREMENTS)

Location	Flow (gpm)	Field pH	Temp (°C)	Lab pH	Lab Cond (µS/cm)	Hot Acidity (mg/L)	Alkalinity	TSS	TDS	Sulfate (mg/L)	Total Fe	Total Al	Total Mn
PA256A (RAW Historic Avgs)	<1	-	-	2.73	-	509.3	0	78.3	21.79	743.9	43.81	42.62	12.95
PA256C (Final Outfall)		5.25	12.02	6.2	1420	10	20	8		815	0.26	0.06	0.69
PA256D (LS Ditch to Wetland)		2.57	10.4	3.2	1800	349	0	9		1066	26.4	43	13.5

SHOTGUN AMD SEEP TREATMENT SYSTEM WATER QUALITY (03-24-2010 SNAPSHOT MEASUREMENTS)

Location	Flow (gpm)	Field pH	Temp (°C)	Lab pH	Lab Cond (µS/cm)	Hot Acidity (mg/L)	Alkalinity	TSS	TDS	Sulfate (mg/L)	Total Fe	Total Al	Total Mn
PA256A (RAW)	20	2.02	7.5	2.7	1970	391	0	<5	1181	763	18.3	39.4	8.72
PA256B (SRB Effluent)	20	4.62	8.3	6.2	1340	-30	66	20	1120	674	1.25	5.39	5.84
PA256C (Final Effluent)	20	5.04	10.4	5.6	1260	63	16	21	1023	651	3.29	11.5	7.22

SHOTGUN AMD SEEP TREATMENT SYSTEM WATER QUALITY (05-17-2012 SNAPSHOT MEASUREMENTS)

Location	Flow (gpm)	Field pH	Temp (°C)	Lab pH	Lab Cond (µS/cm)	Hot Acidity (mg/L)	Alkalinity	TSS	TDS	Sulfate (mg/L)	Total Fe	Total Al	Total Mn
PA256A (RAW)	4	3.2	11	2.6	1910	342	0	7		739	12.64	32.26	8.04
PA256B (SRB Effluent)	4	5.9	15	6.5	1500	-71	120	17		747	28.04	0.06	11.59
PA256C (Final Effluent)	4	5.10	20	5.1	1350	21	9	0		767	1.62	1.46	10.31

SHOTGUN SEEP RAW HISTORIC AVERAGE WATER QUALITY (1998-2000)

Location	Flow (gpm)	Field pH	Temp (°C)	Lab pH	Lab Cond (µS/cm)	Hot Acidity (mg/L)	Alkalinity	TSS	Ferrous Fe	Sulfate (mg/L)	Total Fe	Total Al	Total Mn
PA256A	<1	-	-	2.73	-	509.3	0	78.3	21.79	743.9	43.81	42.62	12.95

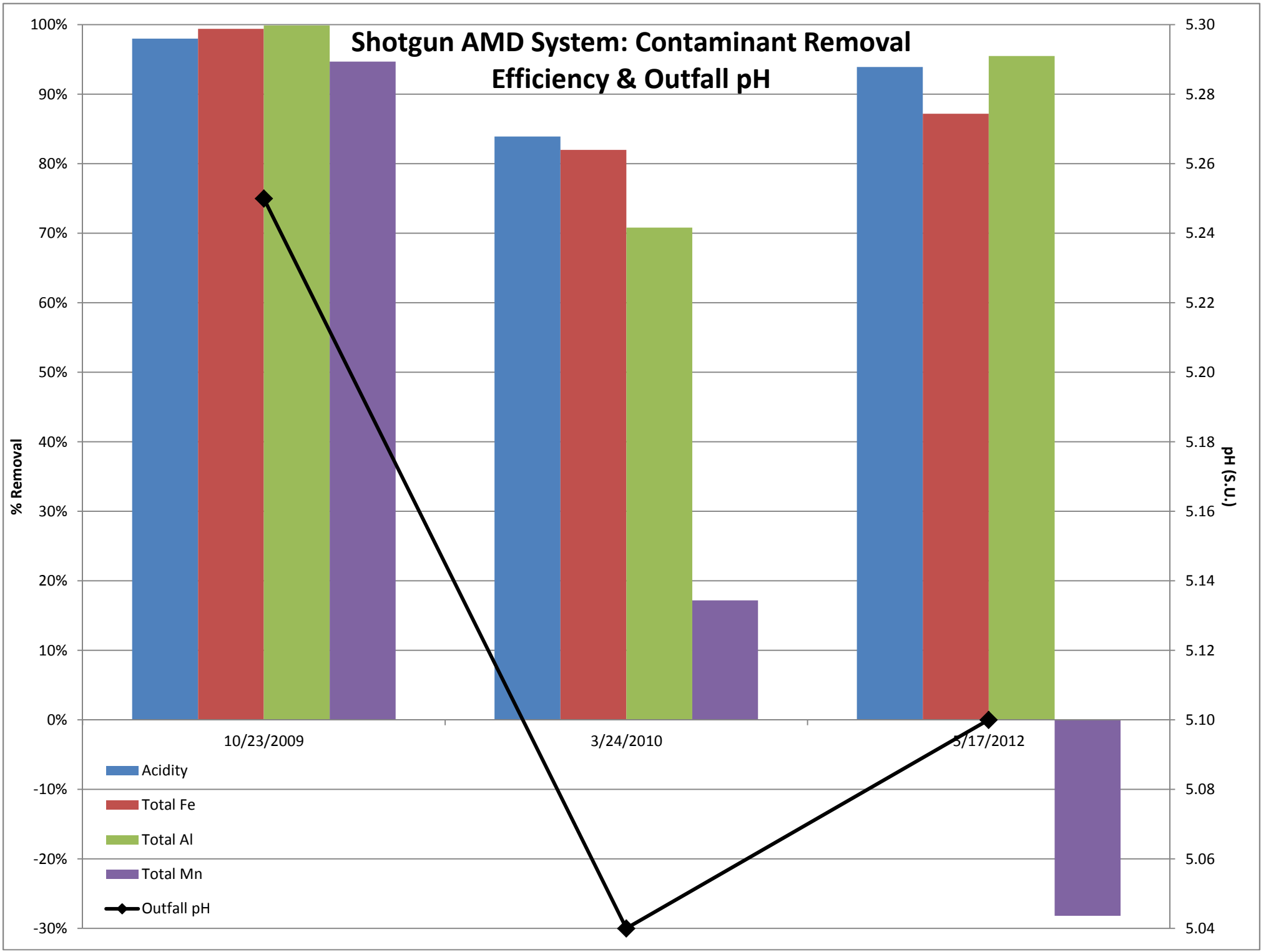
SHOTGUN SEEP RAW HISTORIC AVERAGE WATER QUALITY (1998-2012)

Location	Flow (gpm)	Field pH	Temp (°C)	Lab pH	Lab Cond (µS/cm)	Hot Acidity (mg/L)	Alkalinity	TSS	Ferrous Fe	Sulfate (mg/L)	Total Fe	Total Al	Total Mn
PA256A (RAW)	8.33	2.61	-	2.73	-	437.9	0	78.3	21.79	747.5	29.64	39.23	10.67

	Percent Reduction (%)								
Date	Acidity	Total Fe	Total Al	Total Mn	Diss Fe	Diss Al	Diss Mn	Flow Rate	Outfall pH
10/23/2009	98.00%	99.40%	99.90%	94.70%					5.25
3/24/2010	83.90%	82.00%	70.80%	17.20%				20	5.04
5/17/2012	93.90%	87.20%	95.50%	-28.20%				4	5.1

*Data from 10/23/09 sampling event uses raw AMD versus the limestone pond outfall (final outfall not sampled), all others compare raw versus final outfall

	SRB Removal Amount (mg/L)								
Date	Acidity	Total Fe	Total Al	Total Mn	Diss Fe	Diss Al	Diss Mn	Flow Rate	Outfall pH
3/24/2010	421.00	17.05	34.01	2.88				20	4.62
5/17/2012	413.00	-15.40	32.20	-3.55				4	5.9


Shotgun AMD System: Contaminant Removal Efficiency & Outfall pH
% Removal
pH (S.U.)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
-10%
-20%
-30%
5.30
5.28
5.26
5.24
5.22
5.20
5.18
5.16
5.14
5.12
5.10
5.08
5.06
5.04
10/23/2009
3/24/2010
5/17/2012
Acidity
Total Fe
Total Al
Total Mn
Outfall pH

PROJECT 70 DITCH AMD WATER QUALITY (01-15-14 FIELD MEASUREMENTS)

Location	Flow (gpm)	Field pH (s.u.)	Temp (°C)	Cond (µS/cm)	ORP (mV)	D.O. (mg/L)	Acidity (mg/L CaCO3)	Alkalinity (mg/L CaCO3)	Lab pH (s.u.)	Sulfate (mg/L)	Total Al (mg/L)	Dissolved Al (mg/L)	Dissolved Ca (mg/L)	Total Fe (mg/L)	Dissolved Fe (mg/L)	Total Mn (mg/L)	Dissolved Mn (mg/L)
MOUTH	430	4.57	2.58	1030	410	9.5	144	0	3.2	267	9.42	9.04	32.73	19.11	18	5.24	4.95
DS CONFLUENCE W/ TURTLE SPRING & FOSSIL ROCK	-	5.03	3.12	601	380	9.7	-	-	-	-	-	-	-	-	-	-	-
US CONFLUENCE W/ TURTLE SPRING & FOSSIL ROCK	-	4.99	3.35	643	394	9.6	-	-	-	-	-	-	-	-	-	-	-
UPSTREAM OF CHILLER SYSTEM CONFLUENCE	NM	4.72	2.03	724	415	7.4	99	0	3.7	213	8.43	7.93	25.35	1.33	1.22	9.24	8.85

PROJECT 70 DITCH AMD WATER QUALITY (1998-2000 AVERAGES)

Location	Flow (gpm)	Field pH (s.u.)	Temp (°C)	Cond (µS/cm)	ORP (mV)	D.O. (mg/L)	Acidity (mg/L CaCO3)	Alkalinity (mg/L CaCO3)	Lab pH (s.u.)	Sulfate (mg/L)	Total Al (mg/L)	Dissolved Al (mg/L)	Dissolved Ca (mg/L)	Total Fe (mg/L)	Dissolved Fe (mg/L)	Total Mn (mg/L)	Dissolved Mn (mg/L)
MOUTH	2744	-	-	-	-	-	141.5	0.15	3.37	259.1	10.41	-	44.31	27.08	8.26	7.29	-
UPSTREAM OF CHILLER SYSTEM CONFLUENCE	3544	-	-	-	-	-	71.9	4.68	4.15	191.7	7.02	-	28.18	5.24	1.66	9.7	-

TURTLE SPRING WATER QUALITY (01-15-14 FIELD MEASUREMENTS)

Location	Flow (gpm)	Field pH (s.u)	Temp (°C)	Cond (µS/cm)	ORP (mV)	D.O. (mg/L)	Acidity (mg/L CaCO3)	Alkalinity (mg/L CaCO3)	Lab pH (s.u.)	Sulfate (mg/L)	Total Al (mg/L)	Dissolved Al (mg/L)	Dissolved Ca (mg/L)	Total Fe (mg/L)	Dissolved Fe (mg/L)	Total Mn (mg/L)	Dissolved Mn (mg/L)
AT FOSSIL ROCK SYSTEM	90	6.25	1.56	392	342	9.2	26	6	4.8	41	0.41	0.48	12.83	<0.05	<0.05	0.29	0.33
Constructed LS Ditch from Turtle Spring to Project 70 Ditch	NM	5.93	2.57	510	297	10.0	-	-	-	-	-	-	-	-	-	-	-

NEW AMD SOURCE WATER QUALITY (04-28-14 FIELD MEASUREMENTS)-ENTERED PROJECT 70 DITCH BETWEEN ACCESS RD TO UPPER SYSTEMS & SHOTGUN SYSTEM

Location	Flow (gpm)	Field pH (s.u)	Temp (°C)	Cond (µS/cm)	ORP (mV)	D.O. (mg/L)	Acidity (mg/L CaCO3)	Alkalinity (mg/L CaCO3)	Lab pH (s.u.)	Sulfate (mg/L)	Total Al (mg/L)	Dissolved Al (mg/L)	Dissolved Ca (mg/L)	Total Fe (mg/L)	Dissolved Fe (mg/L)	Total Mn (mg/L)	Dissolved Mn (mg/L)	Dissolved Mg (mg/L)	Dissolved K (mg/L)	Dissolved Na (mg/L)
NEW AMD SOURCE	60	3.86	8.9	341	-	-	49	1	-	118	4.41	4.28	12.92	0.09	0.08	3.12	3.08	12.89	2.02	9.62

UPPER POND SEEP WATER QUALITY (01-15-14 FIELD MEASUREMENTS)

Location	Flow (gpm)	Field pH (s.u.)	Temp (°C)	Cond (µS/cm)	ORP (mV)	D.O. (mg/L)
40 52' 53.6" 78 12 ' 9.8"	NM	6.69	2.59	154	134	8.46

SOCCER FIELD SEEPS WATER QUALITY (01-15-14 FIELD MEASUREMENTS)

Location	Flow (gpm)	Field pH (s.u.)	Temp (°C)	Cond (µS/cm)	ORP (mV)	D.O. (mg/L)	Acidity (mg.L CaCO3)	Alkalinity (mg/L CaCO3)	Lab pH (s.u.)	Sulfate (mg/L)	Total Al mg/L)	Dissolved Al (mg/L)	Dissolved Ca (mg/L)	Total Fe (mg/L)	Dissolved Fe (mg/L)	Total Mn (mg/L)	Dissolved Mn (mg/L)
#1 (HDPE PIPE) 40 53' 46.66" 78 12' 19.85"	<1*	6.9	3.07	1370	-3	3	73	27	5.7	335	<0.05	<0.05	92.45	68.49	64.84	2.7	2.59
#2 (CONCRETE PIPE) 40 53' 46.69" 78 12' 19.63"	1.5*	6.83	3.62	1050	17	3.5	-	-	-	-	-	-	-	-	-	-	-

*ESTIMATED FLOWS

ARTESIAN AMD DISCHARGE NEAR COLD STREAM MOUTH WATER QUALITY (04-28-14 FIELD MEASUREMENTS)

Location	Flow (gpm)	Field pH (s.u.)	Temp (°C)	Cond (µS/cm)	ORP (mV)	D.O. (mg/L)	Total Inorganic Carbon (mg/L)	Alkalinity (mg/L CaCO3)	Acidity (mg/L CaCO3)	Sulfate (mg/L)	Total Cl (mg/L)	Lab pH (mg/L)	Ferrous Fe (mg/L)	Total Al (mg/L)	Dissolved Al (mg/L)	Dissolved Ca (mg/L)	Total Fe (mg/L)	Disolved Fe (mg/L)	Potassium (mg/L)	Dissolved Mg (mg/L)	Total Mn (mg/L)	Dissolved Mn (mg/L)	Dissolved Na (mg/L)
RAW AMD SOURCE	**Field meter issues**						2.00	0.00	421.00	892.00	31.00	-	-	14.58	14.14	104.77	184.22	171.87	5.00	48.24	6.43	6.19	19.23

BLUE PIPE AMD WATER QUALITY (01-15-14 FIELD MEASUREMENTS)

Location	Flow (gpm)	Field pH (s.u.)	Temp (°C)	Cond (µS/cm)	ORP (mV)	D.O. (mg/L)	Total Inorganic Carbon (mg/L)	Alkalinity (mg/L CaCO3)	Acidity (mg/L CaCO3)	Sulfate (mg/L)	Total Cl (mg/L)	Lab pH (s.u.)	Ferrous Fe (mg/L)	Total Al (mg/L)	Dissolved Al (mg/L)	Dissolved Ca (mg/L)	Total Fe (mg/L)	Dissolved Fe (mg/L)	Potassium (mg/L)	Dissolved Mg (mg/L)	Total Mn (mg/L)	Dissolved Mn (mg/L)	Dissolved Na (mg/L)
AT WEIR	52.5	3.85	3.14	2050	507	9.3	ND	0	412	483	25.7	2.7	0.8	23.45	23.01	31.59	41.55	39.73	1.09	28.27	3.94	3.84	16.98
HISTORIC AVGS	415	-	-	-	-	-	-	0	658	599.1	-	2.76	58.8	28.6	-	-	149	-	-	-	6.17	-	-

COLD STREAM WATER QUALITY (1998-2000 HISTORIC AVERAGES)

Location	Flow (gpm)	Field pH (s.u.)	Temp (°C)	Cond (µS/cm)	ORP (mV)	D.O. (mg/L)	Acidity (mg/L CaCO3)	Alkalinity (mg/L CaCO3)	Lab pH (mg/L)	Sulfate (mg/L)	Total Al (mg/L)	Dissolved Al (mg/L)	Dissolved Ca (mg/L)	Total Fe (mg/L)	Dissolved Fe (mg/L)	Total Mn (mg/L)	Dissolved Mn (mg/L)	
US PROJ.70 DITCH @ MILSON HOUSE	31026						0.3	14.9	6.25	20.4	0.32		8.06	0.37	0.06	0.12		
US PROJ.70 DITCH & BELOW DAM	30120						1.03	14.7	6.24	27.6	0.2	-	9.36	0.85	0.24	0.19	-	
DS PROJECT 70 DITCH	28798						16.6	7.6	4.80	53.6	1.12		13.77	3.10	1.02	1.08		At Football Stadium Field House

COLD STREAM WATER QUALITY (12-12-13 LAB DATA & FIELD MEASUREMENTS-PA DEP)

Location	Flow (gpm)	Field pH (s.u.)	Temp (°C)	Cond (µS/cm)	ORP (mV)	D.O. (mg/L)	Acidity (mg/L CaCO3)	Alkalinity (mg/L CaCO3)	Lab pH (mg/L)	Sulfate (mg/L)	Total Al (mg/L)	Dissolved Al (mg/L)	Dissolved Ca (mg/L)	Total Fe (mg/L)	Dissolved Fe (mg/L)	Total Mn (mg/L)	Dissolved Mn (mg/L)	
US PROJ.70 DITCH @ MILSON HOUSE		7.1					-11.4	10.4	7.0	<20	<0.5			<0.3		<0.05		
US PROJ.70 DITCH & BELOW DAM	-	6.9					14.2	9	6.8	26.9	13.61	-	-	0.60	-	0.33	-	
DS PROJECT 70 DITCH		6.5					11.4	6	6.3	39.8	<0.5			1.74		0.39		At Football Stadium Field House

COLD STREAM WATER QUALITY (01-15-14 LAB DATA & FIELD MEASUREMENTS)

Location	Flow (gpm)	Field pH (s.u.)	Temp (°C)	Cond (µS/cm)	ORP (mV)	D.O. (mg/L)	Acidity (mg/L CaCO3)	Alkalinity (mg/L CaCO3)	Lab pH (mg/L)	Sulfate (mg/L)	Total Al (mg/L)	Dissolved Al (mg/L)	Dissolved Ca (mg/L)	Total Fe (mg/L)	Dissolved Fe (mg/L)	Total Mn (mg/L)	Dissolved Mn (mg/L)	
*US PROJ.70 DITCH & BEHIND HOUSE	10100	6.92	3.74	82	205	8.9	*1394*	*0*	*1.8*	*113*	0.06	0.06	5.27	0.07	<0.05	0.03	0.07	
US PROJ.70 DITCH & BELOW DAM	-	6.95	3.16	88	189	9.9	-	-	-	-	-	-	-	-	-	-	-	
DS PROJ.70 DITCH	8740	6.48	3.11	141	226	9.6	18	7	5.2	33	0.71	0.26	7.6	1.56	0.84	0.38	0.38	Below SR504 Bridge

***Sample was accidentally acidified with HNO3 in the field, sulfate was only potential viable result of wet chemistry parameters**