July 6, 2005

Six Mile Run, Sandy Run and Long's Run Restoration Plan Update
Broad Top Township, Bedford County, PA

Introduction

Broad Top Township has been working for more than twenty years to improve the quality of life for its citizens through support of environmental restoration efforts. The Township is heavily impacted by abandoned mine lands (AMLs) and abandoned mine discharges (AMDs). In 2000, the Township used Growing Greener funds to perform an assessment of the mine drainage affecting Six Mile Run and Sandy/Longs Run watersheds for the purpose of updating outdated water quality information and to establish a priority list for AMD remediation projects. Skelly and Loy, consultant to the Township, completed the AMD remediation plan in December 2001.

The watersheds have also been severely impacted by failing on-lot and wildcat sewage systems many of which drain directly into the streams and by illegal garbage dumping. The Township has worked since 1990 to solve these problems as well. To deal with illegal garbage dumping, a collection system has been implemented along with an education program and strict enforcement of Township ordinances.

The Township in cooperation with Coaldale Borough completed an Act 537 Sewage Plan in 1995 that addresses all of the sewage systems in the two municipalities. The Plan provides for four community sewage collection and treatment systems in the existing villages and the repair or replacement of the remaining on-lot septic systems. The Plan also provides for continuing Township maintenance of the on-lot septic systems to ensure that they do not pollute the watersheds in the future. Construction using Township employees and equipment started in 1997 with primary funding from the US Army Corps of Engineers Section 313 program. As of 2004 approximately half of the homes are being served by the new systems.

The 2001 watershed plan focused on field survey and water quality sampling in the Six Mile, Sandy, and Longs Run watersheds covering a total of 28 square miles. A field survey of the watersheds by volunteers and Skelly and Loy, Inc. staff identified a total of 80 discharges: 42 discharges located along Six Mile Run; 23 discharges along Sandy Run; and 15 along Longs Run. Volunteers took part in a year long sampling effort developed to monitor flow and water quality parameters typical for AMDs for all discharges, except for 5 AMDs undergoing remediation.

Flow and water quality data were then used to help develop priorities for the remediation plan. Stream sampling data collected by Penn State University on the watersheds for the Total Maximum Daily Loadings (TMDLs) was also incorporated into the water quality evaluation. Data indicated that cumulatively, the monitored AMDs contribute a total of 63 tons per year of iron, 42 tons per year of aluminum, and 542 tons per year of acidity.

Data were also used to identify passive treatment options at each site and roughly estimate costs for remediation. Construction of passive treatment systems to remediate all monitored AMDs within the entire study area in 2001 was estimated at $6,680,000, with approximately $3,150,000 needed to fully treat the Six Mile Run Watershed, $3,060,000 needed for Sandy Run, and approximately $470,000 for Longs Run. An additional $4,000,000 would be needed across the entire study area for operation, maintenance, and replacement of the systems. Based on the analyses, an overall remediation plan was developed that identified passive treatment of 26 discharges and relocation of one discharge as top priorities.

The Watersheds

The Six Mile, Longs, and Sandy Run watersheds are located in South Central Pennsylvania, in the northeast corner of Bedford County. The watershed areas are found on the United States Geological Survey maps covering portions of the Everett East, Hopewell, Saxton, and Wells Tannery 7.5-Minute Quadrangles. The watersheds are within 7-digit HUC #2050303, Raystown Branch of the Juniata River, and part of State Water Plan (SWP) Subbasin 11D. The Six Mile Run watershed is 14.6 square miles, Sandy Run watershed is 10.9 square miles, and the Longs Run watershed is 4.58 square miles. Longs Run is a tributary of Sandy Run. All three streams flow in a westerly direction to their confluence with the Raystown Branch. Six Mile Run enters the Raystown Branch at river mile 51.7 and Sandy Run enters it at river mile 54.3. The eastern edge of the Broad Top coal field follows a small ridge called Riddlesburg Mountain just east of the confluences with the Raystown Branch. See Appendix A for maps of watershed.

The Broad Top coal field is contained within the northeast corner of Bedford county, northwest corner of Fulton county, and southern Huntington County. The coal field lies east of Allegheny Mountain and is isolated from the main bituminous coal bed. The Broad Top Region has an extremely complex geology. Distances between the coal bed layers vary throughout the region due to the folding and faulting of the underlying geology, which is most prevalent in the western flank of the region. The coal seams are folded into a series of small steep-sided basins, almost like a smaller version of the large, folded basins in the Anthracite coal region. This folding makes surface mining more difficult than in Pennsylvania's main Bituminous coal field and may hinder the potential for remining. It has been estimated that only ten percent of the Broad Top coal field has been surface mined and that at least eighteen percent of the field has been deep mined.

Mining began in the Broad Top Region in the early 1800's. Initially, almost all of the coal extraction was done by underground methods. Deep mining was most extensively done through the early twentieth century. The amount of underground mining in the watershed began to decline in the early 1900's and continued to diminish throughout the next century. The majority of the underground mining was completed prior to any state or federal regulation and enforcement. Underground mining ended in the Broad Top Region in the 1980's. Surface mining also occurred in the watersheds from the 1930's through the 1970's and 1980's. The majority of the surface mining was conducted prior to stringent regulations requiring back filling and planting. There is one active surface but no active underground mines in the watersheds.

DEP has a mandate to assess all the waters in the state to determine if water bodies meet water quality standards or their designated uses. These watershed assessments are done under the DEP unassessed waters program. The unassessed waters evaluations for the Six Mile, Longs, and Sandy Run watersheds were being conducted by SRBC in summer 2004. All three watersheds were added to the 303d list based on a 1980 assessment by DEP regional biologists. Data from the 2004 assessment will be added to this plan update when it becomes available. This data will be helpful in evaluating the restoration needs on individual stream segments.

Monitoring Points (MP's) used in this plan update are listed from upstream to downstream. The MP's are used in the TMDLs and the restoration plan. Maps of the monitoring points and the TMDL end points for the restoration plan are found in Appendix A.

Six Mile Run (SX):

- Six Mile Run main stem= SX0, MP's 57, 68, 53, 50
- Spruce Hill Run= SX2, MP's 59, 58; unnamed tributary at Wisdom Hollow= SX2B
- Shreves Run= SX3, MP's 60, 56
- SX8= Brewsters Hollow Run, MP's 55, 54
- Unnamed tributary #13793= SX10, MP 52

Sandy/Longs Run (SA and LR):

- Sandy Run = SA0, no major tributaries, MP's 61, 62, 63
- Longs Run = LR0, no major tributaries, MP's 66, 65, 69, 64, 67

The TMDLs

Two separate Total Maximum Daily Loads (TMDLs) reports were developed for stream segments in these watersheds, one for Six Mile Run and one for Sandy/Longs Run. The two TMDL reports will, therefore, be discussed separately. Due to the large number of discharges found in the Six Mile Run and Sandy/Longs Run watersheds, the TMDLs were calculated for stream segments rather than individual discharges. The TMDLs address the impairments noted on the 1996 Pennsylvania Section 303(d) list of impaired waters, required under the Clean Water Act, and cover the segments on that list. High levels of metals, and in some areas depressed pH, have caused the impairments. All impairments result from drainage from abandoned coal mines. The TMDLs address iron, manganese, aluminum, the three primary metals associated with acid mine drainage, and pH.

One of the major components of a TMDL is the establishment of an instream numeric endpoint, which is used to evaluate the attainment of applicable water quality. An instream numeric endpoint represents the water quality goal that is to be achieved by implementing the load reductions specified in the TMDL. The endpoint allows for comparison between observed instream conditions and conditions that are expected to restore designated uses. The endpoint is based on either the narrative or numeric criteria available in water quality standards.

The TMDL components were expressed as load allocations that were specified above a point in the stream segments. All allocations were specified as long-term average daily concentrations. These long-term average daily concentrations were expected to meet water quality criteria 99% of the time, since Pennsylvania Title 25 Chapter 96.3(c) specifies that the water quality standards must be met 99% of the time. The TMDLs for iron were expressed as total recoverable as the iron was reported as total recoverable. The TMDLs focus remediation efforts on the identified numerical reduction targets for each watershed. As changes occur in the watershed, the TMDLs may be reevaluated to reflect current conditions. Table 1 shows water quality criteria for the selected parameters.

Table 1. Applicable Water Quality Criteria

Parameter	***Criterion Value (mg/l)***	***Total Recoverable/Dissolved***
Aluminum (Al)	0.75	Total Recoverable
Iron (Fe)	1.50 0.3	30-Day Average Total Recoverable Dissolved
Manganese (Mn)	1.00	Total Recoverable
pH *	6.0-9.0	N/A

*The pH values shown will be used when applicable. In the case of freestone streams with little or no buffering capacity, the TMDL endpoint for pH is the natural background water quality, which can be as low as 5.4.

The existing and allowable loadings for TMDL points for all parameters were computed using water quality sample data collected at the monitoring points. Loadings were based on the sample data for each point and did not account for any load reductions already specified from upstream sources. Load reduction from upstream points were subtracted from the existing load at the next point and compared to the allowable load for each parameter to determine if any further reductions were needed at that point.

Table 2. TMDL Summary for Six Mile Run Watershed
Load Reductions Required to Meet the TMDL

Station	***Parameter***	***Measured Sample Data***		***Allowable***		***Reduction Identified***
		Conc. (Mg/l)	***Load (Lb/day)***	***LTA Conc. (Mg/l)***	***Load (Lb/day)***	***Percent***
59	**Spruce Hill Run (UNT #13805) upstream**					
	Al	0.65	4.1	0.17	1.1	74
	Fe	0.20	1.3	0.20	1.3	0
	Mn	0.85	5.4	0.30	1.9	65
	Acidity	7.63	48.6	0.53	3.4	93
	Alkalinity	1.14	7.3			
58	**Spruce Hill Run (UNT #13805) downstream**					
	Al	0.48	11.4	0.23	5.6	33
	Fe	0.04	1.0	0.04	1.0	0
	Mn	0.18	4.4	0.18	4.4	0
	Acidity	8.06	192.6	0.32	7.7	95
	Alkalinity	0.85	20.2			
57	**Six Mile Run upstream of Shreves Run**					
	Al	0.66	20.5	0.32	9.9	33
	Fe	0.09	2.7	0.09	2.7	0
	Mn	0.18	5.7	0.18	5.7	0

Table 2. TMDL Summary for Six Mile Run Watershed Load Reductions Required to Meet the TMDL						
Station	*Parameter*	*Measured Sample Data*		*Allowable*		*Reduction Identified*
		Conc. (Mg/l)	*Load (Lb/day)*	*LTA Conc. (Mg/l)*	*Load (Lb/day)*	*Percent*
	Acidity	4.26	133.1	0.68	21.3	0
	Alkalinity	2.15	67.3			
60	**Shreves Run upstream**					
	Al	0.05	0.02	0.05	0.03	0
	Fe	0.06	0.03	0.06	0.02	0
	Mn	0.03	0.01	0.03	0.01	0
	Acidity	0.00	0.00	0.00	0.00	0
	Alkalinity	9.13	4.2			
56	**Shreves Run downstream**					
	Al	7.58	75.7	0.30	3.0	96
	Fe	1.30	13.0	0.83	8.3	36
	Mn	1.31	13.0	0.52	5.2	60
	Acidity	79.23	791.5	48.33	482.8	39
	Alkalinity	0	0			
68	**Six Mile Run upstream of Brewsters Hollow Run (UNT #13794)**					
	Al	2.64	160.4	0.19	11.2	85
	Fe	0.35	21.2	0.35	21.2	0
	Mn	0.62	37.5	0.40	24.0	8
	Acidity	22.76	1380.2	0.00	0.0	100
	Alkalinity	0	0			
55	**Brewsters Hollow Run upstream (UNT #13794)**					
	Al	0.82	4.7	0.33	1.9	60
	Fe	0.07	0.4	0.07	0.4	0
	Mn	1.39	8.0	0.61	3.5	56
	Acidity	0.46	2.7	0.46	2.7	0
	Alkalinity	10.80	61.9			
54	**Brewsters Hollow Run downstream (UNT #13794)**					
	Al	0.66	7.6	0.19	2.1	56
	Fe	7.32	83.4	0.37	4.2	95
	Mn	0.37	4.2	0.28	3.2	0
	Acidity	19.98	227.6	6.99	79.7	65
	Alkalinity	0	0			
53	**Six Mile Run upstream of UNT #13794 (downstream of Defiance)**					
	Al	2.08	163.9	0.21	16.4	0
	Fe	2.74	216.5	0.74	58.4	56
	Mn	0.62	48.6	0.41	32.6	0
	Acidity	15.55	1226.5	0.31	24.5	0
	Alkalinity	1.38	109.2			
52	**UNT #13793 (downstream of Defiance)**					
	Al	0.08	0.2	0.08	0.2	0
	Fe	0.18	0.4	0.18	0.4	0
	Mn	0.04	0.1	0.04	0.1	0
	Acidity	0.00	0.0	0.00	0.0	0
	Alkalinity	30.76	72.9			
50	**Six Mile Run just upstream of confluence with Raystown Branch**					

Table 2. TMDL Summary for Six Mile Run Watershed Load Reductions Required to Meet the TMDL						
		Measured Sample Data		***Allowable***		***Reduction Identified***
Station	***Parameter***	***Conc. (Mg/l)***	***Load (Lb/day)***	***LTA Conc. (Mg/l)***	***Load (Lb/day)***	***Percent***
	Al	3.29	279.1	0.20	16.7	87
	Fe	1.89	160.3	0.70	59.3	0
	Mn	0.91	77.2	0.36	30.9	48
	Acidity	26.45	2244.8	0.00	0.0	100
	Alkalinity	0	0			

Table 3. TMDL Summary for Longs and Sandy Run Watersheds Load Reductions Required to Meet the TMDL						
		Measured Sample Data		***Allowable***		***Reduction Identified***
Station	***Parameter***	***Conc. (mg/l)***	***Load (lb/day)***	***LTA Conc. (mg/l)***	***Load (lb/day)***	***Percent***
61		**Longs Run downstream confluence w/ Tributary 14035**				
	Fe	2.50	17.8	0.53	3.7	79
	Mn	0.28	2.0	0.28	2.0	0
	Al	1.87	13.3	0.75	5.3	60
	Acidity	24.62	174.8	0.00	0.0	100
	Alkalinity	0.00	0.0			
62		**Longs Run, ½ mile downstream of MP 61**				
	Fe	2.34	18.2	0.49	3.8	7
	Mn	0.76	5.9	0.76	5.9	NA
	Al	1.77	13.7	0.72	5.6	2
	Acidity	27.49	213.3	0.00	0.0	100
	Alkalinity	0.00	0.0			
63		**Longs Run, near mouth, upstream confluence w/ Tributary 14032**				
	Fe	0.34	5.4	0.20	3.2	NA
	Mn	2.75	43.8	0.80	12.7	71
	Al	0.58	9.2	0.55	8.8	NA
	Acidity	8.27	131.6	1.41	22.4	NA
	Alkalinity	3.74	59.5			
66		**Sandy Run 1.5 miles down of headwaters**				
	Fe	0.23	1.0	0.23	1.0	NA
	Mn	0.05	0.2	0.05	0.2	NA
	Al	0.10	0.5	0.10	0.5	NA
	Acidity	7.24	33.0	0.43	2.0	94
	Alkalinity	0.74	3.4			
65		**Sandy Run downstream confluence w/ Tributary 14042**				
	Fe	0.08	0.7	0.08	0.7	NA
	Mn	0.48	4.0	0.48	4.0	NA
	Al	0.24	2.0	0.24	2.0	NA
	Acidity	7.89	64.7	7.89	64.7	NA
	Alkalinity	18.69	153.4			

Table 3. TMDL Summary for Longs and Sandy Run Watersheds Load Reductions Required to Meet the TMDL						
Station	*Parameter*	*Measured Sample Data*		*Allowable*		*Reduction Identified*
		Conc. (mg/l)	*Load (lb/day)*	*LTA Conc. (mg/l)*	*Load (lb/day)*	*Percent*
69		**Sandy Run about 3 miles upstream of mouth**				
	Fe	2.42	41.0	0.46	7.8	81
	Mn	4.27	72.2	0.34	5.8	92
	Al	0.65	11.0	0.61	10.2	7
	Acidity	31.40	531.5	0.00	0.0	100
	Alkalinity	0.00	0.0			
64		**Sandy Run upstream confluence w/ Tributary 14037**				
	Fe	6.02	214.1	0.36	12.8	93
	Mn	7.63	271.3	0.69	24.4	88
	Al	1.33	47.3	0.61	21.8	53
	Acidity	73.37	2608.5	0.00	0.0	100
	Alkalinity	0.00	0.0			
67		**Sandy Run near mouth**				
	Fe	4.07	212.6	0.37	19.1	NA
	Mn	3.53	184.5	1.06	55.3	NA
	Al	1.07	55.8	0.68	35.7	NA
	Acidity	48.24	2518.5	0.00	0.0	NA
	Alkalinity	0.00	0.0			

Six Mile Run

The TMDL for Six Mile Run consists of load allocations for three tributaries and five sampling sites along the main stem (Map Figure 1). Six Mile Run is on the 303d list for both high metals and low pH caused by discharges from abandoned mines. The water quality data and TMDL indicate that surface or underground mines extending from the headwaters to the mouth impair Six Mile Run and most of its tributaries with elevated iron, aluminum, and acidity. The only area with little mining is the Round Knob area in the middle portion of the watershed south of Six Mile Run. The abandoned mining contributing the most loading to the watershed is concentrated in the tributary Shreves Run and in Six Mile Run between the confluences of Shreves Run and the unnamed tributary known as Spruce Hill Run. Spruce Hill Run is actually larger and has much higher flow volume than Six Mile Run. Additional loading comes from the Brewsters Hollow unnamed tributary and from a cluster of discharges on Six Mile Run about one mile upstream of the confluence with Raystown Branch. In addition to elevated total metals, Six Mile Run has aluminum precipitate starting in the village of Defiance. Farther downstream, both iron and aluminum precipitate is present in some areas.

Sandy/Longs Run

Each segment of these streams on the Section 303(d) list was addressed as a separate TMDL. The TMDLs were expressed as long-term average loadings for 5 segments on Sandy Run and 3 segments on Longs Run (Figure 2). Due to the nature and complexity of mining effects on the watershed, expressing the TMDL as a long-term average gives a better representation of the data for the calculations.

Longs Run

The TMDL for Longs Run consists of load allocations for three sampling sites along the stream. Longs Run is listed as impaired for both high metals and low pH from AMD. The majority of the discharges to Longs Run are in the headwaters, upstream of MP 61. Two additional discharges are between MP 61 and MP 62. Three additional discharges are farther downstream in the watershed upstream of MP 63. Lower Longs Run has both aluminum and iron precipitate.

Sandy Run

The TMDL for Sandy Run consists of load allocations for five sampling sites along the stream. Sandy Run is on the 303d list for both high metals and low pH, with AMD as the cause. The cumulative TMDL table shows that the main areas in need of remediation from metals on Sandy Run are at MP 69 and MP 64, in the lower watershed. In addition to elevated total metals, lower Sandy Run also has iron precipitate. The discharges upstream of these points should be the priority discharges to be treated to achieve the TMDL.

Pollutant Load Reductions Required to Meet the TMDL

Six Mile Run

Portions of the Six Mile Run watershed are affected by acidity, iron, manganese, and aluminum concentrations above water quality criteria. All concentrations of metals in the unnamed tributary locally known as Spruce Hill Run are below water quality criteria; however, the calculated loadings for acidity and aluminum are high enough at the mouth to affect aquatic life and, therefore, reductions are required. The full list of load reductions established for the TMDL endpoints can be found in Table 2.

Some of the calculated TMDL end points are based on measured water quality parameters already below water quality standards. When instream flow measurements are put into the model, the TMDL yielded excessive loadings requiring reductions. Based on instream concentrations, the major loadings that should be targeted for reductions are:

- MP 56 lower Shreves Run, aluminum and acidity
- MP 68 Six Mile Run, upstream of Brewsters Hollow Run, aluminum and acidity
- MP 54 lower Brewsters Hollow Run, iron and acidity
- MP 53 Six Mile Run downstream of Defiance, aluminum, iron, and acidity
- MP 50 Six Mile Run, just upstream of mouth, aluminum, iron, and acidity

Sandy/Longs Run

Some of the calculated TMDL end points are based on measured water quality parameters already below water quality standards. When instream flow measurements are put into the model, the TMDL yielded excessive loadings requiring reductions. Based on instream concentrations, the major loadings that should be targeted for reductions are:

- MP’s 61 and 62 Longs Run, iron, aluminum, and acidity
- MP 63 lower Longs Run, manganese and acidity

- MP’s 66 and 65 Sandy Run, acidity
- MP 69 middle Sandy Run, iron, manganese, acidity
- MP’s 64 and 67 lower Sandy Run, iron, manganese, aluminum, and acidity

Major Sources of Abandoned Mine Drainage

Six Mile Run Watershed

Water quality data indicate that approximately 21 tons per year of iron, 25 tons per year of aluminum, and 276 tons per year of acidity are discharged from monitored AMD sources within Six Mile Run. The highest AMD sources of metal and acidity (contributing greater than 5% of the total iron, aluminum, or acidity loadings within the watershed) are listed in the Table 4. Treatment of the eight discharges in Table 4 would address an estimated 92% of the iron loadings, 75% of the aluminum loadings, and 76% of the acidity loadings to the Six Mile Run watershed.

Table 4. Primary AMD Sources in the Six Mile Run Watershed

Discharge ID	Discharge Location	Iron Tons per year (Percentage)	Aluminum Tons per year (Percentage)	Acidity Tons per year (Percentage)
SX0-D6	Upstream of Coaldale & MP 54	1.41 (7%)	0.82 (3%)	9.33 (3%)
SX0-D8	Upstream of Coaldale & MP 54	2.05 (10%)	1.61 (7%)	17.67 (6%)
SX0-D9	Upstream of MP 53	2.34 (11%)	0.77 (3%)	9.21 (3%)
SX0-D11	Six Mile Run, ½ mile upstream of mouth & MP 50	2.07 (10%)	0.59 (2%)	10.25 (4%)
SX0-D12	Six Mile Run ½ mile upstream of mouth & MP 50	1.74 (8%)	0.50 (2%)	9.37 (3%)
SX3-D1	Headwaters Shreves Run	0.84 (4%)	3.53 (14%)	40.17 (15%)
SX8-D1	Brewsters Hollow Run near mouth, upstream MP 54	8.03 (38%)	0.65 (3%)	24.43 (9%)
SX10-D2	UNT #13793, near mouth	0.79 (4%)	10.14 (41%)	90.29 (33%)
TOTAL		**19.27 (92%)**	**18.61 (75%)**	**210.72 (76%)**
TOTAL OF ALL AMD SOURCES		**21.17 (100%)**	**24.52 (100%)**	**276.21 (100%)**

The greatest increases in iron loadings are observed from MP 57 on Six Mile Run upstream of Shreves Run, to MP 53 on Six Mile Run, upstream of the Judy Hollow Tributary (SX9). Six Mile Run extends approximately three miles between these two monitoring points and includes the Village of Coaldale. Between these two points, iron loadings increase from 2 lbs per day to more than 200 lbs per day. Discharges located between MP 57 and MP 53 include all SX3 discharges along Shreves Run, SX8-D1 and SX8A-D1 & D2 discharges on the Brewster Hollow tributary, and five AMD sources along Six Mile Run (SX0-D6, SX0-D8, SX0-D9, SX0-D11, SX0-D12). Of these, SX8-D1 at the lower end of Brewster Hollow is the largest contributor of iron loadings, composing approximately 38% of the total iron loadings to the Six Mile Run watershed.

Significant increases in aluminum loadings are also observed at two segments within Six Mile Run. Large increases are observed from MP 57 (at 20 lbs per day) to MP 53 (at 160 lbs per day). This is the same stretch influenced by high iron loadings described above. Also, aluminum, manganese, and acidity levels are nearly double on the downstream end of Six Mile Run between the mouth of Six Mile Run (MP 50) and the closest monitoring point (MP 51) just under a mile upstream. Improvements in aluminum levels would be expected with remediation of the discharges located between MP 51 and MP 50. These are SX0-D10, D11, D12, D13, & D14 and discharges along the SX10 tributary. In particular, remediation of SX10-D2, the largest source of aluminum in the Six Mile Run watershed, could reduce loadings of aluminum and acidity by 41% and 33%, respectively at MP 50 near the mouth of Six Mile Run.

Shreves Run (SX3)

Discharges in the Shreves Run watershed contribute a significant amount of iron and aluminum loadings to the Six Mile Run watershed. The instream concentration of aluminum at MP 56 on Shreves Run near the mouth is quite high at 7.58 mg/l. Average aluminum concentrations of all the SX3 discharges are over 7 mg/l; the highest, SX3-D10, averages over 21 mg/l, and two others, SX3-D1 and SX3-D2, average over 14 mg/l. Luckily, SX3-D10 is very low flow, one gpm. The highest flow of these three is SX3-D1 averaging 113 gpm.

The effect of these discharges on Six Mile Run immediately downstream of Shreves Run is not documented in the TMDL, since no monitoring point was located there. The next downstream monitoring point on main stem Six Mile Run is located over 3 miles downstream. Establishment of a monitoring point on Six Mile Run halfway between the confluence of Shreves Run and just upstream of he village of Coaldale would help evaluate progress on remediation of the middle section of Six Mile Run. The watershed advisory committee should consider sampling at this location to better evaluate effects of the treatment systems.

Spruce Hill Run (SX2)

High loads of aluminum (levels greater than the allowable loading) were measured at MP 59, which is located on Spruce Hill Run near the mouth. The average concentration of aluminum, however, is 0.65 mg/l, which is below recommended limits. The only known discharge influencing water quality at this point is SX2-D1, near the headwaters of the tributary. This discharge has an average aluminum concentration of 12 mg/l; however, the average flow is low at only 3 gpm. Treatment of this discharge with a passive treatment system should easily accomplish the necessary TMDL load reductions at MP 59.

MP 58 near the mouth of Spruce Hill Run is affected by 7 more discharges, SX2-D2 through SX2-D8. All of these discharges are also low flow, below 15 gpm. SX2-D6 & SX2-D9 have the highest iron concentrations, and SX2-D8, the highest aluminum concentrations. Because of the low flows, passive treatment should easily accomplish the desired TMDL load reductions at MP 58. Since most of these discharges are in two clusters, combined treatment in two systems may be possible. Because of the lower loadings from these sources and the number of discharges, this tributary is considered a lower priority for the overall remediation of Six Mile Run.

Longs Run Watershed

Longs Run is a moderately acidic stream approximately 6 miles in length. Discharges from surface and underground mining have negatively impacted water quality and restricted its uses. Even the upstream reaches of Longs Run have undesirable aluminum, manganese, and acidity loadings.

Approximately 6 tons per year of iron, 1 ton per year of aluminum, and 23 tons per year of acidity are discharged from monitored AMD sources within the Longs Run sub-watershed. The highest AMD sources of metal and acidity are listed in Table 5. LR0-D1 contributes the greatest aluminum and acidity at 0.48 tons per year and 7.78 tons per year, respectively.

Table 5: Primary AMD Sources in the Longs Run Watershed

Discharge ID	Discharge Location	Iron Tons per year (Percentage)	Aluminum Tons per year (Percentage)	Acidity Tons per year (Percentage)
LR0-D1	Headwaters Longs Run, upstream MP 61	0.60 (10%)	0.48 (39%)	7.78 (34%)
LR0-D2	Headwaters Longs Run, upstream MP 61	0.26 (4%)	0.12(10%)	2.38 (10%)
LR0-D3	Headwaters Longs Run, upstream MP 61	0.02 (0%)	0.13(11%)	1.32 (6%)
LR0-D5	Headwaters Longs Run, upstream MP 61	0.01 (0%)	0.14 (12%)	1.61 (7%)
LR0-D10	Longs Run between MP 61 & MP 62	1.18 (20%)	0.09 (7%)	4.11 (18%)
LR0-D14	Longs Run, ¼ mile upstream of MP 63	2.20 (37%)	2.20 (37%)	0.19 (1%)
TOTAL		**4.27 (72%)**	**0.99 (82%)**	**17.39 (76%)**
TOTAL OF ALL AMD SOURCES		**5.94 (100%)**	**1.21 (100%)**	**22.75 (100%)**

Only one discharge, LR0-D10, has acidity over 100 mg/L; therefore, it is technically feasible to passively treat all the Longs Run discharges. LR0-D14 is the largest contributor of iron, discharging an estimated 2.2 tons per year. Remediation of the six primary AMD’s listed in Table 5 would address an estimated 72% of the iron loadings, 82% of the aluminum loadings, and 76% of the total acidity loadings to Longs Run. Remediation of discharges influencing water quality of the headwaters, especially LR0-D1, which contributes the largest amount of aluminum (an estimated 39%, or approximately 0.5 tons per year) and acidity, is critical for restoration of Longs Run. Treatment of these discharges should achieve the required load reductions at MP 61, 62 and MP 63.

Iron loadings are the largest issue in the remaining stretch from MP 62 on Longs Run at the bridge over T-134, upstream of Kearney, to MP 63 near the mouth of Longs Run. Between these two segments, LR0-D10 and LR0-D14 have the greatest influence and are the primary sources of iron. Table 5 indicates that these two discharges contribute 20% and 37% of the iron loadings, respectively, throughout the Longs Run watershed.

Sandy Run Watershed

Water quality data indicate that approximately 37 tons per year of iron, 17 tons per year of aluminum, and 245 tons per year of acidity are discharged from monitored AMD sources within the Sandy Run watershed. The highest AMD sources of metal and acidity are listed in Table 6. SA0-D17 is the major source of iron, aluminum and acidity and contributes roughly 59%, 43%, and 41%, respectively to the Sandy Run watershed. Remediation of the five primary discharges listed in Table 6 has the potential to decrease iron, aluminum, and acidity loadings by 90% or more.

Table 6. Primary AMD Sources in Sandy Run Watershed

Discharge ID	Discharge Location	Iron Tons per year (Percentage)	Aluminum Tons per year (Percentage)	Acidity Tons per year (Percentage)
SA0-D4	Sandy Run <¼ mile downstream of MP 65	3.11 (9%)	1.24 (7%)	15.84 (7%)
SA0-D5	Sandy Run ½ mile downstream of MP 65	1.43 (4%)	1.39 (8%)	18.57 (8%)
SA0-D10	Sandy Run about 1 mile upstream MP 69	1.74 (5%)	1.09 (6%)	17.80 (7%)
SA0-D14	Sandy Run near MP 69	5.09 (14%)	5.15 (30%)	72.69 (30%)
SA0-D17	Sandy Run about ½ mile upstream of MP 64	21.38 (59%)	7.28 (43%)	99.41 (41%)
TOTAL		**32.75(90%)**	**16.15(95%)**	**224.31 (92%)**
TOTAL OF ALL AMD SOURCES		**36.52(100%)**	**17.06 (100%)**	**243.54 (100%)**

The restoration plan states that Sandy Run meets water quality standards in approximately 2.5 miles of the upper stream reaches, above MP 66 and MP 65 and that the stream becomes severely degraded after discharge SA0-D4 enters Sandy Run, approximately 1,000 feet downstream of MP 65. The entire stream is presently on the 303d list, however. The ongoing assessment should help determine the degree of impairment or attainment of the headwaters of Sandy Run. High loadings of aluminum, iron, and acidity are observed at the next monitoring point, MP 69, located along SR 915. Remediation of discharges between these two points, from SA0-D4 to SA0-D13, would restore 1.5 stream miles.

The greatest loadings and all the primary AMD sources are located between MP 69 and 64, where concentrations of iron, aluminum, manganese, and acidity increase more than four times. Discharges located between these two points include SA6, SA0-D15, SA0-D16, and SA0-D17 along the main stem of Sandy Run. SA0-D17 is the largest source of iron, aluminum and acidity within the Sandy Run watershed.

Recommendations/Priorities

The Six Mile, Sandy, and Longs Run watersheds have been impacted by AMD for many years. Remediation of some of these discharges and additional discharges based on economic feasibility and improved conditions as outlined in the 2001 plan will help Broad Top Township realize its goals to restore water quality in the area. Continued chemical sampling of the discharges and chemical and biological sampling of stream aquatic habitat is planned to gauge the effects of current and future remedial actions on water quality. In addition, the Township's continued implementation of the Act 537 Sewage Plan by completing construction of new community sewage systems and repair and management of on-lot septic systems will deal with sewage pollution in the watersheds.

Priority AMD Remediation Projects

Priority sites were selected by Broad Top Township with advice from their consultant, Skelly and Loy. Factors considered included economic feasibility, landowner cooperation, and overall expected water quality improvement provided by passive treatment. Priority discharges for remediation are those that have potential to provide the greatest improvement at the least cost with immediate opportunities for design and construction. Treatment of smaller discharges at the headwaters of a tributary may be appropriate before treatment of a larger discharge near the mouth of that tributary, because treatment of the headwaters discharge has the potential to restore more miles of stream, especially if several other discharges are located upstream on the main stem.

Costs and type of passive treatment system for each discharge was based on the experience of the Township's consultant, Skelly and Loy. Rough costs of treatment are based on type of system, tons of limestone needed, and associated settling ponds and wetland areas needed. A system life of 25 years was assumed. Estimated long-term operation and maintenance costs were estimated to be 60% of construction costs.

TABLE 7: Priority Discharges for Remediation 2004 through 2010

Priority Discharges	Estimated Construction Cost	Potential Stream Miles Improved	Other factors/ Comments
A. Longs Run LR0-D3, 4, 5, 6, 7, 9 LR0-D1, D2, D10, D11, D12, D13, D14, and D15	$330,000	4.0 miles	Growing Greener funding was secured to treat LR0-D3 to D9. Section 319 funds were received to treat the remaining discharges. These projects should result in full restoration of the Longs Run watershed from AMD impacts.
B. Six Mile Run SX3-D1, D2, and D3	$243,000	0.4 miles	SX3-D1 is the largest flowing discharge along Shreves Run. In combination with SX3-D2 and D3, treatment will reduce aluminum and acidity loadings in the headwaters of Six Mile Run. Grants were secured for remediation.

TABLE 7: Priority Discharges for Remediation 2004 through 2010			
Priority Discharges	**Estimated Construction Cost**	**Potential Stream Miles Improved**	**Other factors/ Comments**
C. Six Mile Run SX8A-D1 and D2 SX2-D1, D2, D3, D4, D5, D6, D7, D8, D9 SX2B-D1, D2	 $214,000	 2.1 miles 1.3 miles 1.1 miles	Headwater discharges along Brewster Hollow. Headwater discharges along Six Mile Run locally known as the Spruce Hill area. Discharges along Wisdom Hollow, in the headwaters of Six Mile Run.
D. Six Mile Run SX0-D1 and D2	$271,000	1.1 miles	Headwater discharges along Six Mile Run.
E. Six Mile Run Relocation of SX0-D8	$10,000	Not applicable	Treatment is costly due to location near houses and other building structures. Relocation of the discharge will help prevent spread of the discharge across residential and public properties.

Construction of passive treatment systems to remediate all discharges in the three watersheds is estimated at $6,680,000, with approximately $3,150, 000 needed to remediate AMDs within the Six Mile Run watershed, $3,060,000 needed for Sandy Run and approximately $470,000 needed to restore Longs Run. Costs to treat individual discharges range from $288,000 to $1,312,000. With additional operation, maintenance and replacement costs estimated at 60% of construction, the grand total for construction and O, M, & R is approximately $10,680,000.

Several primary discharges identified in Table 4, including SA0-D14, SA0-D17, SX0-D8 and SX10-D2, are not listed as priority AMD remediation projects in Table 7, due to high associated treatment costs, comparatively lower anticipated overall water quality improvement, and potentially fewer restored stream miles. Other problems associated with these projects include location within the watershed, proximity to residences, availability of space, or limitations of passive treatment systems. Once the priority projects on Six Mile Run and Longs Run are completed, the restoration plan will be updated to consider how to address these problem discharges.

Status of Recommended Priority Treatment Systems

A. Longs Run: treatment systems completed for LR0-D3, 4, 5, 6, 7, 9 in 2004, funds received for treatment of LR0-D2, D10, D11, D13, D14 and D15
B. Six Mile Run: Grants received for SX3-D1, 2, and D3
C. Six Mile Run: Grants applied for SX8A-D1 and D2, and
D. Six Mile Run: Grants applied for SX0-D1 and D2
E. Six Mile Run: Broad Top Township relocation of SX0-D8 in summer-fall 2004

Several primary discharges including SX0-D8, SA0-D14, SA0-D17, and SX10-D2 are not listed as priority AMD remediation projects due to high associated costs and comparatively lower anticipated overall water quality improvement (e.g., less restored stream miles) associated with treatment.

Restoration Schedule for Projects Not Funded

Longs Run

The restoration of Longs Run was a top priority in the 2001 Remediation Plan because of the lower costs to benefits and ease of treatment. Passive treatment of all the discharges in Longs Run watershed was estimated to cost $752,000 in 2001. Additional costs for operation and maintenance were estimated at $282,000. A conceptual plan of each system along with a detailed cost estimate can be found in the restoration plan.

Longs Run Priority Treatment Systems, Estimated Costs, and Time Frame			
Discharge	**Treatment system**	**Cost**	**Time Frame**
LR0-D2	Vertical flow wetland	$42,000	2005
LR0-D10	Vertical flow wetland	$70,000	2005
LR0-D11	Limestone pond	$10,000	2006
LR0-D14	Wetland	$26,000	2006
LR0-D13 & LR0-D15	Combine into one Anoxic limestone drain	$47,000	2006
Selected areas as needed	Limestone sand dosing	Not determined	Various

One site not included in the remediation plan was discharge LR0-D1, which disappears within several feet of the discharge and will need some further evaluation after completion of the third project. The use of limestone dosing is expected to alleviate the AMD problems caused by this and any other unknown discharges.

Six Mile Run

Treatment of all the discharges in Six Mile Run watershed was estimated to cost $3.2 million in 2001. Additional costs for operation and maintenance were estimated at $1.9 million. The Six Mile Run priority projects consist of eight independent areas locally known as Brewster Hollow (SX8A), Wisdom Hollow (SX2B) and Spruce Hill (SX2). A conceptual plan of each system along with a detailed cost estimate can be found in the restoration plan.

Six Mile Run Priority Treatment Systems, Estimated Treatment Costs and Time Frame			
Discharge	**Treatment system**	**Cost**	**Time Frame**
SX8A-D1, SX8A-D2	Wetland	$14,000	2007
SX2B-D1	Limestone pond	$7,000	2007
SX2B-D2	Wetland System	$14,000	2008
SX2-D1	Limestone channel	$45,000	2008
SX2-D2, SX2-D3, SX2-D4	Wetland system	$30,000	2009
SX2-D5	Limestone pond	$45,000	2009
SX2-D6, SX2-D7, SX2-D8	Vertical flow wetland & limestone pond	$45,000	2010
SX2-D9	Limestone pond	$21,000	2010

Sandy Run
Treatment of discharges in the Sandy Run watershed started in 1999, with projects in the headwaters treating discharges SA0-D1, SA0-D2 and SA0-D3. Treatment of all the remaining discharges in Sandy Run watershed was estimated to cost $3.1 million in 2001. Additional costs for operation and maintenance were estimated at $1.8 million. Treatment options for Sandy Run continuing down from the headwaters will be reevaluated after priority treatment projects are completed on Six Mile Run and Longs Run.

Six Mile Run Priority Treatment Systems, Estimated Treatment Costs and Schedule			
Discharge	**Treatment system**	**Cost**	**Time Frame**
SA0-D4	Vertical Flow Wetlands & Removal of coal refuse material	$192,000+	2011
SA0-D5	Vertical Flow Wetlands	$204,000	2012
SA0-D6	Limestone Pond	$12,000	2013
SA0-D7	Vertical Flow Wetlands	$8,000	2013
SA0-D8	Vertical Flow Wetlands	$8,000	2013
SA0-D9	Vertical Flow Wetlands	$20,000	2013
SA0-D10	Vertical Flow Wetlands	$88,000	2014
SA0-D11	Anoxic limestone drain	$245,000	2014
SA0-D12	Wetland	$5,000	2015
SA0-D13	Anoxic limestone drain	$6,000	2015
SA0-D14	Vertical Flow Wetlands	$1,312,000	2016
SA0-D15	Anoxic limestone drain	$15,000	2017
SA0-D16	Limestone pond	$5,000	2017
SA0-D17	Vertical Flow Wetlands	$852,000	2018
SA0-D18	Limestone pond	$6,000	2019
SA0-D19	Limestone pond	$6,000	2019
SA0-D20	Limestone pond	$5,000	2019
SA6-D1	Vertical Flow Wetlands	$24,000	2020
SA6-D2	Limestone pond	$14,000	2020
SA6-D3	Vertical Flow Wetlands	$12,000	2020

Treatment of several of the Sandy Run projects will be difficult, which is reflected in the projected costs. Not enough space is available for proper treatment of SA0-D14, D17, D18, and D19. By the time these projects are ready to be considered for design and construction, new technologies may be available that would provide efficient treatment in the available space.

Sources of Funding

Broad Top Township plans to continue applying for 3 grants per year until all the projects are completed. Most likely sources of funding are PA DEP Growing Greener Grant Program and EPA Section 319. Any shortfalls from these sources could be supplemented through grants from the US Office of Surface Mining (OSM). OSM can provide up to $150,000 per project as supplemental money for construction for projects funded by other sources. Any state sources of funding received can be used as match money for the ongoing sewage projects funded by the US Army Corps of Engineers.

The following grant applications were submitted to Growing Greener Round 6 in 2004:

- $28,680, to treat discharges SX8A-D1 and SX8A-D2, in the headwaters of Brewsters Hollow Run
- $78,285 to treat discharge SX0-D1 in headwaters of main stem Six Mile Run
- $151,239 to treat discharge SX0-D2 in upper main stem Six Mile Run

If these grants are not funded, applications will be resubmitted next year. If one or two are funded, the remaining proposals plus the next additional proposals on the schedule will be submitted the following year.

Completed or Funded Projects

- Early projects completed in the study area include passive treatment at North Point and a diversion well at Shreves Run constructed with 319 funding through the Western Pennsylvania Coalition of Abandoned Mine Reclamation (WPCAMR). Other partners included DEP District Mining Office, Broad Top Township, and the Bedford County Conservation District. The diversion well had problems from its early days and is no longer operational. The variations in stream flow combined with requirements for almost daily O&M made consistent water quality extremely difficult to obtain. Even when operated successfully the in stream pH effect was only one tenth of a point which did little to buffer a stream with an average pH of 3.1.
- Passive treatment systems for discharges SA0-D1, SA0-D2 and SA0-D3 in the headwaters of Sandy Run were constructed by the Bedford, Fulton and Huntingdon Solid Waste Agency in cooperation with the DEP Bureau of Abandoned Mine Reclamation.
- The first restoration project within the Longs Run watershed, completed in 2001, was the relocation of surface runoff around an abandoned spoil pile and discharge LR0-D10 using Growing Greener Grant funds. Work continued with the recent completion of construction of passive treatment systems for Discharges LR0-D3, D4, D5, D6, D7, D8 and D9.

<u>Land Reclamation</u>
A number of reclamation projects have already been completed in the watersheds (See Table 2 of the 2001 Restoration Plan). Eight sites along Six Mile Run and five sites along Sandy and Longs Run watersheds were reclaimed through the Rural Abandoned Mine Program (RAMP) administered by the USDA Natural Resources Conservation Service.

The DEP Bureau of Abandoned Mine Reclamation (BAMR) has also completed six reclamation projects in the study area. The most recent BAMR project involved reclamation of an abandoned surface mine at North Defiance in 2001. In addition, the US Office of Surface Mining (OSM) has completed mine collapse and washout restoration on two locations along T549 (Landfill Road) in the Sandy Run watershed.

As of June 2004 the following grants had been received:

- Growing Greener Grants Received:
    - Broad Top Township received a Growing Greener Grant in 2001 for $19,680 to redirect surface runoff around an abandoned spoil pile and discharge LR0-D10.
    - Broad Top Township received a second Growing Greener Grant in 2002 for $140,079 to treat seven discharges in the headwaters of Longs Run, LR0-D3 through LR0-D9.
    - In 2003 Broad Top Township received a Growing Greener grant for $187,310 to treat SX3-D1, D2, and D3 on Shreeves Run, called the Finleyville project.

- US EPA 319 grants:
    - $227,619 was received in 2003 for treatment of six additional AMD discharges, LR0-D2, LR0-D10, LR0-D11, LR0-D13, LR0-D14, and LR0-D15. These 6 discharges were determined to contribute 5 tons of iron per year and 1/2 ton of aluminum per year. Construction of these projects along with limestone dosing at selected locations should complete the restoration priorities for the Longs Run watershed and should significantly improve the water quality of Longs Run by reducing iron and aluminum loading and increasing pH.

Milestones to Determine if Implementation Measures are Being Met

The implementation projects planned for each year will serve as the implementation milestones of the restoration plan. Broad Top Township holds regular monthly meetings to discuss the progress of their watershed restoration activities. The progress of the planned watershed restoration and grants is discussed at those meetings. Yearly meetings between the Township and the DEP Cambria District Office Project Advisors will be scheduled to determine if the implementation schedule milestones are achieved and to chart progress of projects. If the milestones are not achieved due to lack of funding, weather, or other unforeseen factors that might prevent construction of all of the scheduled projects in a given year, the group will continue to follow progress of the projects and reschedule uncompleted projects for the following year.

When construction of each project is completed, the evaluation process will begin and the conceptual designs of the next project will be reconsidered to determine if changes should be made prior to submittal of a proposal for the next grant.

Partnerships, Pubic Information and Participation

For over twenty years, the Broad Top Township supervisors have taken the lead in supporting and participating in numerous AMD and sewage projects. Through these efforts they developed partnerships and gained the support of numerous agencies, organizations, and the community.

Broad Top Township initiated a joint Citizens Watershed Advisory Committee with Coaldale

Borough to determine its watershed priorities and activities in 1990. Over the years the advisory committee's membership has varied from 15 to 30 interested local residents in addition to various technical advisors. The advisory committee functions as a local watershed association in addition to its formal governmental role. It initially concentrated on sewage pollution issues while it completed the Act 537 Sewage Plan. As the Township started to implement the Sewage Plan the advisory committee has concentrated most of its time on AMD issues in the watersheds. The advisory committee supervised the work for the 2001 AMD Assessment and Remediation Plan and is responsible for recommending future priorities in watershed restoration. The advisory committee and other volunteers are working with the Township to implement the watershed priorities.

All the monthly meetings of the advisory committee are announced and open to the public. When there are particularly important issues it has held advertised public meetings attracting over 200 local residents. In 2003 it started holding an annual watershed festival in cooperation with most of the area's environmental resource agencies and organizations. In addition to regular local newspaper coverage of its meetings and activities the advisory committee's activities are highlighted in the Township's Newsletter which is mailed to all local addresses and other interested parties. In 2004 the advisory committee secured the services of an OSM/VISTA intern to help expand educational and public involvement in watershed activities.

Long committed to the restoration and improvement of the area's water quality**,** the advisory committee has sought to find innovative and cost effective ways to treat AMD sites. The Township officials have supported and participated in numerous State and Federally funded programs and projects which have eliminated many health and safety hazards to the area's residents and environment that were a result of past coal mining activities and practices.

The Township performs its pre and post construction water testing in cooperation with teachers and students of the Tussey Mountain High School. In addition, the Township maintains close association with the Bedford County Conservation District, the Bedford County Planning Commission, the Bedford County Commissioners, State and Federal Legislators, the US Army Corps of Engineers, the Western Pennsylvania Coalition for Abandoned Mine Reclamation and DEP. Since construction work has been done by Broad Top Township with Township employees, the Township has been able to keep sewage construction and AMD restoration costs low.

Monitoring and Evaluation of Treatment Systems and Stream Water Quality

Streams or stream segments will be assessed after each implementation project is completed. The Township, the watershed committee, the Township consultant, and the Cambria DMO and other DEP staff will meet each year to review the water quality data, evaluate the performance and effectiveness of the completed treatment systems, and the load reductions achieved. If the restoration and performance goals are not being met, the meeting attendees will discuss how the treatment systems may be modified so that restoration goals may be better achieved.

The watershed committee samples inflow and outflow of the installed treatment systems on discharges to determine their efficiency and if expected loading reductions are being achieved. Quarterly sampling is planned; but if problems arise with availability of funds or volunteers to monitor, sampling will be conducted at least twice a year. The watershed committee will continue to monitor treatment systems that will be installed in the future. The data collected after implementation is completed in each watershed will be evaluated and further implementation needs will be established to attempt to achieve further load reductions and restoration of aquatic life

Treatment systems will continue to be monitored on a regular basis. If performance of individual treatment systems is less than expected, the township or watershed committee will adjust the treatment systems as necessary to try to improve results. Flushing of accumulated metals in many of the passive treatment systems is through siphons that automatically operate when the water levels reach a certain height. The siphons will be examined regularly to be certain of proper operation. Manual flushing is also possible if deemed necessary. If additional metals reductions or alkalinity increases are determined to be needed at some systems, an evaluation of the design parameters will be made and changes such as enlargement of treatment ponds or adding treatment or settling ponds could be made. The discharges with higher volumes or in difficult locations will be harder to treat and may not achieve the desired load reductions. If this is the case, then alkaline addition through means other than passive treatment may be necessary.

An evaluation of the instream aquatic life was conducted in spring-summer 2004 by DEP Bureau of Mining and Reclamation. Evaluation of aquatic life and instream sampling for chemistry will continue on a regular basis, at one year or six month intervals, depending on funding and people available.

As of the June 11, 2004 sampling round, most installed treatment systems were performing well. All systems were significantly reducing metals concentrations and many were also significantly raising the pH of effluent water. Some areas of all three streams have significant layers of either iron or aluminum precipitate. These precipitates could slow the recovery of aquatic life, especially macroinvertebrates, in the affected stream segments. The amount of time necessary to scour the remaining metals from the stream substrate is hard to gauge. Two significant flooding events occurred in both 1996 and 2004, which scoured out precipitated metals. The scouring will be temporary since additional metals will accumulate downstream of untreated discharges.

Treatment of all the priority discharges in Longs Run is expected to achieve the TMDL endpoints. Treatment of all of the listed discharges in Six Mile Run watershed may not achieve the load reductions in the TMDLs. Passive treatment systems on the smaller, lower flow discharges are expected to produce discharge parameters at or above water quality criteria.

Additional Activities Planned to Achieve Goals of the Restoration Plan

- Continue to use state and federal funding programs to treat priority AMD sites. Some sources of funding for remediation efforts include PA DEP Growing Greener Grant Program; EPA Section 319; Title IV, Surface Mining Control and Reclamation Act; 10% Set Aside; US Army Corps of Engineers; and US Office of Surface Mining (OSM).
- Identify areas for remining for reclamation of abandoned mine lands that could help reduce associated AMD discharges. One potential area is at SA6-D1 and SA6-D2 on State Game Lands #261.
- Work with property owners to develop remediation plans on priority sites. Promote use of the Environmental Good Samaritan Act that protects property owners from liability for remediation projects on their land to encourage property ownership cooperation.
- Work towards identifying interconnections between discharges and deep mines in the area. Use methods such as associating water quality data with specific coal seams to link discharges with deep mine interconnections. The information will aid in development of more detailed treatment and remediation plans and will assist in future remining and permitting efforts.
- Complete a full year's monitoring of newly discovered discharges SX0-D15, SX0-D16, SX2-D9, SX3-D10, LR0-D15, and at SX0-D3, where samples were collected in the wrong location.
- Monitor instream and discharges between MP 53 and MP 57 along Six Mile Run, and between MP 69 and MP 64 along Sandy Run to verify if additional AMD sources may be present. Comparison of instream data taken by PSU and data taken by Broad Top Township indicated potential additional sources of metal and acidity at these segments. Further monitoring of the discharges between these segments and instream will verify if other potential sources exist and should be conducted.
- Continue monitoring all discharges for flow, field pH, and field conductivity on a quarterly basis if possible and if not at least twice a year. Compare new data with data taken previously to update priorities and cost estimates.
- Complete biological assessments throughout the watershed annually or biannually to track improvements in water quality and stream health after remediation projects are implemented for future comparison. Select stream water quality and biological monitoring points for each project to sample before and after remediation to track progress.
- Use students and other potential volunteers to assist with continued water quality monitoring efforts within the watersheds.
- Continue coordinated monitoring efforts in order to collect the most comprehensive data on the watersheds.
- Continue and expand upon existing outreach and education activities regarding abandoned mine drainage, and clean-up efforts of the Six Mile, Sandy and Longs Run watersheds. Outreach and education activities should include:
    - Continued coverage of the assessment and AMD remediation efforts in the Broad Top Township newsletter, local newspapers and presentations at local schools
    - Help local schools develop and integrate AMD topics in the curriculum
    - Use students, and other potential volunteers to assist with continued water quality monitoring efforts within the watersheds

    - Involvement of legislators and media during special events or ceremonies related to milestones reached in restoring Six Mile, Sandy and Longs Run.
- Continue to seek funding for, and continue construction of, community and on-lot sewage systems by the Township to implement the Act 537 Sewage Plan.

APPENDIX A. BROAD TOP WATERSHED MAPS

Figure 1. Watershed Map

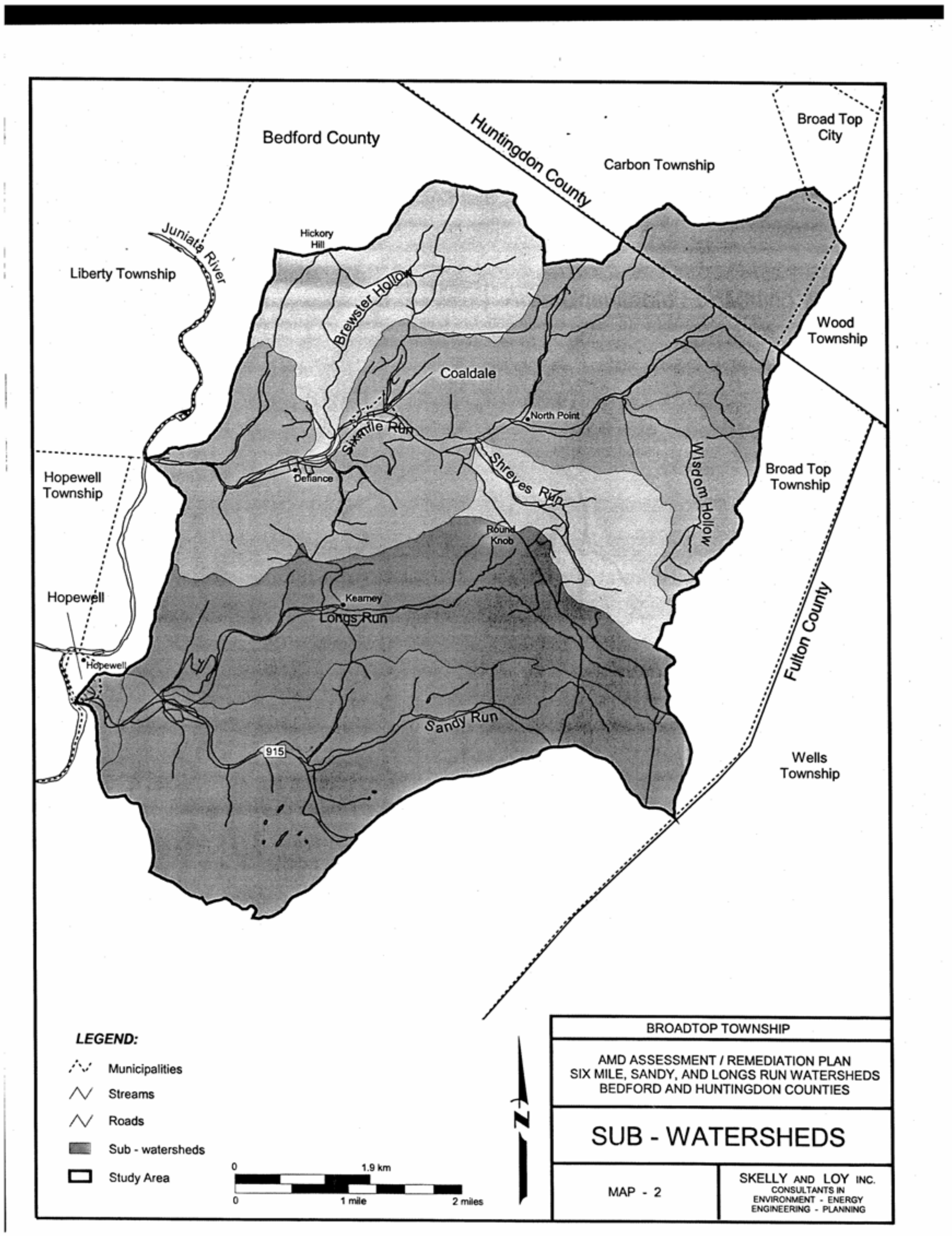

Figure 2. Discharges and Monitoring Points.