TABLE OF CONTENTS

ATTACHMENTS

APPLICATION FOR STREAM VARIANCE IN FICKEY RUN, GLADE RUN, MARTIN CREEK, AND TRIBUTARIES THEREOF.

1.0 SUMMARY

WVDEP Office of Special Reclamation (OSR) is submitting this application for variance from water quality standards pursuant to 46 SCR 1, section 8.3. This variance is being requested based on human-caused conditions which prohibit the full attainment of any designated use. It is important to note that these streams have never been able to meet their designated use as a result of human-caused conditions (pre-law mining) that were in existence before the stream designations were assigned. A stream use inventory is currently ongoing and will be supplied once it has been completed.

A study conducted by the Friends of the Cheat in cooperation with the West Virginia University (WVU) National Mine Land Reclamation Center, WVU Department of Forestry and Natural Resources and OSR (Lower Cheat River Remediation Plan U.S. EPA Targeted Watershed Grant Program Final Report December 31, 2012) evaluated AMD treatment efficiency and cost, both capital and O&M. The results of this study show that in-stream dosing treated the largest amount of acid load and was the second most expensive of all treatment systems implemented. Below is a summary of a table included in the report showing cost and efficiency comparisons:

In-stream dosing proved to have the highest O&M cost but also treated the highest amount of acid. At-source active treatment had the highest capital cost and the lowest treatment efficiency.

Three different passive at-source treatment types were also included and they had the lowest capital cost but did not treat as much acid as the in-stream dosing.

In addition to this, Friends of the Cheat also submitted a watershed based plan for the lower Cheat River Watershed (prepared by Downstream Strategies, LLC January 26, 2005) in which they estimated the cost to fully remediate the nonpoint source AML's. The estimated cost for the impaired portion of Muddy Creek and its Tributaries is $3,200,000.

OSR is proposing the strategic placement of in-stream dosers[1] to increase alkalinity and pH and remove dissolved metals within the stream, thereby enhancing the overall stream quality. Precipitation of metals within the stream channel immediately below the doser is anticipated. Periodic flushing of these sediments will occur due to high flow events which will eventually disperse the sediments throughout the entire stream system. Highly soluble hydrated lime, or lime slurry (liquefied lime) will be used to treat the streams. Dosing rates will be regulated by pH sensors placed downstream of the dosers. The sensors will measure the pH of the stream and send a signal back to the doser that will enable the dosing rate to increase or decrease accordingly. The treatment systems will be powered by electricity with a generator backup. The proposed in-stream treatment sites will be visited and maintained as needed (at least once a week) to ensure that the doser's are functioning properly as well as assuring there are no other maintenance issues with the facility. This information is documented on inspection forms and submitted to regional office. A regional maintenance contractor is under contract to provide necessary equipment and manpower to ensure the maintenance of the treatment facility. The

[1] For purposes of this document a doser is defined as a silo that holds a chemical reagent; hydrated lime, or lime slurry, that is dispensed into the stream at a regulated rate.

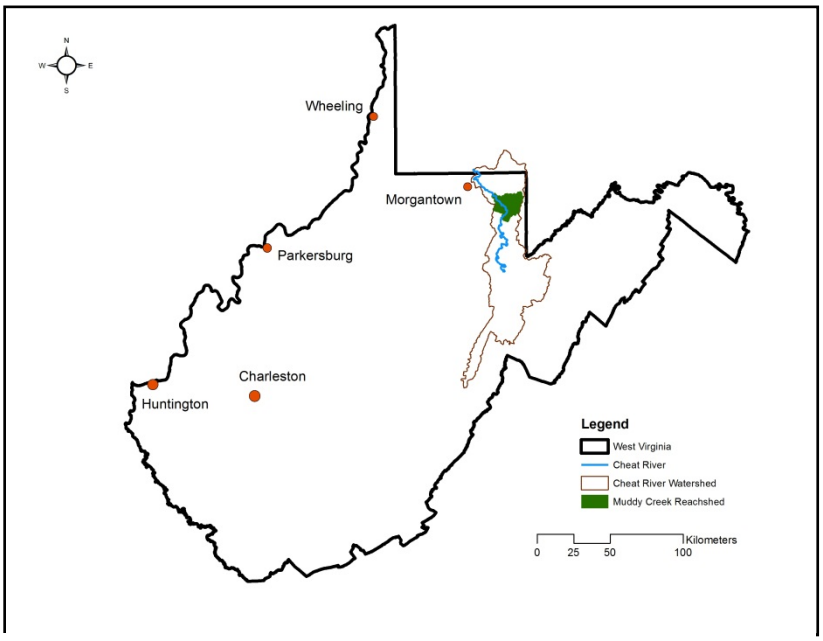
maintenance contractor is required to have necessary equipment readily available for any required site maintenance.

OSR has set a restoration goal of restoring the lower 3.4 miles of Muddy Creek to its designated stream usage by decreasing the water quality impairment from pre and post law coal mine discharges within the watershed. This will effectively reestablish biologic connectivity throughout the entire 15.6 miles of Muddy Creek. Also, as part of the 10 year variance term, OSR will be constructing a treatment facility at its T&T EM-113 site that will be treating water from the T&T site, Viking Coal UO-519, as well as the Preston Energy UO-235 site.

To measure the success of the restoration project, benthic macro-invertebrate sampling and fish surveys will be conducted at designated stream locations within Muddy Creek prior to full implementation of in-stream treatment and one year following. Water quality monitoring stations and parameters will be established in the permit.

2.0 INTRODUCTION

Muddy Creek meanders through the hills of Preston County, West Virginia and joins the Cheat River in Ruthbelle, an unincorporated community near Albright. AMD from abandoned mine lands, especially discharges emanating from the Upper Freeport coal seam, is the most damaging pollutant to Muddy Creek and the lower Cheat River watershed. The Cheat River watershed has a long history of coal mining; this activity dates as far back as the late 1700s, with a significant amount of activity occurring prior to the 1977 passage of the Federal Surface Mining Control and Reclamation Act (SMCRA).



Map 1. The Cheat River flows north draining approximately right.

Beginning in the 1970's, whitewater paddlers on the Cheat River witnessed water quality become increasingly degraded from AMD discharging from coal mines, both abandoned and active. Rocks in the rivers were stained a bright orange color that became more common in the Cheat River Canyon each year. Rafters and kayakers complained of stinging eyes, nosebleeds, and other ailments after spending time in the Cheat's waters.

In the spring of 1994, mine water from a large underground coal mine complex blew out of an illegally sealed mine and into Muddy Creek. The resulting discharge impacted Muddy Creek and the Cheat River Canyon, killing fish for 16 miles downstream, and lowering the pH in Cheat Lake to 4.5. A second blowout in 1995 further degraded the Cheat and prompted American Rivers, Inc., a national river conservation organization, to name the Cheat as one of ten of the nation's most endangered rivers (1995). Muddy Creek contributes an estimated 6,000 tons of acidity and 67 tons of iron and aluminum per year to the Cheat River, primarily from three major tributary drainages: Fickey Run, Glade Run, and Martin Creek as well as from an upstream section of Muddy Creek, totaling nearly 30 miles of AMD impaired streams in the Muddy Creek drainage. Fickey Run is impaired by two Abandoned Mine Lands (AML) and three bond forfeiture sites, and Glade Run is impaired by five AML and three bond forfeiture sites (Lower Cheat River Watershed Based Plan, 2005). Both Fickey and Glade empty into Martin Creek which also receives AMD from two AML sites before it joins Muddy Creek. Within less than one mile upstream of the confluence with Martin Creek, Muddy Creek receives AMD from several AMD sources originating from the Dream Mountain abandoned mine area. Upstream of the confluence of Martin Creek and Muddy Creek, the creek supports healthy benthic macroinvertebrate and fish communities including sensitive organisms such as a variety of Ephemeropterans (mayflys) and native brook trout.

Photo 1. An aerial shot of AMD entering the Cheat River main stem from Muddy Creek during the first and most devastating mine blowout.

3.0 REGULATORY BASIS FOR VARIANCE APPLICATION

Streams have designated uses which are described in §47-2-6.2 and include: water supply public, propagation and maintenance of fish and other aquatic life, water contact recreation, agriculture and wildlife, and water supply industrial/water transport/cooling and power. Water use categories are supported by both numeric and narrative criteria. Procedural Rules for Site-Specific Revisions to Water Quality Standards are described in 46 CSR 6 and include rules for promulgation of designated use reclassifications, site-specific criteria, and variances. OSR is proposing the following:

7.2.d.8.2. A variance pursuant to 46 CSR 6, Section 5.1, based on human-caused conditions which prohibit the full attainment of any designated use and cannot be immediately remedied, shall apply to WV DEP Division of Land Restoration's Office of Special Reclamation's discharges into Martin Creek of Preston County and its tributaries, including Glade Run, Fickey Run, and their unnamed tributaries. The

following existing conditions will serve as instream interim criteria while this variance is in place: pH range of 3.2-9.0, 10 mg/L total iron, and 15 mg/L dissolved aluminum. Alternative restoration measures, as described in the variance application submitted by WV DEP Division of Land Restoration's Office of Special Reclamation, shall be used to achieve significant improvements to existing conditions in these waters during the variance period. Conditions will be evaluated during each triennial review throughout the variance period. This variance shall remain in effect until action by the Secretary to revise the variance or until July 1, 2025, whichever comes first

4.0 REQUIRED INFORMATION

Pursuant to §46-6-3.1 a-g, the following information is required to be included in an application seeking reclassification of a designated use, a variance from numeric water quality criteria, or a site specific numeric criterion:

a. *A USGS 7.5 minute map showing those stream segments to be affected and showing all existing and proposed discharge points. In addition, the alphanumeric code of the affected stream, if known*:

A USGS 7.5 minute map showing the stream segments to be affected and showing all existing and proposed discharge points for Martin Creek (MC-17-A), Fickey Run (MC-17-A-0.5), and Glade Run MC-17-A-1 have been provided, please refer to Attachment 1 at the end of this application.

b. *Existing water quality data for the stream or stream segment. Where adequate data are unavailable, additional studies may be required by the Board*:

Available existing water quality data for Martin Creek, Fickey Run, Glade Run and associated tributaries has been provided, please see below.

FICKEY RUN AT MOUTH

Site_Descritption	Date	Mouth_Data	FlowGPM	FieldpH	FieldCon	AcidTPY	NetHotAcid	NetCalc_Acid	LabpH	Alk	Acidity	LabCon	D_Al	D_Ca	D_Fe	D_Mg	D_Mn	SO4
Fickey Mouth	8/4/2005	Yes	385.3	2.00	2000	511.2395904	603.15	1166.81241	2.92	0.00	603.15	2670	47.90	286.50	142.40	71.40	10.60	1320.00
Fickey Mouth	12/5/2005	Yes	2536	3.13	988	1684.9184	302	282.3557718	NS	0.00	302.00	NS	25.20	136.70	36.60	34.70	3.99	368.00
Fickey Mouth	5/3/2006	Yes	1109	2.74	1895	CNBD	CNBD	CNBD	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fickey Mouth	8/23/2006	Yes	118.0	2.80	2770	288.825768	1112.58	845.5283537	2.66	0.00	1112.58	3090	48.31	323.35	179.12	82.04	9.96	2080.00
Fickey Mouth	9/15/2006	Yes	252.1	2.60	2530	443.9576425	800.44	432.1821102	2.79	0.00	800.44	2590	1.25	206.78	107.19	59.97	6.89	1550.00
Fickey Mouth	9/27/2006	Yes	NS	2.90	2500	CNBD	CNBD	CNBD	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fickey Mouth	11/9/2006	Yes	732.0	2.88	2200	1068.74196	663.65	380.6463687	3.14	0.00	663.65	2090	30.13	167.51	51.35	41.58	5.39	978.00
Fickey Mouth	12/12/2006	Yes	331.0	3.18	2400	472.113906	648.33	434.0771688	3.14	0.00	648.33	2350	32.30	249.43	78.44	45.86	6.32	1105.00
Fickey Mouth	12/22/2006	Yes	557.0	2.95	2200	CNBD	CNBD	CNBD	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fickey Mouth	1/23/2007	Yes	1520.5	3.27	1800	1287.294833	384.83	289.7918856	3.15	0.00	384.83	1837	22.87	177.66	47.54	39.66	4.70	756.00
Fickey Mouth	3/13/2007	Yes	2433.00	3.35	1200	4276.085088	798.88	248.180987	2.95	0.00	798.88	1590	21.48	120.53	37.43	31.00	3.44	660.00
Fickey Mouth	5/14/2007	Yes	671.00	2.91	2400	1190.156726	806.23	580.5298166	3.28	0.00	806.23	2290	34.51	177.32	117.16	55.07	7.41	1255.00
Fickey Mouth	5/16/2007	Yes	1541.00	2.86	2400	2471.184584	728.92	543.1796028	3.41	0.00	728.92	2230	32.76	199.82	104.60	44.85	6.59	1225.00
Fickey Mouth	6/14/2007	Yes	267.00	2.70	2900	652.648392	1111.08	335.9390176	3.37	0.00	1111.08	2960	41.65	200.50	0.64	59.47	1.69	1600.00
Fickey Mouth	6/26/2007	Yes	320.00	2.70	2700	694.03136	985.84	768.2720443	3.59	0.00	985.84	3180	44.82	225.76	150.27	69.87	9.35	652.00
Fickey Mouth	7/17/2007	Yes	369.00	2.83	2600	498.461436	614.02	606.7591351	3.33	0.00	614.02	2520	37.21	247.25	116.30	52.94	8.01	1640.00
Fickey Mouth	8/15/2007	Yes	349.73	2.85	2500	534.3447729	694.49	238.7869782	3.03	0.00	694.49	2630	18.37	163.07	21.00	70.85	5.42	1620.00
Fickey Mouth	3/13/2008	Yes	1598.00	3.05	1600	1426.489856	405.76	297.4203932	2.96	0.00	405.76	1679	22.65	96.75	45.23	34.98	3.23	696.00
Fickey Mouth	4/23/2008	Yes	1097.00	2.90	1900	926.166384	383.76	409.9010505	3.65	0.00	383.76	1790	23.96	171.23	76.57	39.77	4.81	1008.00
Fickey Mouth	4/24/2008	Yes	875.00	2.90	1900	CNBD	CNBD	CNBD	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fickey Mouth	5/29/2008	Yes	1385.00	3.30	1500	1133.39259	371.97	294.5430197	3.85	0.00	371.97	1699	15.54	86.26	65.98	21.68	3.53	689.00
Fickey Mouth	6/24/2008	Yes	538.00	2.80	2100	881.699148	744.93	496.3823941	3.12	0.00	744.93	2240	31.52	115.35	86.44	40.14	5.77	1180.00
Fickey Mouth	7/28/2008	Yes	1129.00	3.78	2050	926.606428	373.06	218.8365529	3.45	0.00	373.06	1996	17.32	190.62	40.73	25.80	2.87	832.00
Fickey Mouth	11/12/2008	Yes	220.00	2.81	5470	509.44872	1052.58	696.9879089	3.42	0.00	1052.58	3200	35.73	205.40	150.98	63.19	9.15	1885.00
Fickey Mouth	12/30/2008	Yes	2098.00	3.14	1440	1103.543804	239.09	220.9015419	3.33	0.00	239.09	1466	19.00	115.10	27.13	24.06	3.55	626.00
Fickey Mouth	4/17/2009	Yes	2614.00	3.17	1330	1409.866128	245.16	193.2679294	3.06	0.00	245.16	1357	14.62	63.04	27.52	20.28	2.49	508.00
Fickey Mouth	5/15/2009	Yes	877.00	2.92	1620	828.29142	429.3	381.4499822	2.91	0.00	429.30	1894	28.28	120.40	58.46	34.39	4.20	908.00
Fickey Mouth	6/26/2009	Yes	963.00	2.94	1910	992.797146	468.61	408.0767648	2.97	0.00	468.61	1923	24.73	143.96	76.38	39.98	4.78	1065.00
Fickey Mouth	7/21/2009	Yes	519.00	2.75	2300	750.128346	656.97	625.6178666	3.01	0.00	656.97	2250	30.60	179.05	132.64	46.95	6.28	1455.00

GLADE RUN AT MOUTH

Site_Description	Date	Mouth_Data	FlowGPM	FieldpH	FieldCon	AcidTPY	NetHotAcid	NetCalc_Acid	LabpH	Alk	Acidity	LabCon	D_Al	D_Ca	D_Fe	D_Mg	D_Mn	SO4
Glade Mouth	8/10/2005	Yes	109.0	4.10	1173	12.13388	50.6	35.45757191	4.40	0.00	50.60	1471	4.20	194.00	0.60	85.80	3.60	828.00
Glade Mouth	12/5/2005	Yes	15374	3.75	636	4307.671808	127.36	94.80853269	NS	0.00	127.36	NS	13.30	88.21	1.66	46.27	4.17	370.00
Glade Mouth	1/30/2006	Yes	5200.0	3.60	850	2135.9624	186.71	110.6846847	3.73	0.00	186.71	1008	14.65	84.02	2.80	50.40	5.08	479.00
Glade Mouth	3/27/2006	Yes	1077.0	3.70	1140	541.313124	228.46	135.2953772	3.61	0.00	228.46	1224	19.10	100.39	3.01	62.07	6.13	640.00
Glade Mouth	5/3/2006	Yes	6181	3.32	1209	#VALUE!	CNBD	CNBD	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Glade Mouth	6/1/2006	Yes	1669.0	3.60	1280	1068.016466	290.87	129.4888513	3.47	0.00	290.87	7520	18.01	136.36	2.03	69.75	6.29	750.00
Glade Mouth	7/27/2006	Yes	902.0	3.30	1540	792.311388	399.27	165.4454367	3.41	0.00	399.27	1573	21.70	150.98	2.36	79.24	7.43	924.00
Glade Mouth	8/23/2006	Yes	286.0	3.40	1600	207.787008	330.24	184.3358059	3.26	0.00	330.24	1758	24.55	209.67	4.00	97.52	9.53	1038.00
Glade Mouth	8/29/2006	Yes	203.0	3.30	1670	122.060246	273.31	177.7491164	3.25	0.00	273.31	1794.00	23.35	200.77	2.16	94.95	9.45	1125.00
Glade Mouth	9/27/2006	Yes	NS	3.50	1360	CNBD	CNBD	CNBD	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Glade Mouth	11/9/2006	Yes	2038.0	3.55	1300	1510.121316	336.81	120.4595193	3.48	0.00	336.81	1204	16.40	99.87	2.20	50.50	5.15	640.00
Glade Mouth	12/6/2006	Yes	869.0	3.61	1700	620.990876	324.82	161.948743	3.49	0.00	324.82	1431	22.42	131.22	4.45	74.35	7.26	738.00
Glade Mouth	1/23/2007	Yes	2014.00	3.67	1300	985.232688	222.36	116.0213941	3.59	0.00	222.36	1149	16.00	96.51	2.67	55.02	5.11	556.00
Glade Mouth	1/25/2007	Yes	3098.00	3.75	1400	1671.389588	245.23	125.8780673	3.56	0.00	245.23	1230	17.77	106.16	2.97	62.18	5.67	554.00
Glade Mouth	5/14/2007	Yes	1308.00	3.46	1300	1047.417624	363.99	165.9146925	3.46	0.00	363.99	1511	22.12	126.86	4.52	76.88	7.47	764.00
Glade Mouth	5/16/2007	Yes	1294.00	3.44	1400	1061.99874	373.05	149.0293356	3.54	0.00	373.05	1466	19.74	123.15	3.18	73.84	6.98	728.00
Glade Mouth	5/31/2007	Yes	1608.00	3.40	1500	1021.482	288.75	136.6352828	3.93	0.00	288.75	1581	17.25	124.18	3.43	67.18	6.44	862.00
Glade Mouth	6/14/2007	Yes	803.00	3.40	1600	514.221928	291.08	330.0023643	3.70	0.00	291.08	1594	18.34	139.92	72.26	75.39	8.06	852.00
Glade Mouth	6/26/2007	Yes	260.00	3.39	1600	55.09504	96.32	48.64987608	3.80	0.00	96.32	1452	2.03	154.27	5.35	55.86	1.47	650.00
Glade Mouth	6/27/2007	Yes	682.00	3.30	1900	505.199684	336.71	145.9892318	3.58	0.00	336.71	1780	18.18	130.93	2.56	76.29	7.19	970.00
Glade Mouth	9/13/2007	Yes	914.65	3.50	1480	334.8149497	166.39	133.5336827	3.64	0.00	166.39	1461	17.70	133.97	2.84	67.49	6.48	816.00
Glade Mouth	10/8/2007	Yes	308.10	3.40	1900	226.3037634	333.87	163.3620865	3.36	0.00	333.87	1746	22.07	148.45	2.61	79.70	7.62	986.00
Glade Mouth	2/23/2008	Yes	2438.00	3.60	1000	CNBD	CNBD	CNBD	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Glade Mouth	3/10/2008	Yes	6064.00	3.71	1100	2587.314752	193.94	125.3373002	3.74	0.00	193.94	967	19.51	21.34	0.95	9.36	2.56	471.00
Glade Mouth	4/17/2008	Yes	3035.00	3.80	1300	1000.74876	149.88	128.1864609	3.72	0.00	149.88	1221	18.22	120.32	2.73	67.53	6.45	636.00
Glade Mouth	4/23/2008	Yes	2438.00	3.60	1000	639.126576	119.16	96.6067626	3.80	0.00	119.16	1001	12.76	95.10	1.60	49.48	4.88	489.00
Glade Mouth	5/19/2008	Yes	11423.00	3.90	600	2429.375102	96.67	43.57294596	4.04	0.00	96.67	702	5.69	41.23	0.86	22.71	1.85	389.00
Glade Mouth	5/29/2008	Yes	4194.00	3.80	300	1292.766948	140.11	65.96102801	4.06	0.00	140.11	942	8.20	58.25	2.63	30.26	2.99	469.00
Glade Mouth	6/23/2008	Yes	1587.85	3.50	1300	632.4216008	181.04	120.2408255	3.73	0.00	181.04	1327	15.81	113.05	2.32	57.02	5.71	607.00
Glade Mouth	8/12/2008	Yes	1775.00	3.55	1341	792.1683	202.86	71.44211307	3.40	0.00	202.86	1221	8.38	75.64	1.79	44.48	3.30	620.00
Glade Mouth	11/12/2008	Yes	343.00	3.47	1830	226.779938	300.53	133.1064755	3.61	0.00	300.53	1627	16.87	136.42	3.43	68.87	7.29	870.00
Glade Mouth	12/15/2008	Yes	4525.00	3.90	836	1059.6102	106.44	57.78842215	3.85	0.00	106.44	784	7.46	66.41	1.60	27.40	3.17	386.00
Glade Mouth	12/30/2008	Yes	4510.00	3.68	1063	1099.75448	110.84	95.24832048	3.77	0.00	110.84	977	12.48	84.51	2.70	39.96	4.53	481.00
Glade Mouth	5/20/2009	Yes	2780.00	3.62	1210	1008.58956	164.91	114.8542476	3.74	0.00	164.91	1212	15.80	91.94	2.23	44.45	5.01	688.00
Glade Mouth	6/26/2009	Yes	2467.00	3.64	1110	667.5702	123	105.035922	3.76	0.00	123.00	1125	14.02	104.13	2.39	54.95	5.11	642.00

MARTIN CREEK AT MOUTH

Site_Description	Date	Mouth_Data	FlowGPM	FieldpH	FieldCon	AcidTPY	NetHotAcid	NetCalc_Acid	LabpH	Alk	Acidity	LabCon	D_Al	D_Ca	D_Fe	D_Mg	D_Mn	SO4
Martin mou	5/28/2002	Yes	7910	3.13	1552	5394.62	310	229.3996	NS	0.00	310.00	NS	22.58	NS	19.70	NS	7.77	904.00
Martin mou	6/17/2002	Yes	3724	3.02	1623	2359.526	288	268.8475	NS	0.00	288.00	NS	26.83	NS	20.71	NS	9.11	1084.00
Martin mou	7/8/2002	Yes	1933	2.83	2347	2117.795	498	451.0819	NS	0.00	498.00	NS	37.41	NS	54.46	NS	12.88	1595.00
Martin mou	7/29/2002	Yes	3181	3.00	2042	2589.334	370	266.8958	NS	0.00	370.00	NS	23.90	NS	30.99	NS	0.61	295.00
Martin mou	8/13/2002	Yes	2011	2.85	2448	3238.514	732	228.8936	NS	0.00	732.00	NS	3.05	NS	43.97	NS	12.95	1072.00
Martin mou	9/9/2002	Yes	599	2.73	2716	971.2186	737	310.004	NS	0.00	737.00	NS	5.22	8.68	60.30	56.78	14.51	1642.00
Martin mou	9/30/2002	Yes	1890	2.93	2394	1787.94	430	269.8128	NS	0.00	430.00	NS	23.59	9.44	21.40	51.50	12.48	1261.00
Martin mou	10/22/2002	Yes	3336	2.96	1843	2656.79	362	275.46	NS	0.00	362.00	NS	22.74	8.36	29.40	38.18	8.55	1084.00
Martin mou	11/4/2002	Yes	9390	2.95	1621	7953.33	385	296.1832	NS	0.00	385.00	NS	28.87	24.48	24.03	34.68	8.43	1010.00
Martin mou	11/11/2002	Yes	9332	3.08	1303	5502.147	268	224.6356	NS	0.00	268.00	NS	24.10	10.28	13.47	42.55	7.19	707.00
Martin mou	12/9/2002	Yes	7008	2.82	1757	6598.733	428	300.5556	NS	0.00	428.00	NS	24.29	141.32	26.20	84.02	10.87	1175.00
Martin mou	1/7/2003	Yes	7703	3.12	1488	3287.64	194	194.3823	NS	0.00	194.00	NS	18.88	60.44	14.84	48.91	6.50	686.00
Martin mou	2/4/2003	Yes	27780	3.26	968	5518.775	90.3	98.99794	NS	0.00	90.30	NS	8.16	6.08	7.05	1.32	4.02	300.00
Martin mou	3/3/2003	Yes	18344	3.03	1342	16505.93	409	210.5305	NS	0.00	409.00	NS	18.91	49.36	18.64	41.52	4.89	710.00
Martin mou	3/31/2003	Yes	6435	3.09	1526	3326.895	235	260.7366	NS	0.00	235.00	NS	25.20	NS	24.89	NS	7.38	670.00
Martin mou	4/22/2003	Yes	9494	3.15	1680	5869.191	281	270.1539	NS	0.00	281.00	NS	25.11	6.60	30.31	18.34	7.74	1026.00
Martin mou	5/12/2003	Yes	24285	3.13	1077	8227.758	154	145.143	NS	0.00	154.00	NS	14.39	73.20	7.61	19.20	4.26	330.00
Martin mou	9/15/2003	Yes	2495	3.04	1643	1471.052	268	299.6215	NS	0.00	268.00	NS	34.20	34.40	18.20	44.98	8.40	431.20
Martin mou	3/11/2004	Yes	15824	3.21	1037	1660.919	47.71	152.2707	NS	0.00	47.71	NS	15.50	82.60	10.40	39.80	4.11	476.00
Martin mou	5/27/2004	Yes	4984	3.32	1330	871.1534	79.45	186.0942	NS	0.00	79.45	NS	18.29	125.03	18.54	59.86	5.99	706.35
Martin mou	7/26/2004	Yes	3138	2.79	2195	1111.963	161.07	481.8517	NS	0.00	161.07	NS	34.33	233.38	68.64	114.06	14.40	1061.00
Martin mou	7/29/2005	Yes	2199.7	3.30	1570	773.9073	159.92	110.4896	3.21	0.00	159.92	1644	9.19	99.00	10.60	38.00	3.29	731.00
Martin mou	12/5/2005	Yes	11570	3.60	717	4066.277	159.75	113.3098	NS	0.00	159.75	NS	13.30	100.30	7.51	43.65	3.71	402.00
Martin mou	5/3/2006	Yes	8400	3.22	1319	CNBD	CNBD	CNBD	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Martin mou	8/23/2006	Yes	556.0	3.00	2010	537.1316	439.12	319.8059	2.89	0.00	439.12	2250	27.02	256.68	39.12	94.09	8.20	1214.00
Martin mou	9/27/2006	Yes	708.0	3.00	1700	632.3389	405.97	270.7942	3.22	0.00	405.97	1937	21.87	195.46	32.04	75.89	7.41	942.00
Martin mou	11/9/2006	Yes	2620.0	3.27	1600	2287.732	396.9	165.5323	3.22	0.00	396.90	1483	17.38	125.12	12.55	48.78	4.68	726.00
Martin mou	1/23/2007	Yes	6186.0	3.60	1300	2941.084	216.11	135.5177	3.37	0.00	216.11	1298	15.33	117.21	11.00	52.36	4.58	351.00
Martin mou	5/14/2007	Yes	1932.00	3.26	1600	1713.124	403.05	233.167	3.47	0.00	403.05	1637	21.57	144.27	27.77	69.24	6.31	802.00
Martin mou	6/12/2007	Yes	760.00	2.90	1800	665.2554	397.88	310.1114	4.10	0.00	397.88	2180	25.35	163.06	35.00	74.69	6.92	1018.00
Martin mou	6/14/2007	Yes	851.00	3.00	1800	750.8833	401.07	208.2162	3.57	0.00	401.07	2090	22.58	167.07	7.30	69.55	7.27	980.00
Martin mou	8/15/2007	Yes	1047.46	3.21	1780	698.5595	303.14	31.83498	3.30	0.00	303.14	1775	0.10	32.79	0.10	7.10	0.10	938.00
Martin mou	3/13/2008	Yes	6257.00	3.42	1200	2788.87	202.6	109.3554	3.45	0.00	202.60	1204	11.21	77.36	8.68	45.51	2.65	485.00
Martin mou	4/23/2008	Yes	3861.00	3.30	1300	1377.504	162.17	153.0789	3.79	0.00	162.17	1257	13.30	118.28	17.29	44.96	4.30	527.00
Martin mou	4/25/2008	Yes	4545.00	3.30	1300	CNBD	CNBD	CNBD	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Martin mou	5/29/2008	Yes	6516.00	3.60	1000	1615.577	112.7	106.4832	3.68	0.00	112.70	1139	11.03	88.01	10.07	37.00	3.12	498.00
Martin mou	6/24/2008	Yes	3090.00	2.90	1500	1868.022	274.79	221.9134	3.39	0.00	274.79	1630	17.34	115.91	19.84	50.32	5.22	768.00
Martin mou	8/7/2008	Yes	6641.00	3.41	1248	1918.027	131.28	95.92403	3.52	0.00	131.28	1178	6.89	75.39	12.63	32.52	2.40	532.00
Martin mou	11/12/2008	Yes	1191.79	3.12	3710	1049.352	400.22	232.6843	3.43	0.00	400.22	2170	17.61	151.14	31.84	61.35	6.40	1050.00
Martin mou	11/12/2008	Yes	1030.00	3.12	3710	906.2187	399.92	228.5427	3.38	0.00	399.92	2180	17.57	150.40	30.37	62.32	6.41	1054.00
Martin mou	11/14/2008	Yes	1682.00	3.14	3460	984.5284	266.06	212.2153	3.06	0.00	266.06	2000	17.15	141.20	25.81	60.08	6.37	958.00
Martin mou	12/30/2008	Yes	5520.00	3.49	1124	1622.681	133.62	108.0802	3.40	0.00	133.62	1082	11.81	90.43	7.31	35.38	3.69	484.00
Martin mou	5/15/2009	Yes	7609.00	3.36	1200	3154.95	188.47	156.5845	3.27	0.00	188.47	1383	15.82	109.64	14.62	48.54	4.24	700.00
Martin mou	6/26/2009	Yes	4435.00	3.33	1320	1720.647	176.35	161.0886	3.30	0.00	176.35	1343	14.68	116.04	18.09	51.62	4.23	734.00
Martin mou	8/17/2009	Yes	681.00	3.00	1960	532.4453	355.39	309.5377	2.79	0.00	355.39	2000	22.64	152.36	45.81	59.69	6.08	1195.00
Martin mou	11/6/2009	Yes	3193.00	2.13	1240	1201.628	171.06	179.5246	3.42	0.00	171.06	1399	15.71	144.41	24.62	46.00	4.01	726.00

MARTIN CREEK @ MOUTH (EXISTING CONDITIONS)

SAMPLE_NO	SITE_DESC	SAMPLE_DATE	CFS	FPH	T_FE	D_AL
31	MARTIN CREEK @ MOUTH (26 BRIDGE)	12-May-15	7.8245	3.26	9.63	14.8
31	MARTIN CREEK @ MOUTH (26 BRIDGE)	05-Apr-15	18.566	3.68	6.93	9
31	MARTIN CREEK @ MOUTH (26 BRIDGE)	17-Mar-15	19.212	4	9.09	

c. *General land uses (e.g., mining, agricultural, recreation, residential, commercial, industrial, etc.) as well as specific land uses adjacent to the waters for the length of the segment proposed to be revised*:

A Total Maximum Daily Load (TMDL) was developed for the Cheat River watershed, the land use coverage are as follows:

Martin Creek 46.6% deciduous forest, 39.4% pasture, 13.2% mine lands, 0.2% residential, 0.6% commercial.

Fickey Run 49.9% deciduous forest, 33.6% pasture, 16.5% mine lands.

Glade Run 33.9% deciduous forest, 49.5% pasture, 15.1% mine lands, 0.3% residential, 1.2% commercial.

d. The existing and designated uses of the receiving waters into which the segment in question discharges and the location where those downstream uses begin to occur:

Martin Creek, Fickey Run, Glade Run, and tributaries thereof is designated as follows:

- Category A (Water Supply, Public), the closest downstream drinking water intake is greater than 5 miles downstream of our bond forfeiture site,
- Category B (Warm Aquatic Life), and
- Category C (Water Contact Recreation);

however, it is important to note that these streams have never been able to meet their designated use as a result of human-caused conditions (pre-law mining) that were in existence before the stream designations were assigned.

e. *General physical characteristics of the stream segment including, but not limited to, width, depth, bottom composition, and slope*:

Fickey Run is located in Preston County and the watershed is approximately 1.72 square miles. The widths of the stream vary along its reach, 1 foot to 6 feet with the average width of 3 feet. The average instream water depth is approximately .2 foot deep. Stream bed substrate is comprised of mainly boulder and cobble; however, bedrock is more prominent in the upper reaches and gravel components increase towards the lower reaches. Martin Creek as a stream gradient is approximately 15,155 feet and has an overall slope of 2.94%.

Martin Creek is located in Preston County and the watershed is approximately 7.1 square miles. The widths of the stream vary along its reach, 1 foot to 9 feet with the average width of 6.4 feet. The average instream water depth is approximately .29 foot deep. Stream bed substrate is comprised of mainly boulder and cobble; however, bedrock is more prominent in the upper reaches and gravel components increase towards the lower reaches. Martin Creek as a stream gradient is approximately 14,245 feet and has an overall slope of 4%.

Glade Run is located in Preston County and the watershed is approximately 3.74 square miles. The widths of the stream vary along its reach, 1.3 foot to 4.1 feet with the average width of 3.17 feet. The average instream water depth is approximately .32 foot deep. Stream bed substrate is comprised of mainly boulder and cobble; however, bedrock is more prominent in the upper reaches and gravel components increase towards the lower reaches. Martin Creek as a stream gradient is approximately 19,691 feet and has an overall slope of 1.68%.

f. *The average flow rate in the segment, the amount of flow at a designated control point, and a statement regarding whether the flow of the stream is ephemeral, intermittent, or perennial*:

Martin Creek is a perennial stream with a watershed area of approximately 7.1 square miles. Average flow data for this stream is approximately 896.26 cfs.

Fickey Run is a perennial stream with a watershed area of approximately 1.72 square miles. Average flow data for this stream is approximately 160.54 cfs

Glade Run is a perennial stream with a watershed area of approximately 3.74 square miles. Average flow data for this stream is approximately 403.14 cfs

g. *An assessment of aquatic life in the stream segment in question and in the adjacent upstream and downstream segments*:

Friends of the Cheat watershed group and its partners began gathering information and developing a remediation plan in 2004. The following data is comprised of over 7 years of study. Biological assessment sight locations can be found on the Attachment 1 map located at the end of this application. WVU Division of Forestry and Natural Resources identified 32,161 individual benthic macroinvertebrates comprising 64 taxonomic families. The upper most sampling location within the Muddy Creek watershed, Upper Muddy Creek, had the greatest family richness (37 taxa; $\bar{x}$ = 30.8) during the study period. The second richest site was Muddy Creek at Million Dollar Bridge, located just upstream of the confluence with Martin Creek, with an average richness of 17.3. Study sites located just downstream of the Gary Conner passive treatment project and the Allen Conner - Messenger passive treatment project (Upper UNT of Glade Run and Glade Run above Tribs, respectively) had an average pre-treatment richness of 4.7 and 7.0 respectively (Table 10). Post-treatment richness for Glade Run above Tribs decreased to 5.0 while the Upper UNT of Glade Run experienced an increase in taxa richness to 8.0. In fact, none of the benthic macroinvertebrate biometrics improved at Glade Run above Tribs in spring 2012 after AMD treatment. However, just below the Gary Conner passive treatment system, at the Upper UNT of Glade Run sampling location, benthic macroinvertebrate metrics improved significantly after AMD treatment. Post-treatment WVSCI scores for Upper UNT of Glade Run still indicate impairment because scores fall below the impairment threshold of 68.0 (WV DEP 2010; Table 10).

Glade Run Mouth, a study site at the mouth of Glade Run downstream of the Gary Conner and Allen Conner - Messenger passive treatment systems (the uppermost study site receiving the cumulative benefit of both passive treatment systems) only showed improvement for the % Ephemeroptera metric. All other post-treatment biometrics were within the pre-treatment 95% confidence intervals, indicating no significant improvement in bioscores (Table 10, Table 11).

	Pre-Treatment Mean ± 95%CI			Post-Treatment Spring 2012 Data		
Site Name	Taxa Rich	%2Dom	WVSCI	Taxa Rich	%2Dom	WVSCI
Glade above Tribs	7.00±1.60	87.20±4.43	25.70±3.20	5.00	97.89	13.87
Upper UNT Glade	4.67±1.20	97.52±1.81	12.75±3.03	8.00	71.09	26.19
Glade Run Mouth	7.67±3.87	95.93±2.93	19.96±8.84	9.00	96.28	17.23
Martin ab Fickey	6.67±2.80	95.30±2.85	18.64±5.14	5.00	96.60	11.77
Martin Mouth	4.00±2.21	85.80±10.03	23.88±14.83	8.00	53.33	49.12

Muddy ab Crab Orchard	4.00±2.21	70.24±29.57	33.22±18.13	8.00	80.27	32.81
Muddy ab Sypolt	8.33±4.01	71.28±15.96	51.58±13.49	9.00	65.17	36.46
Muddy Mouth	9.83±7.73	72.41±18.03	47.19±19.64	7.00	77.78	39.26
Cheat at Decision Right	13.17±8.42	51.59±8.91	60.35±19.75	17.00	65.25	68.54
Cheat at Jenkinsburg	13.00±3.89	63.36±14.02	75.14±5.30	12.00	48.11	65.06

Table 10. Family Richness (Taxa Rich), Percent of assemblage as the top two dominant families (%2Dom), and West Virginia Stream Condition Index (WVSCI) for the Gary Conner and Allen Conner - Messenger treatment continuums before and after AMD treatment. ("ab" = above)

	Pre-Treatment Mean ± 95%CI			Post-Treatment Spring 2012 Data		
Site Name	% EPT	EPT Richness	% Ephem	% EPT	EPT Richness	% Ephem
Glade above Tribs	10.40±0.70	0.50±0.67	0.30±0.63	1.68	1.00	0.00
Upper UNT Glade	1.06±1.74	0.50±0.44	0.12±0.23	3.13	1.00	0.00
Glade Run Mouth	2.78±2.43	2.83±2.55	0.35±0.60	1.29	1.00	1.29
Martin ab Fickey	4.04±3.53	2.00±1.13	0.57±1.12	0.00	0.00	0.00
Martin Mouth	14.93±14.77	1.50±1.58	6.80±13.33	40.00	3.00	26.67
Muddy ab Crab Orchard	29.58±29.39	2.33±1.65	3.81±4.32	4.48	2.00	0.00
Muddy ab Sypolt	40.08±20.42	4.67±2.36	10.59±7.02	12.36	3.00	10.11
Muddy Mouth	27.11±21.41	5.17±4.37	7.80±9.38	33.33	2.00	31.48
Cheat at Decision Right	51.94±17.38	7.33±5.23	34.69±18.03	39.67	9.00	3.28
Cheat at Jenkinsburg	72.96±14.21	8.17±1.92	55.32±15.57	59.43	7.00	15.57

Table 11. Percent of assemblage as Ephemeroptera, Plecoptera, and Trichoptera (%EPT), number of families within the orders of Ephemeroptera, Plecoptera, and Trichoptera (EPT Richness), and percent of assemblage as Ephemeroptera (% Ephem) for the Gary Conner and Allen Conner - Messenger treatment continuums before and after AMD treatment. ("ab" = above)

The Fickey Mouth site only experienced a slight improvement in taxa richness post-treatment. All other biometrics (%EPT, EPT Richness, %Ephemeroptera, %2Dominant Taxa) remained extremely degraded with no change or with post-treatment results within the pre-treatment 95% confidence interval (WVSCI) (Table 12, Table 13).

	Pre-Treatment Mean ± 95%CI			Post-Treatment Spring 2012 Data		
Site Name	% EPT	EPT Richness	% Ephem	% EPT	EPT Richness	% Ephem
Fickey Mouth	0.00±0.00	0.00±0.00	0.00±0.00	0.00	0.00	0.00
Martin Mouth	14.93±14.77	1.50±1.58	6.80±13.33	40.00	3.00	26.67
Muddy ab Crab Orchard	29.58±29.39	2.33±1.65	3.81±4.32	4.48	2.00	0.00
Muddy ab Sypolt	40.09±20.42	4.67±2.36	10.59±7.02	12.36	3.00	10.11

Muddy at Mouth	27.11±21.41	5.17±4.37	7.79±9.38	33.33	2.00	31.48
Cheat at Decision Right	51.94±17.38	7.33±5.23	34.69±18.03	39.67	9.00	3.28
Cheat at Jenkinsburg	72.96±14.22	8.20±1.92	55.32±15.57	59.43	7.00	15.57

Table 12. Percent of assemblage as Ephemeroptera, Plecoptera, and Trichoptera (%EPT), number of families within the orders of Ephemeroptera, Plecoptera, and Trichoptera (EPT Richness), and percent of assemblage as Ephemeroptera (% Ephem) for the Fickey Doser treatment continuums before and after AMD treatment. ("ab" = above)

	Pre-Treatment Mean ± 95%CI			Post-Treatment Spring 2012 Data		
Site Name	Taxa Rich	%2Dom	WVSCI	Taxa Rich	%2Dom	WVSCI
Fickey Mouth	1.70±0.65	99.0±1.92	13.6±11.53	3.00	0.00	15.87
Martin Mouth	4.00±2.21	85.80±10.03	23.88±14.83	8.00	53.33	49.12
Muddy ab Crab Orchard	4.00±2.21	70.24±29.58	33.22±18.13	8.00	80.27	32.81
Muddy ab Sypolt	8.33±4.01	71.28±15.96	51.58±13.49	9.00	65.17	36.46
Muddy at Mouth	9.83±7.73	72.41±18.03	47.19±19.64	7.00	77.78	39.26
Cheat at Decision Right	13.17±8.43	51.60±8.90	60.36±19.75	17.00	65.25	68.54
Cheat at Jenkinsburg	13.00±3.89	63.40±14.02	75.10±5.30	12.00	48.11	65.06

Table 13. Family Richness (Taxa Rich), Percent of assemblage as the top two dominant families 2Dom), and West Virginia Stream Condition Index (WVSCI) for the Fickey Doser treatment continuums before and after AMD treatment. ("ab" = above)

At the mouth of Martin Creek, the uppermost study site that captures the influence of all three treatment systems, %EPT, % Ephemeroptera, Family Richness, %2Dominant Taxa, and WVSCI all increased significantly post-treatment. There was a slight improvement in EPT Richness (Table 10, Table 11) and a significant decrease in the percent of generally tolerant organisms (%Gen Tol) in the assemblage post-treatment as well (Table 14).

	Pre-Treatment Mean ± 95%CI			Post-Treatment Spring 2012 Data		
Site Name	% Gen Tol	% Acid Tol	% Alum Tol	% Gen Tol	% Acid Tol	% Alum Tol
Glade above Tribs	93.8±3.67	0.00±0.00	0.00±0.00	97.92	1.69	0.00
Upper UNT Glade	96.9±1.96	0.75±1.48	0.00±0.00	85.19	3.12	0.00
Glade Run Mouth	92.73±4.95	1.58±2.03	0.09±0.13	94.83	0.00	0.00
Martin ab Fickey	91.37±4.16	3.09±3.37	0.00±0.00	95.36	0.00	0.00

Martin Mouth	75.95±20.10	4.20±7.47	0.58±0.73	34.00	6.67	0.00
Muddy ab Crab Orchard	61.56±31.29	3.43±5.83	2.75±4.53	44.88	3.59	0.89
Muddy ab Sypolt	37.23±18.29	13.75±15.49	10.24±15.72	66.41	1.12	1.12
Muddy Mouth	48.86±29.39	12.65±13.26	0.74±1.10	46.48	1.85	0.00
Cheat at Decision Right	39.48±20.49	9.56±7.24	3.77±3.54	44.62	27.86	5.90
Cheat at Jenkinsburg	15.4±11.93	5.70±4.49	5.30±5.74	23.62	3.04	11.32

Table 14. Percent of assemblage as generally tolerant organisms (%Gen Tol), perecent of assemblage as organisms tolerant to acidity (%Acid Tol) (Leuctrids, Capniids, Nemourids), and percent of assemblage as organisms tolerant to aluminum floc (Hydropsychids) along the Gary and Allen Conner treatment continuums before and after AMD treatment. ("ab" = above)

Figures 3a-d display benthic macroinvertebrate metrics along the Muddy Creek stream continuum in regard to distance from the mouth of Muddy Creek. Figure 3a displays % Ephemeroptera (%E) along the stream continuum; interestingly, unimpaired communities were more highly variable over the 6 years compared to impaired sites in terms of %E possibly because there is higher relative biodiversity to begin with at unimpaired sites. The percent of mayflies is relatively high for pre-treatment (~40%) for Muddy at Million Dollar Bridge and Upper Muddy Creek but near the confluence of Martin Creek there is a dramatic decline in both the mean % Ephemeroptera and the 95% confidence intervals which translates as less mayflies and less assemblage diversity as a whole at sites on Muddy Creek near the confluence of Martin Creek and downstream. However, the increase in %E outside the 95% confidence interval at the downstream most site on the Muddy Creek main stem is an exception (Figure 3a).

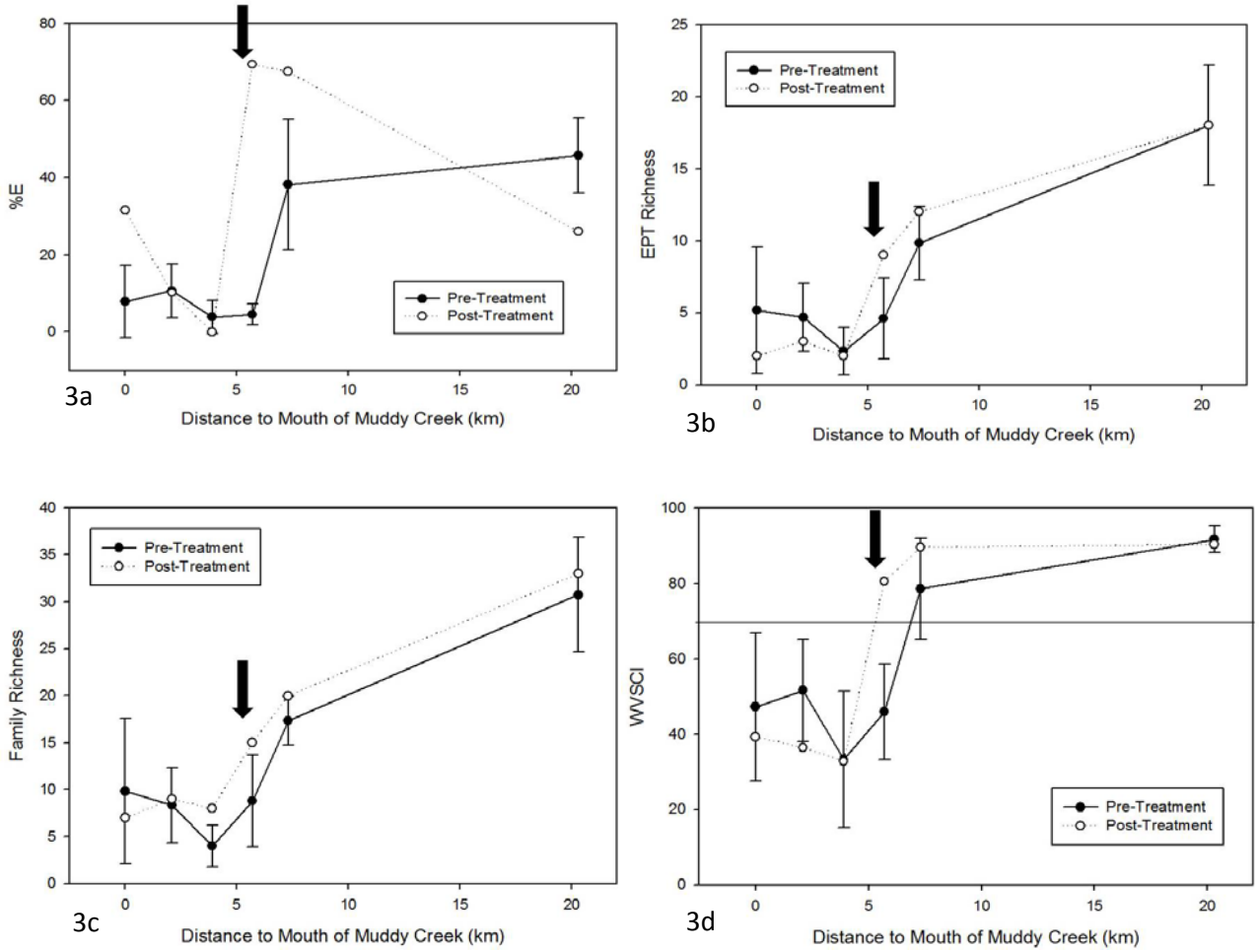


Figure 3a-d. Percent of assemblage comprised of Ephemeroptera (a), the number of families within the orders Ephemeroptera, Plecoptera, and Trichoptera (b), the total number of families comprising an assemblage (c), and the West Virginia Stream Condition Index (WVSCI) scores (d) for sites along the Muddy Creek stream continuum. Error bars represent 95% confidence intervals about the mean for pre-treatment data from 2006-2011.The horizontal line in (d) represents the impairment threshold for WVSCI (68.0) as defined by the West Virginia Department of Environmental Protection. The sites displayed in Figures 3a-d are as follows from left to right along the x-axis of each figure: Muddy Creek at Mouth, Muddy Creek above Sypolt Run, Muddy Creek above Crab Orchard Run, Muddy Creek above Martin Creek, Muddy Creek at Million Dollar Bridge, and Upper Muddy Creek. Martin Creek enters Muddy Creek 5.6 km (3.2 miles) from the mouth of Muddy Creek.

Some of the highest percentages of EPT were observed for sites upstream of the confluence with Martin Creek. When traveling downstream, a severe decline occurs and some of the lowest observances for %EPT were seen in sites downstream from Martin Creek on the main stem of Muddy Creek, except for the Mouth of Muddy Creek which experienced a post-treatment percentage near the mean for pre-treatment. However, when examining EPT Richness (Figure 3b) it can be seen that upstream of Martin Creek EPT richness is slightly elevated relative to the mean and 95% confidence intervals at two of the three upstream sampling locations. Downstream of the confluence with Martin Creek, post-treatment EPT richness declines steeply and is relatively lower than the pre-treatment mean. Post-treatment values of %EPT and EPT richness remained severely depressed at the mouth of Muddy Creek.

Family richness showed a similar pattern to EPT post-treatment (Figure 3c). Upstream of the confluence with Martin Creek, family richness was high. Below the confluence, family richness declined severely, except for Muddy Creek above Crab Orchard Run, which experienced a relative improvement in family richness. Tables 14 – 16 display the percentage of each assemblage that is comprised of generally tolerant organisms (%Gen Tol). Study sites above Martin Creek (5.6 km from Mouth of Muddy Creek) all experience a relatively low composition of generally tolerant taxa post-treatment, while sites below Martin Creek still contained numerous tolerant taxa.

	Pre-Treatment Mean ± 95%CI			Post-Treatment Spring 2012 Data		
Site Name	% Gen Tol	% Acid Tol	% Alum Tol	% Gen Tol	% Acid Tol	% Alum Tol
Fickey Mouth	81.6±31.89	0.00±0.00	0.00±0.00	70.33	0.00	0.00
Martin Mouth	75.95±20.10	4.20±7.47	0.58±0.73	34.00	6.67	0.00
Muddy ab Crab Orchard	61.56±31.29	3.43±5.83	2.75±4.53	44.88	3.59	0.89
Muddy ab Sypolt	37.23±18.29	13.75±15.49	10.24±15.72	66.41	1.12	1.12
Muddy at Mouth	48.86±29.39	12.65±13.26	0.74±1.10	46.48	1.85	0.00
Cheat at Decision Right	39.48±20.49	9.56±7.24	3.77±3.54	44.62	27.86	5.90
Cheat at Jenkinsburg	15.4±11.93	5.70±4.49	5.30±5.74	23.62	3.04	11.32

Table 15. Percent of assemblage as generally tolerant organisms (%Gen Tol), perecent of assemblage as organisms tolerant to acidity (%Acid Tol) (Leuctrids, Capniids, Nemourids), and percent of assemblage as organisms tolerant to aluminum floc (Hydropsychids) along the Fickey Doser treatment continuum before and after AMD treatment. ("ab" = above)

	Pre-Treatment Mean ± 95%CI			Post-Treatment Spring 2012 Data		
Site Name	% Gen Tol	% Acid Tol	% Alum Tol	% Gen Tol	% Acid Tol	% Alum Tol
Upper Muddy	12.97±6.01	7.79±6.53	4.32±4.12	7.11	24.27	3.98
Million Dollar Bridge	20.34±14.03	11.54±6.57	6.00±3.02	12.29	2.87	1.83
Muddy ab Martin	54.16±18.77	12.31±10.02	16.75±17.78	15.64	5.75	4.93
Muddy ab Crab Orchard	61.56±31.29	3.43±5.83	2.75±4.53	44.88	3.59	0.89

Muddy ab Sypolt	37.23±18.29	13.75±15.49	10.24±15.72	66.41	1.12	1.12
Muddy at Mouth	48.86±29.39	12.65±13.26	0.74±1.10	46.48	1.85	0.00
Cheat at Decision Right	39.48±20.49	9.56±7.24	3.77±3.54	44.62	27.86	5.90
Cheat at Jenkinsburg	15.4±11.93	5.70±4.49	5.30±5.74	23.62	3.04	11.32

Table 16. Percent of assemblage as generally tolerant organisms (%Gen Tol), perecent of assemblage as organisms tolerant to acidity (%Acid Tol) (Leuctrids, Capniids, Nemourids), and percent of assemblage as organisms tolerant to aluminum floc (Hydropsychids) along the Muddy Creek continuum before and after AMD treatment from the upper most sampling site to the downstream most sampling site. ("ab" = above)

WVSCI scores from the headwaters of Muddy Creek to the Mouth of Muddy Creek take on the same general pattern. There were relatively healthy assemblages upstream of Martin Creek at most study sites, and relatively degraded assemblages at sites below Martin Creek with none of them attaining the non-impaired threshold of 68.0 (Figure 3d).

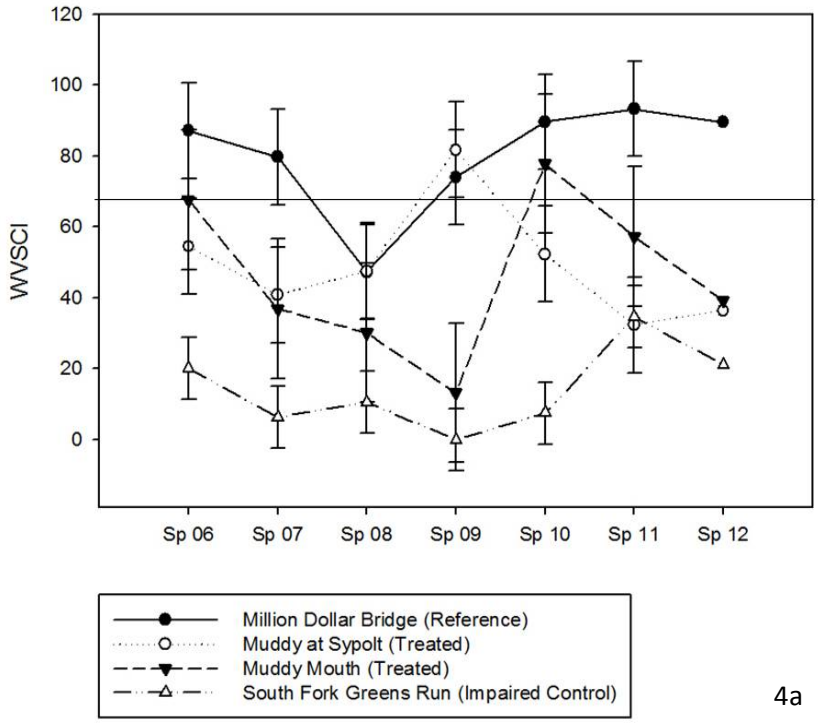
Time series data displayed for the four key study sites show how extremely variable benthic macroinvertebrate assemblages were over the seven years. However, the un-impaired reference site (Muddy at Million Dollar Bridge) and impaired control site (South Fork of Greens Run) were always distinctly different (separated in Figures 4a-d). The study sites that were downstream from AMD were highly variable with large 95% confidence intervals (Table 16-18). These figures indicate that the final round of monitoring in Spring 2012 after AMD treatment did not result in noticeable improvement in benthic macroinvertebrate communities.

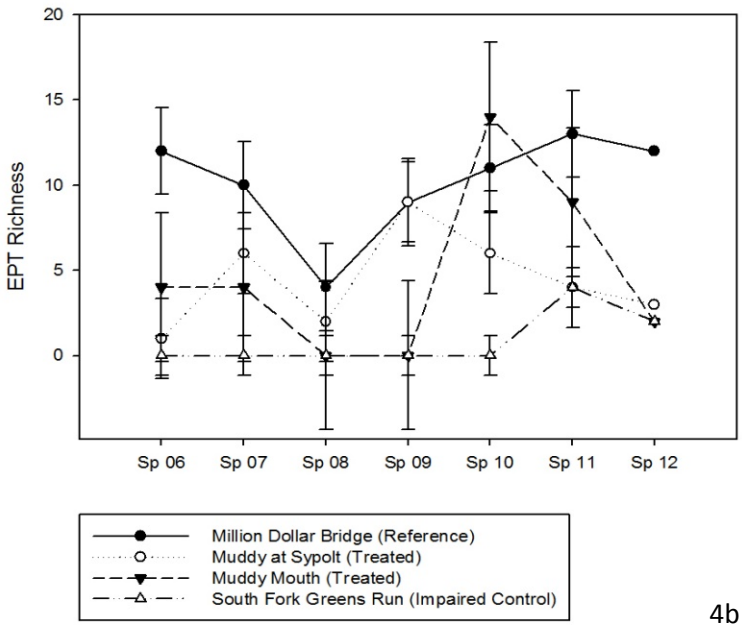
	Pre-Treatment Mean ± 95%CI			Post-Treatment Spring 2012 Data		
Site Name	% EPT	EPT Richness	% Ephem	% EPT	EPT Richness	% Ephem
Upper Muddy	72.99±8.92	18.00±4.16	45.72±9.73	60.89	18.00	26.00
Million Dollar Bridge	65.99±13.62	9.83±2.55	38.18±16.90	79.56	12.00	67.51
Muddy ab Martin	37.61±12.85	4.60±2.81	4.45±2.77	82.47	9.00	69.32
Muddy ab Crab Orchard	29.58±29.39	2.33±1.65	3.81±4.32	4.48	2.00	0.00
Muddy ab Sypolt	40.09±20.42	4.67±2.36	10.59±7.02	12.36	3.00	10.11
Muddy at Mouth	27.11±21.41	5.17±4.37	7.80±9.38	33.33	2.00	31.48
Cheat at Decision Right	51.94±17.38	7.33±5.23	34.69±18.03	39.67	9.00	3.28
Cheat at Jenkinsburg	73.00±14.22	8.20±1.92	55.30±15.57	59.43	7.00	15.57

Table 17. Percent of assemblage as Ephemeroptera, Plecoptera, and Trichoptera (%EPT), number of families within the orders of Ephemeroptera, Plecoptera, and Trichoptera (EPT Richness), and percent of assemblage as Ephemeroptera (% Ephem) for the Muddy Creek continuum before and after AMD treatment from the upper most sampling site to the downstream most sampling site. ("ab" = above)

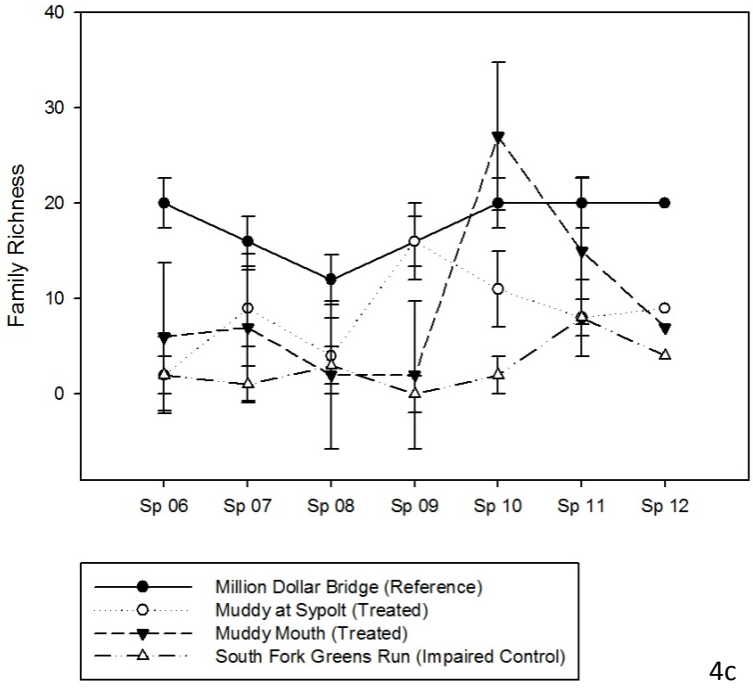
	Pre-Treatment Mean ± 95%CI			Post-Treatment Spring 2012 Data		
Site Name	Taxa Rich	%2Dom	WVSCI	Taxa Rich	%2Dom	WVSCI
Upper Muddy	30.75±6.11	42.56±5.04	91.64±3.55	33.00	43.72	90.34
Million Dollar Bridge	17.33±2.61	51.20±11.74	78.55±13.46	20.00	72.33	89.58
Muddy ab Martin	8.80±4.86	63.71±13.71	45.92±12.60	15.00	77.26	80.54
Muddy ab Crab Orchard	4.00±2.21	70.24±29.58	33.22±18.13	8.00	80.27	32.81
Muddy ab Sypolt	8.33±4.01	71.28±15.96	51.28±13.49	9.00	65.17	36.46
Muddy at Mouth	9.83±7.73	72.41±18.03	47.19±19.64	7.00	77.78	39.26
Cheat at Decision Right	13.17±8.43	51.60±8.91	60.36±19.75	17.00	65.25	68.54
Cheat at Jenkinsburg	13.00±3.89	63.40±14.02	75.10±5.30	12.00	48.11	65.06

Table 18. Family Richness (Taxa Rich), Percent of assemblage as the top two dominant families (%2Dom), and West Virginia Stream Condition Index (WVSCI) for the Muddy Creek continuum before and after AMD treatment from the upper most sampling site to the downstream most sampling site. ("ab" = above)

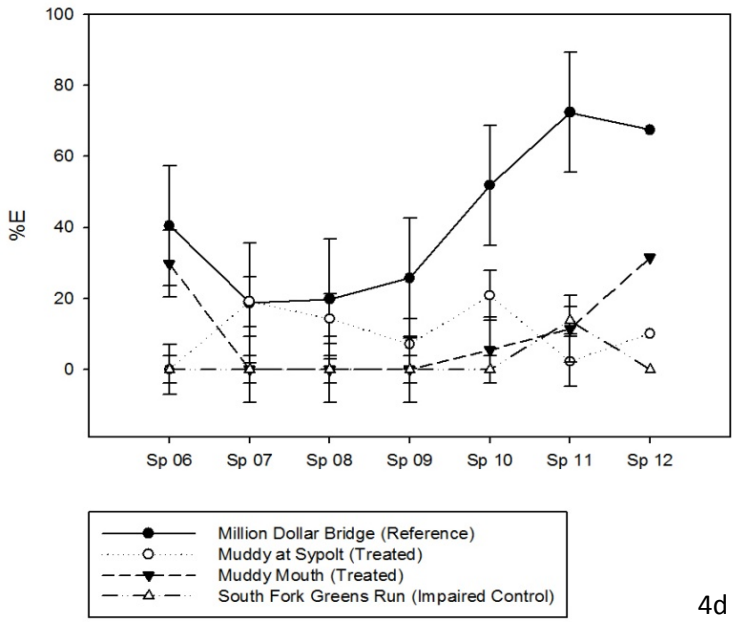



EPT Richness
20
15
10
5
0
Sp 06
Sp 07
Sp 08
Sp 09
Sp 10
Sp 11
Sp 12
Million Dollar Bridge (Reference)
Muddy at Sypolt (Treated)
Muddy Mouth (Treated)
South Fork Greens Run (Impaired Control)

4b


Family Richness
40
30
20
10
0
Sp 06
Sp 07
Sp 08
Sp 09
Sp 10
Sp 11
Sp 12
Million Dollar Bridge (Reference)
Muddy at Sypolt (Treated)
Muddy Mouth (Treated)
South Fork Greens Run (Impaired Control)

4c



4d

Figure 4a-d. West Virginia Stream Condition Index (WVSCI) scores (a), the number of families within the orders Ephemeroptera, Plecoptera, and Trichoptera (b), the total number of families within each assemblage (c), and percent of the assemblage comprised of Ephemeroptera for a reference site, two treated sites, and an impaired, untreated control site. Error bars represent pre-treatment 95% confidence intervals about the mean for each parameter. The horizontal line in (a) represents the impairment threshold for WVSCI (68.0) as defined by the West Virginia Department of Environmental Protection.

The percent of assemblage comprised of the top two dominant taxa (%2Dom) and percent of assemblage comprised of generally tolerant taxa (%Gen Tol) show the greatest variation in treated sites relative to reference and control sites. However, when observing Figure 4a there is a distinct separation in WVSCI scores; with treated sites experiencing a decreased score relative to the little change experienced in reference and impaired control sites. This relationship also holds true for Family Richness (Figure 4b) and EPT Richness (Figure 4c) in that there is little decline or change in impaired and control study sites, but Muddy Creek main stem sites that experience treatment do not respond positively to treatment. There may be a slight improvement in % E (Figure 4d) at the Mouth of Muddy Creek.

5.0 ADDITIONAL REQUIRED INFORMATION

The following information is provided to support preparation of an information sheet (as is required under W.Va. C.S.R. 46-6-5.3), which summarizes the information in the application pertinent to the Board's Decision.

a. *The designated use categories outlined in 46 CSR 1 which apply to the stream*:

Martin Creek, Fickey Run, Glade Run, and tributaries thereof are designated as follows:

- Category A (Water Supply, Public), the closest downstream drinking water intake is less than 5 miles downstream of our bond forfeiture site,
- Category B (Warm Aquatic Life), and
- Category C (Water Contact Recreation);

b. *The existing numeric water quality criterion which applies to the stream and for which the applicant seeks a variance, and the alternative numeric water quality criterion desired by the applicant*:

The existing numeric water quality criterion for these streams and tributaries thereof are as follows: Iron = 1.5 mg/l, Aluminum = 0.75 mg/l, pH = 6-9 su. The existing numeric water quality standards in the stream have never been able to be obtained as a result of human-caused conditions (pre-law mining) that were in existence before the criterions were assigned. The current existing conditions for the Martin Creek watershed are 10 mg/l Fe, 15 mg/l dissolved Al, and 3.2 pH. The purpose of this variance is not to meet existing numeric water quality criterion but to show overall improvement to the Martin Creek watershed as a whole and to improve water quality in Muddy Creek downstream of the confluence with Martin Creek. This will be achieved with the addition of in-stream dosers at strategic locations that will raise the pH and reduce metal loading. Please refer to summary in section 1.0 for more detailed explanation.

c. *Identification of the specific criterion outlined in section 3.1 a-f above which render the existing numeric water quality criterion unattainable*:

As mentioned above, the current conditions for the Martin Creek watershed are 10 mg/l Fe, 15 mg/l dissolved Al, and 3.2 pH

d. *Identification of the specific circumstances which render the discharger unable to meet the existing numeric water quality criteria which apply to the stream*:

AMD from abandoned mine lands, especially discharges emanating from the Upper Freeport coal seam, is the most damaging pollutant to Martin Creek watershed. The Martin Creek watershed has a long history of coal mining; this activity dates as far back as the late 1700s, with a significant amount of activity occurring prior to the 1977 passage of the Federal Surface Mining Control and Reclamation Act (SMCRA).

6.0 REFERENCES

Dsa, J.V., Johnson, K.S., Lopez, D., Kanuckel, C., Tumlinson, J. 2008. Residual toxicity of acid mine drainage contaminated sediment to stream macroinvertebrates: relative contribution of acidity vs. metals. Water, Air, and Soil Pollution. 194(1-4)185-197

Gerritsen, J., J. Burton, M.T. Barbour. 2000. A stream condition index for West Virginia wadeable streams. Tetra Tech, Inc. Owings Mills, MD. March 28, 2000 (Revised July 21, 2000).

Gunn, J., C.Sarrazin-Delay, B. Wesolek, A. Stasko, and E. Szkokan-Emilson. 2010. Delayed recovery of benthic macroinvertebrate communities in Junction Creek, Sudbury, Ontario, after the diversion of acid mine drainage. Human and Ecological Risk Assessment 16:901-912.

Gutta, B. and Ziemkiewicz, P. 2004. The Life Cycle of a Passive Treatment System: A Study of the Open Limestone Channel at Sovern Run #62. *In* Barnhisel, R.I., Ed. Proceedings of the American Society of Mining and Reclamation. 21st Annual National Conference. Morgantown, WV, 18-21 April 2004.

McClurg, S.E., J.T. Petty, P.M. Mazik, and J.T. Clayton. 2007. Stream ecosystem response to limestone treatment in acid impacted watersheds of the Allegheny Plateau. Ecological Applications 17(4): 1087-1104

Merritt, R.W., K.W. Cummins. 1996. An Introduction to the Aquatic Insects of North America. Kendall/Hunt Publishing Co., Dubuque, IA.

Pavlik, M. E. Hansen, M. Christ. 2005. Watershed Based Plan for the Lower Cheat River Watershed: From River Mile 43 at Rolwesburg, WV to the West Virginia/Pennsylvania Border, including all tributaries. Submitted to WVDEP and USEPA Region 3 on January 26th, 2005.

Peckarsky, B.L., P.R. Fraissinet, M.A. Penton, D.J. Conklin, Jr. 1990. Freshwater Macroinvertebrates of Northeastern North America. Cornell Paperback Publishing 1990.

Petty, T., Gutta, B., Herd, R., Fulton, J., Stiles, J., Strager, M., Svetlick, J., and Ziemkiewicz, P. 2008. Identifying Cost-Effective Restoration Strategies in Mining Impacted West Virginia Watersheds *In* Proceedings of the 2008 National Meeting of the American Society of Mining and Reclamation, Richmond, VA, June 2008.

Pond, G. 2010. Patterns of Ephemeroptera taxa loss in Appalachian headwater streams. Hydrobiologia 641: 185-201

Simmons, J., Ziemkiewicz, P., and Black, C. 2002. Use of Steel Slag Leach Beds for the Treatment of Acid Mine Drainage. Mine Water and the Environment 21 (2): p. 91-99.

Skousen, J. and Ziemkiewicz, P. 2005. Performance of 116 Passive Treatment Systems for Acid Mine Drainage. National Meeting of the American Society of Mining and Reclamation, Breckenridge, CO, 19-23 Jun 2005.

Sundermann, A., S. Stoll, and P. Haase. 2011. River restoration success depends on the species pool of the immediate surroundings. Ecological Applications. 21(6) 1962-1971

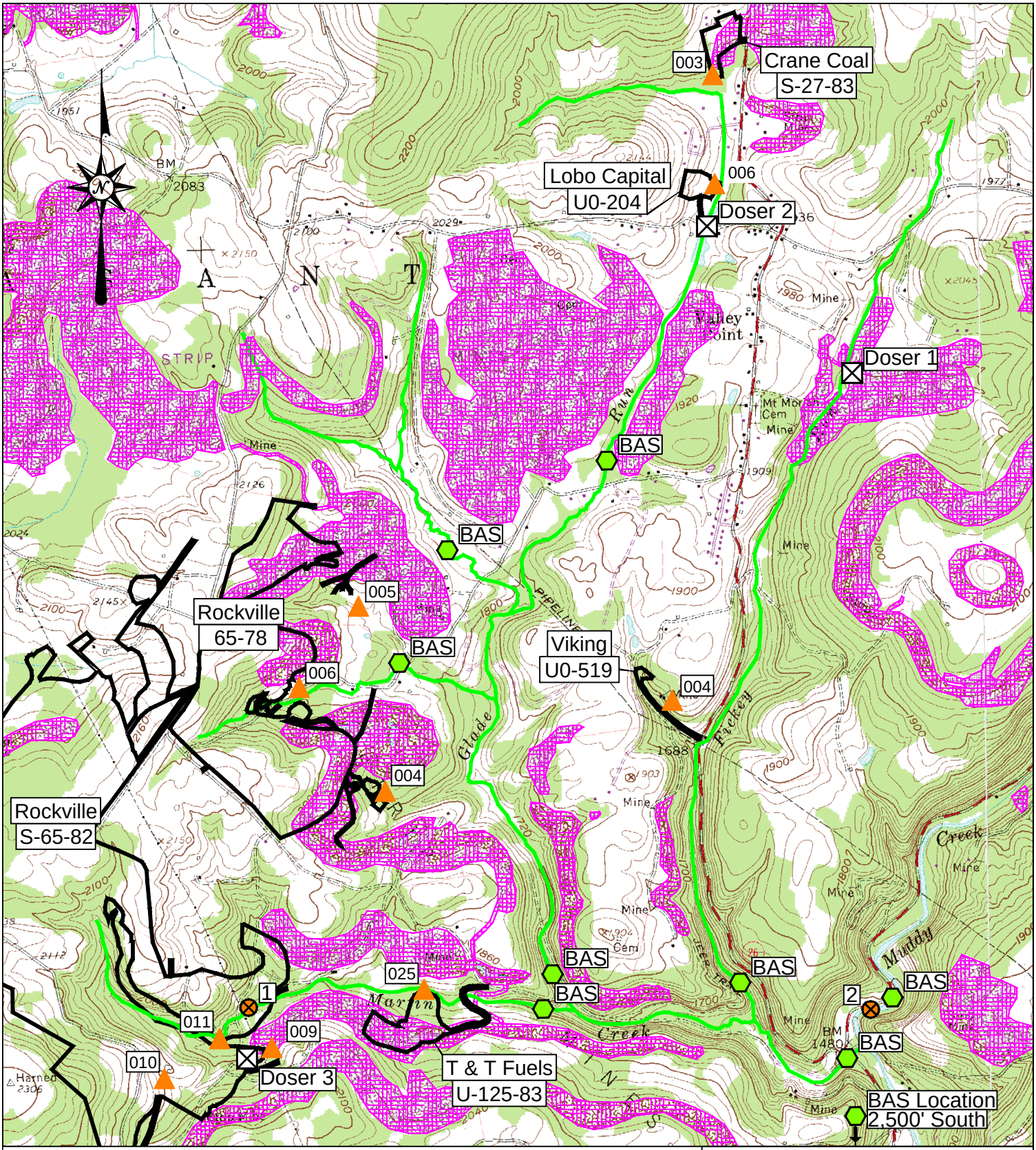
Trekels, H., F.Van de Meutter, and R. Stoks. 2011. Habitat isolation shapes the recovery of aquatic insect communities from a pesticide pulse. Journal of Applied Ecology. (48) 1480-1489

West Virginia Water Research Institute. 2007. Abram Creek Watershed Restoration Plan. Prepared for West Virginia Department of Environmental Protection, Division of Land Restoration, Office of Abandoned Mine Land and Reclamation. 62 pg.

WVDEP. 2010. Title 47: Legislative Rule Department of Environmental Protection Water Resources Series 2 Requirements Governing Water Quality Standards. 47CSR2, Appendix E.

Ziemkiewicz, P. 2005. Evaluation of the Efficiency of In-Stream Versus At-Source Treatment of Acid Mine Drainage for Watershed Restoration *In* Proceedings of 2005 Annual Meeting of the Society of Mining, Mineralogy and Exploration. Salt Lake City UT.

Ziemkiewicz, P., Skousen, J., Brant, D., Sterner, P., and Lovett, R. 1997. Acid Mine Drainage Treatment with Armored Limestone in Open Limestone Channels. J. Environ. Qual. 26: 1017-1024.



Legend

- Permit Boundary
- Proposed Variance
- Pre-Law Strip Mining
- Proposed Doser Location
- 1 — In-Stream Sample Location
- BAS — Benthic Sample Location

Martin Creek	MC-17-A
Fickey Run	MC-17-A-0.5
Glade Run	MC-17-A-1

SPECIAL RECLAMATION

MARTIN CREEK WATERSHED
APPLICATION FOR STREAM VARIANCE
ATTACHMENT 1

SCALE: 1" = 2000'	DRAWN BY: RM
DATE: May 2015	PROJECT NO.: N/A