Preface

The Huff Run Watershed Coordinator, Maureen Wise, has prepared this second edition of the Huff Run Watershed Plan. Kleski Environmental Consulting originally prepared the document. Both editions were written with input from members of the Huff Run Technical Advisory Committee, Federal and State Agencies, members of the partnership and the public. In addition, excerpts from the AMDAT Plan prepared by Gannett Fleming are included. The plan follows the outline for Watershed Plan Development as published within A Guide to Developing Local Watershed Action Plans in Ohio and it's Appendix 8 by the OEPA.

Contact Information for Coordinator:
Maureen Wise
Phone: 330-859-1050
Email: maureen@rurlaction.org
Postal Address: PO Box 55, Mineral City, Ohio 44656
Physical Address: 8728 High Street NE, Mineral City 44656

Acknowledgements

Many individuals assisted in the process of preparing this document. Thank you to the following for their help in preparing this report and its predecessor:
Dave Agnor, Office of Surface Mining, Columbus, Ohio
Mark Bergman, Ohio EPA, Twinsburg, Ohio
Kevin Bratcher, ODNR, Division of Mineral Resources Management, Salem, Ohio
Scott Briggs, Tuscarawas Soil and Water, New Philadelphia, Ohio
Carroll SWCD/Staff, Carrollton, Ohio
Sandy Chenal, Crossroads RC&D, New Philadelphia, Ohio
Leah Graham, Mount Union student intern, Dover, Ohio
Jim Gue, ODNR, Division of Mineral Resources Management, Salem, Ohio
Marlene Harsha, Huff Run Watershed Restoration Partnership, Mineral City, Ohio
Huff Run Watershed Restoration Partnership, Inc.
Dan Imhoff, Ohio EPA, Logan, Ohio
Mark Jukich, Muskingum Watershed District, New Philadelphia, Ohio
Christopher Kiehl, Carroll County Health Department, Carrollton, Ohio
Jennifer Chapman Kleski, Kleski Environmental Consulting, Dover, Ohio
Aaron Lantz, ODNR Division of Soil and Water Conservation, Columbus, Ohio
Owen Lenkner, Carroll NRCS, Carrollton, Ohio
Dan McMillen, ODNR, Division of Wildlife, Akron, Ohio
Deba Mohler, USDA Natural Resources Conservation Service, Columbus, Ohio
Paul Moser, ODNR, Division of Wildlife, Akron, Ohio
Roxane Palone, USDA, Forest Service, Morgantown, West Virginia
Wendy Scott, Crossroads RC&D Council, Inc., Bolivar, Ohio
Mark Smith, ODNR, Division of Mineral Resources Management, Salem, Ohio
Cheryl Socotch, ODNR, Div. of Mineral Resources Management, New Philadelphia, OH
Terri Sponaugle-Schrock, Huff Run VISTA, Mineral City, Ohio
Mike Steinmaus, Rural Action, Trimble, Ohio
Ed Taggart, Huff Run Watershed Restoration Partnership, Mineral City, Ohio
Steven Wahl, Huff Run Watershed Restoration Partnership, Inc., Sandyville, Ohio
Dr. Lin Wu, Mount Union College, Alliance, Ohio

I Introduction

Beginnings

The purpose of the Huff Run Watershed Plan is to document the results of a process that has identified water resource problems and developed strategies designed to improve those resources within the Huff Run Watershed. The process of documentation included: data collection, investigation, field review and public meetings. Potential strategies were devised to improve resources within the watershed, which incorporated the public needs. This document represents a beginning**.** It is intended to be a dynamic work plan that will change as more information becomes available, and as resource improvements are made.

This process began with the organization of the Huff Run Watershed Restoration Partnership. In August of 1996, a small group of local citizens from the Mineral City area began meeting monthly with the goal of improving water quality in Huff Run. This group, in its first year, was successful in obtaining a $500 Citizen's Action Grant; starting a watershed newsletter (*Watermarks*), developing a mission statement, filing for incorporation as "The Huff Run Watershed Restoration Partnership Inc." and receiving a commitment from the USGS to install a gauging station.

In order to proceed with the development of a Watershed Management Plan, the group requested the establishment of the Technical Advisory Committee (TAC), calling on the expertise of various individuals from Federal, State and local governments and organizations. The TAC first met on October 15, 1997 and began the process of collecting data about the watershed, which would be incorporated within the Huff Run Watershed Plan.

In order to include the participation of the public in this process, a public meeting was held on July 8, 1998 in Mineral City. The purpose of this meeting was to enlist the participation of the public in the evaluation of water quality issues within the watershed. As a result of this process, the public's perception of water quality issues were defined and prioritized. For the second addition of the Watershed Management Plan, a similar meeting was held on March 29, 2005 to again procure public participation.

In addition to the definition of the public perception of water quality issues, ODNR, Division of Mineral Resources Management contracted Gannett Fleming to evaluate water quality within the watershed and to provide recommendations as to the most effective types of treatment for the most severe acid mine drainage discharges. This information was provided in the document prepared by Gannett Fleming, "Acid Mine Drainage Abatement and Treatment Plan", excerpts of which are included within Huff Run Watershed Plan and can be found on the Huff Run website.

With the prioritization of water quality issues within Huff Run by both the public and professionals, the Partnership began the task of selecting the best approach to improving water quality within the watershed…

II Defining Huff Run

General Information

The Huff Run Watershed is located in the Northeast Hills Region of Ohio in the counties of Carroll and Tuscarawas. The watershed covers approximately 14.7 square miles. Huff Run originates in northwest Carroll County and flows southwesterly into

Tuscarawas County where it empties into Conotton Creek, a tributary of the Tuscarawas River. The total stream length is approximately 9.9 linear miles. Generally, the watershed area has a relief of 150 to 250 feet.

Huff Run's USGS HUC is 050-40001-080-050. The latitude/longitude coordinates of Huff Run's confluence into the Conotton Creek are 40°35'16"N, 81°22'32"W. The beginning of stream is at 40°138'34"N, 81°13'09"W. (See Figure 1: Huff Run Watershed Location/ Topo Map)

Huff Run is included in Conotton Creek's Water Resource Inventory 305(b) report. Its segment number is OH12-2. This report can be found as Appendix #1. According to this report, Huff Run has an aquatic life use designation of "Warmwater Habitat," a recreational use designation of "Primary Contact" and a "Public Water Supply" use designation of both "agricultural" and "industrial." The 305(b) Report identifies "pH," " siltation," "metals" as the causes of impairment and "acid mine drainage" and "mine tailings" as the source of the impairment. It also lists 2.90 miles in full attainment of its aquatic use attainment in good condition. Two miles are listed as fair quality and five miles listed as poor quality with a total of seven miles not in aquatic use attainment. The designated uses are defined as follows:

Warmwater Habitat: Water capable of supporting balanced reproducing populations of warm water fish and associated vertebrate and invertebrate organisms and plants on an annual basis.

Primary Contact: Suitable for full body contact recreation. The stream must have at least one pool of 100 square feet greater than a depth of three feet at quantity.

Agricultural and Industrial: *Agricultural:* Suitable for irrigation and livestock watering without treatment. *Industrial:* Suitable for industrial and commercial use with or without treatment.

Chemical water quality has been severely impacted by the discharge of acid mine drainage from the unreclaimed mine areas and from the deep mined areas. Studies reveal surface water quality within Huff Run is characteristically lower in pH, higher in specific conductance and higher in concentrations of total and dissolved iron, manganese, and aluminum. These water quality characteristics are indicative of water affected by mine runoff.

Huff Run consists of approximately 72 subwatersheds. The watershed, as a result of its land use history, can be divided into three sections. The eastern section extends from State Route 542 northeast to the headwaters and the primarily land use is agriculture and forest. The central section extends from State Route 542 to State Route 800. This portion of the watershed consists largely of unreclaimed coal refuse piles and surface mine spoil (both forested and unforested), abandoned deep mine portals, and water-filled impoundments. Portions of this area have been mined recently. The western section extends from State Route 800 down to Huff Run's confluence with Conotton Creek. This section consists of a mixture of unreclaimed coal refuse piles and surface mines, abandoned deep mine portals, and water-filled impoundments. Portions of this area have been mined recently. The western section, closest to Conotton Creek, lies within the inundation area of Dover Dam and is thus very susceptible to flooding.

A United States Geological Survey Stream Gauge (number 03121850) is located on Huff Run at Mineral City just off County Road 90 (New Cumberland Road). The gauge began recording data in November 1997. The mean flow between then and

September 30, 2004 was 14.6 cfs. Average daily flows range from .073 cfs on August 20, 2003 to1860 cfs on September 9, 2004. All of the gauge data is available from the USGS and is also available in "real time" on their website (http://www-oh.water.usgs.gov).

Mineral City is the only incorporated town in the watershed. The communities of Lindentree and Morges are also in the watershed but they are very small and not incorporated. Other political jurisdictions include Sandy Township in Tuscarawas County and Rose Township in Carroll County. State Route 800 is located at the western edge of the watershed connecting Mineral City with Canton to the north and Dover to the south. (See Figure 1: Huff Run Watershed Location/ Topo Map) State Route 542 runs north and south through the eastern portion of the watershed. Tuscarawas County Road 110/Carroll County Road 36 runs east/west through the center of the watershed connecting State Route 800 to State Route 542. In addition to these three main roads, there are also several medium and light duty roads.

Huff Run is located in the Muskingum Watershed Conservancy District and is in both the Carroll and Tuscarawas Soil and Water Conservation Districts along with these county Regional Planning Districts.

There are no Park Districts in the area although there is a Tuscarawas County Park Department Advisory Committee that is considering a Park District in Tuscarawas County. It is unlikely that this will include any land in the Huff Run Watershed. There are no areas in the watershed that have been given any special designations such as national parks or scenic rivers.

None of the neighborhoods in Huff Run Watershed are Stormwater Phase II communities. There are no protected land areas (either public or private).

History

The first recognized settler of Sandy Township was Godfrey Huff who Huff Run was named after. Records show that he was from Bedford County, Pennsylvania. In May 1805 he purchased a tract of 1,000 acres in the southwest corner of the third quarter of Township 10, Range 1, or the southwest corner of Sandy Township, embracing also the corner of Lawrence across the river from Godfrey Haga, for $1,062.50. Old settlers have assigned the year 1803 as the date of his emigration to this tract, but historical societies have found evidence that he was here in 1801. Mr. Huff was a man of large frame, and wore the broad-brimmed hat and the garb of the Dunkard sect, of which he was a member. He is said to have raised many hogs on the river bottoms, driven them to Detroit, Michigan for sale, and used the proceeds to pay for his land. He had five sons--Michael, Henry, Samuel, Frederick and Andrew. Most of the boys subsequently emigrated to Iowa. Godfrey Huff died in Sandy Township about 1825.

Mineral City owes its origin to the construction of the Tuscarawas branch of the Cleveland and Pittsburgh, and The Valley Railroads. The village founders, A. Davis and G. Lechner, had an agreement with the railroads officials to establish a train station. In 1853, Davis and Lechner prepared the layout for Mineral City, which consisted of forty lots between Huff Run, and Cleveland and Pittsburgh Railroads. Davis actually built the first house and managed the first store in Mineral City. A post office was established in 1854 and Davis was appointed postmaster.

In approximately 1865, the town began to grow, a growth that was attributed to mining, and in fact was some of the first coal mining in Ohio. Population in 1870 was 175, by 1880 it was 642 and by 1889 it was 900.

The first firebrick works was built in 1872. In 1876, a furniture factory was built. By legislative action, Mineral City became a special school district in 1877 and was incorporated in 1882.

With the loss of the mining industry and the manufacturing base in this small community, the population has declined.

Mineral Extraction History

Mining History

Coal mining started in Tuscarawas County in 1810 and in Carroll County in 1853. Early coal mining in Tuscarawas County developed along the Tuscarawas River and its tributaries. Production levels remained modest until the completion of the Ohio and Erie Canal in 1833. By 1835, the first shipments of coal from mines in Tuscarawas County were arriving in Cleveland. Early coal mining developed in response to the construction of railroads.

When coal mining began along Huff Run is not known, but the opening of the Sandy and Beaver Canal was expected to stimulate development of the mineral resources in the vicinity of Mineral Point (now known as Mineral City), Magnolia, Waynesburg, Malvern, and Minerva. Construction of the Sandy and Beaver Canal began in the Fall of 1834. Work on the canal was slow due to the digging of two tunnels (one 600 yards in length and one 1,060 yards in length). The canal was still under construction when a financial depression interrupted the effort. Work resumed in 1844 and the canal opened for traffic in 1850. The Sandy and Beaver Canal started in Lawrence Township opposite Bolivar and proceeded eastward through Lawrence and Sandy Townships (Tuscarawas County) and into Stark and Carroll Counties. It was about this time when underground coal mining started in the vicinity of Mineral Point. Unfortunately, on April 12, 1852, Cold Run Reservoir gave way ruining portions of the canal that, due to a lack of revenue, were not repaired. However, portions of the eastern and western ends of the canal were used for many years. The canal was finally abandoned in 1884.

Although the Sandy and Beaver Canal failed to stimulate development of the local mineral resources, the railroads were quite successful. The Tuscarawas branch of the Pennsylvania Railroad system was built during the second half of 1854. This 32-mile railroad roughly paralleled the course of Sandy and Beaver Canal through Minerva, Malvern, and near Magnolia, and connected with the Pennsylvania mainline at New Philadelphia (Tuscarawas County) and Bayard (Columbiana County). The construction of a tunnel (about 1,000 feet in length) located on the line of the Tuscarawas branch of the Pennsylvania Railroad about 1 ½ miles northeast of Mineral Point revealed three seams of coal, two of which (Lower Kittanning and Middle Kittanning) were of mineable thickness. A second railroad, the Valley Railroad, later known as the Cleveland Terminal and Valley Railroad also was built and passed through Mineral Point connecting Cleveland and Valley Junction. Sidings of the Valley Railroad were built to serve the mines along Sandy Creek and Huff Run.

Shortly after the completion of the Tuscarawas Branch of the Pennsylvania Railroad, pair of mines called the Tunnel Mines were opened. Although some underground coal mining for home use probably occurred in the vicinity of Mineral Point

prior to the construction of the railroads, the Tunnel Mines were the first large-scale (more than ten miners) underground mines in the area. By 1870, in addition to the Tunnel Mines, there were two mines operated by C.E. Holden at Mineral Point and one mine operated by John Black on the south side of Huff Run. By the early 1880's, there were at least twenty mines producing Lower Kittanning and Middle Kittanning coal in the vicinity of Mineral Point and along Huff Run, and scores of other mines along the Tuscarawas branch of the Pennsylvania Railroad. The Tunnel mines, as some of the other mines in the area, were worked out by the early 1900's. By the early 1930's most of the mines along Huff Run were abandoned. The last underground coal mine in the area to cease operation was the Magnolia Mine located in Rose Township, Carroll County. This mine was abandoned in 1946.

In addition to coal, clay also was mined underground at Mineral Point and along Huff Run. At Lindentree in Carroll County, the Hoover Coal and Clay Company mined and processed Lower Kittanning clay for general refractory purposes. Also, the Federal Clay Products Company mined the Lower Kittanning clay for use at its two firebrick plants at Mineral City. In all, some 26 underground mines were operated within the watershed.

Subsequent to World War II, in conjunction with the development of large earth moving equipment, surface or strip mining supplanted underground mining as the dominant method used for mineral extraction in the Ohio coalfields. The strip mining process involves the removal of the overlying soil and rock strata in order to expose one or more coal seams, which are then removed. Until the passage of strict regulations in the 1970's, the removed material was left in an unreclaimed state. The remaining spoil banks and water impoundments often become the source of contaminants such as sediment and acid mine drainage. This situation is evident throughout much of the Huff Run drainage area, beginning just west of State Route 542 and extending to State Route 800. This portion of the watershed has been nearly 100% affected by mining.

Present and future coal mining trends in the Huff Run drainage indicate a continuous extraction of the mineral resources. Currently, the area has approximately 650 acres under permit or with a permit application for coal mining. Today's mining laws, however, should prevent the environmental follies evident in past mining. The existing State and Federal mining regulations can provide incentives for reclamation of abandoned mine sites in the course of an active mining operation.

Oil and Gas

Oil and gas exploration began in the Huff Run Watershed in the early 1900's. File records at the Ohio Department of Natural Resources, Division of Geological Survey indicate that the Berea Sandstone, approximately 1,200 feet below the surface, was the target of early exploration efforts. Four exploratory dry holes were drilled to the Berea Sandstone in the Huff Run Watershed in Rose Township of Carroll County, from 1917 through 1918.

In 1953, oil and gas were discovered in the East Canton area, approximately 5,200 feet below surface in the "Clinton Sandstone." Active drilling and development began in the mid 1960's and continues today. The East Canton Consolidated Field has a proven productive area of approximately 125,000 acres in a four county area that includes the Huff Run Watershed. Map records indicate that there are approximately 138 producing and 30 plugged "Clinton" wells in the Huff Run Watershed with 18 Oil

and Gas companies operating these wells today (see Figure 2: Huff Run Oil and Gas Wells and Appendix 8 for correlating information). Ultimate recoverable production per well averages approximately 150 million cubic feet of gas and between 28,000 and 63,000 barrels of oil.

Demographics

The demographic information below was taken from 2000 Census data in related communities and was converted from GIS data into information specific to the Huff Run Watershed.

Table 1: Huff Run Demographic Information

	Huff Run in Tuscarawas County	Huff Run in Carroll County	Total or Average of both Counties
Population	1172	376	1548
Average age	36.68	36.87	36.775
Percent minorities	>1%	>1%	>1%
School age population	221	77	298
Household size	2.72	2.56	2.655

School age children attend Mineral City School District for elementary and the Zoarville School District in Tuscarawas County. If they live in Carroll County, they attend elementary grade school in the Dellroy School District and middle school and high school in the Carrollton School District.

As previously stated, Mineral City is the only incorporated town and its population has declined. Below is its population history since 1900. There has been very little growth in the watershed recently.

Table 2: Mineral City Population from 1900 to 2000

Place/Year	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000
Tuscarawas County	53,751	57,035	63,578	68,193	68,816	70,320	76,789	77,211	84,614	84,090	90,914
Mineral City	1,220	1,032	800	840	820	831	917	860	884	725	841

Income levels and education attainment specific to the Huff Run Watershed area have not been calculated. Below are these levels by township.

Table 3: Township Income Levels compared to Ohio and the Nation

Income Levels	Median household income	Per capita income
Sandy Township (Tuscarawas Co.)	$35,721	$18,745
Rose Township (Carroll County)	$40,640	$16,573
Ohio as a whole	$40,956	$21,003
USA as a whole	$41,994	$21,587

Table 4: Rose Township Education Attainment Levels

School Enrollment, Population 3 years & over	**Number**	**Percent**
Enrolled in school	**422**	**100.0**
Nursery school, preschool	35	8.3
Kindergarten	21	5.0
Elementary school (grades 1-8)	227	53.8
High school (grades 9-12)	92	21.8
College or graduate school	47	11.1
Educational Attainment, Population 25 years & over	**Number**	**Percent**
Enrolled in school	**1,092**	**100.0**
Less than 9th grade	79	7.2
9th to 12th grade, no diploma	83	7.6
High school graduate (includes equivalency)	660	60.4
Some college, no degree	163	14.9
Associate degree	23	2.1
Bachelor's degree	57	5.2
Graduate or professional degree	27	2.5
Percent high school graduate or higher	85.2	--
Percent bachelor's degree or higher	7.7	--

Table 5: Sandy Township Education Attainment Levels

School Enrollment, Population 3 years & over	**Number**	**Percent**
Enrolled in school	**774**	**100.0**
Nursery school, preschool	32	4.1
Kindergarten	46	5.9
Elementary school (grades 1-8)	421	54.4
High school (grades 9-12)	174	22.5
College or graduate school	101	13.0
Educational Attainment, Population 25 years & over	**Number**	**Percent**
Enrolled in school	**2,146**	**100.0**
Less than 9th grade	142	12.1
9th to 12th grade, no diploma	259	12.1
High school graduate (includes equivalency)	1,169	54.5
Some college, no degree	393	18.3
Associate degree	69	3.2
Bachelor's degree	68	3.2
Graduate or professional degree	46	2.1
Percent high school graduate or higher	81.3	--
Percent bachelor's degree or higher	5.3	--

For the full Profile of General Demographic Characteristics from the 2000 Census for both Rose Township in Carroll County and Sandy Township in Tuscarawas County, see Appendices 2 and 3.

Zoning

There is no zoning in Carroll County.

Sandy Township in Tuscarawas County updated their zoning in 2000. The majority of the watershed in Sandy Township is zoned "Agricultural" and "Rural Residential." A small portion of land north of Mineral City on State Route 800 is zoned "Commercial Industrial." There is a flood easement along Huff Run for the Tuscarawas River backflow from the Dover Dam. See Sandy Township Zoning Maps in Appendix 4.

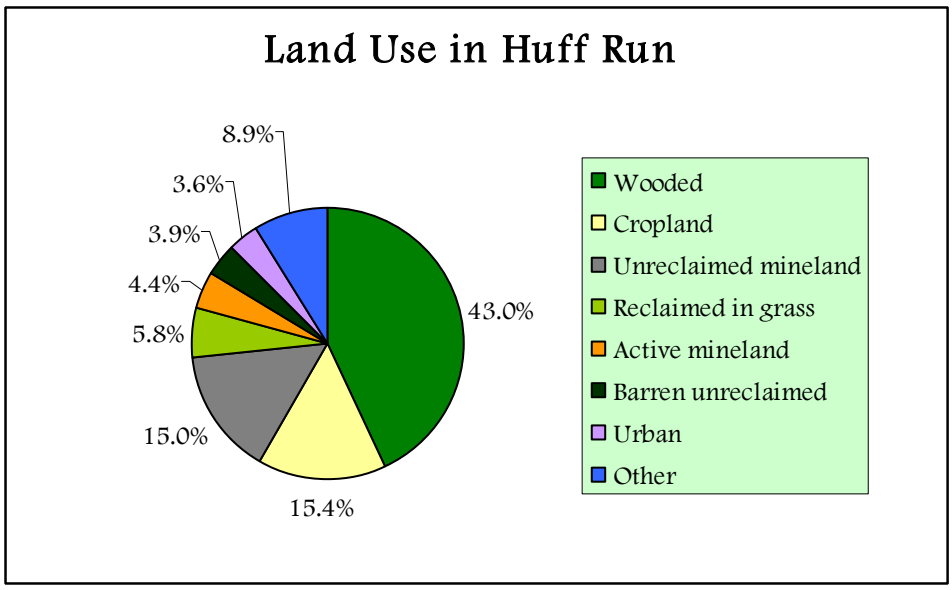
Mineral City completed its zoning in 2002. There are six classifications: "Business," "Residential," "Light Industrial," "Industrial," "Special Residential" and "Special Public." "Residential" and "Special Residential" together take up the most space. "Light Industrial" also holds a large area of land on the south end of the village. Again, there is a flood easement along Huff Run for the Tuscarawas River storage from the Dover Dam. See Mineral City Zoning Maps in Appendix 5.

III Watershed Inventory

Land Use and Ownership

Land use in the watershed is primarily forest at 43%. The remaining land uses include: mineland at 29.1%, cropland at 15.4%, urban land at 3.6%, and other land uses.

Chart 1: Land Use in Huff Run



The watershed encompasses a total of 12,775 acres in two counties. The Carroll County portion totals 9,504 acres and Tuscarawas County portion totals 3,271 acres.

Table 6: Land Uses in the Huff Run Watershed, by acres and percentage

Land Use	Carroll County		Tuscarawas County		Total	
	Acres	Percentage	Acres	Percentage	Acres	Percentage
Cropland	1695	18	275	8.4	1970	15.4
Woodland – Total	5294	56	200	6.2	5,494	43.0

Disturbed Undisturbed	(2720) (2574)					
Reclaimed in grass	622	6	121	3.6	743	5.8
Tree farms	123	1	0	0	123	.9
Active mineland	275	3	275	8.4	550	4.4
Barren unreclaimed	250	3	250	7.7	500	3.9
Urban/town	225	2	225	6.9	450	3.6
Vegetative unreclaimed mineland	0	0	1925	58.8	1925	15.0
Other	1020	11	0	0	1020	8.0
Total	9,504	100%	3271	100%	12,775	100%

Land ownership is predominantly private, although a bulk of the disturbed land (i.e. reclaimed in grass, disturbed woodlands, barren unreclaimed, and active mineland) is industrially owned.

With only 3.6% of the watershed in urban land use, there is very little impervious surface throughout the watershed.

Forest Resources

The largest land use in the watershed is forest, as shown in Table 6. The watershed is 43% forested which covers 5,494 acres. Disturbed forest is pole and sapling sized; composed of red maple, elm, aspen, and cherry. Most of this land is abandoned pasture or land that has been surfaced mined and not properly reclaimed. Land on the ridges that has not been disturbed is mixed oak and hickory. Grapevines are a problem on most of the forested acres.

Agriculture

Agriculture in the Huff Run Watershed is primarily in the upper portion of the watershed in Carroll County, with very little agriculture in the lower portion of the watershed in Tuscarawas County.

The upper portion can be easily divided into two sections. Section one from State Route 542 northeast to the headwaters is primarily agriculture and woodland. This portion contains 1,420 acres of cropland and 13 different soil types. Twenty percent, or 277 acres of this cropland is considered “prime farmland” with an additional 23% or 319 acres considered important farmland. “Important farmlands” can be defined as areas containing soils that can be prime, if drained and/or are below the slope cutoff point for prime farmland.

The major crops produced in this first section are corn, soybeans, small grains, and hay. A common rotation for this area would be 2 years of corn, 1 year of small grain followed by 3 or more years of hay. This will produce acceptable erosion rates on prime and important farmland even if conventional tillage is used. On soils with steeper slopes that are farmed and are not considered prime or important, most farmers have incorporated no-till, reduced tillage, and residue management along with contour strips to reduce erosion rates to acceptable levels.

Section two, downstream from State Route 542, extending into Tuscarawas County to the edge of Mineral City, is predominantly woodland on old mine spoil. There is a limited amount of agriculture to the north and west of Mineral City. This consists of randomly spaced fields and meadows. There are no full time farmers in this portion of the watershed. Crop rotations include, corn, small grains, and long term hay. Some of

the more productive and level cropland near the mouth of the watershed is susceptible to flooding from the backwaters of the Dover Dam. This limits its use as productive farmland.

Non-point source pollution as a result of agricultural activities is not a major concern due to the Soil and Water Conservation District (SWCD) activities within the watershed. In Carroll County, there are four major dairy farms and a few small beef operations. Three of the four dairies have manure management plans, which have storage structures, either installed or planned, and are following approved Natural Resources Conservation Service (NRCS) conservation plans. The remaining agriculture in the watershed is part time farmers with small acreage and little if any livestock. This is particularly true in the lower portion in Tuscarawas County. However, a very high percentage of these farms are following an NRCS approved conservation plan and also work cooperatively with their local SWCDs. Farms with approved conservation plans have erosion rates at or below acceptable levels. This is the result of planned crop rotations and tillage methods to reduce or eliminate soil movement off the field by surface water. These plans are periodically reviewed to ensure compliance. Farms with manure nutrient management plans match the nutrient values in the manure with current soil test levels and yield goals to establish application rates for the manure. This helps to protect against over application of manure that may contaminate surface waters.

The statistics below were estimated by the Tuscarawas County Ohio State University Extension Agent for the Tuscarawas County portion of the Huff Run Watershed in the Fall of 2004.

Table 7: Tuscarawas County Portion of Huff Run Agricultural Stats

Crop Type	
Corn	75 acres
Wheat	25 acres
Permanent Pasture	75 acres
Hay	100 acres
Tillage Practices	
No-Till	240 acres
Full Till	35 acres
Crop Rotations	
Continuous Grass	175 acres
Corn-Wheat-Grass	175 acres
Livestock Inventory	
Dairy Cows	75
Beef Cows	50
Pigs	0
Horses	15
Irrigation	
None	
Chemical Use Patterns	
Most crops are conventional and farmers use	

pesticides
Grazing Patterns
Mostly continuously grazed

The statistics below were estimated by the Carroll County Ohio State University Extension Agent for the Carroll County portion of the Huff Run Watershed in the Fall of 2004.

Table 8: Carroll County Portion of Huff Run Agricultural Stats

Crop Type	
Corn	60 acres
Wheat	25 acres
Permanent Pasture	150 acres
Hay	300 acres
Tillage Practices	
No-Till	475 acres
Full Till	60 acres
Crop Rotations	
Continuous Grass	300 acres
Corn-Wheat-Grass	235 acres
Livestock Inventory	
Dairy Cows	80
Beef Cows	400 (seasonally)
Pigs	5
Horses	20
Irrigation	
None	
Chemical Use Patterns	
Most crops are conventional and farmers use herbicides and pesticides	
Grazing Patterns	
Most continuously grazed 150 acres are under a managed grazing plan	

There is only one farm in Tuscarawas County that is an agricultural district, owned by Orpah G. Fiddler and will be in effect through 2009. In Carroll County, there are five: John Rice, effective through 2007; Daniel and Tracy English, effective through 2006; Dean and Carol Sharver, effective through 2007; R and P Stallman, effective through 2007; and Ray and Lois Frase, effective through 2009.

Geography

Topography and Glacial History

The Huff Run Watershed lies within the unglaciated portion of the Allegheny Plateau. The eastern portion of the watershed consists of gently rolling hills and broad valleys created by water erosion. As Huff Run flows to the southwest, the topography is characterized by steeper, hillier terrain. Local relief within the study area ranges roughly from 150 to 250 feet. The highest elevation is approximately 1,200 feet above sea level forming the southern water divide for the watershed. The lowest elevation, near 880

feet above sea level, is located at the confluence of Huff Run with Conotton Creek. Surface drainage is dendritic which includes many subwatersheds and small tributaries. Natural drainage patterns have been disrupted within unreclaimed strip mine areas impounding water behind spoil ridges. (See Figure 3: Huff Run Topographic Map)

Geological Features

Bedrock of the Huff Run Watershed is composed of alternating layers of sandstone, siltstone, and shale with interstratified thin beds of coal, clay, and limestone of the Pennsylvanian system. The Pennsylvania system can be further subdivided into the older Pottsville series and the younger Allegheny series. The sedimentary strata above drainage is represented by the upper part of the Pottsville series at the lower elevations within Carroll County and the Allegheny series which dominates the remainder of the strata throughout the balance of western Carroll and all of Tuscarawas Counties. (See Figure 4: Typical Stratigraphic Section)

Overall, the structure of the strata is relatively flat and has a regional dip averaging approximately 20 feet per mile to the southeast. Surface coal extraction activities and bore hole drilling in the northern portion of the watershed indicate that this regional dip is occasionally interrupted by local undulatory folds.

Local coal beds include, in ascending order, the Brookville (No. 4), the Lower Kittanning (No. 5), the Middle Kittanning (No. 6), and the Upper Freeport (No. 7). The Brookville (No. 4), located at the base of the Allegheny formation, is exposed at stream level and has not been documented as historically mined within the watershed although evidence appears to dictate otherwise.

The Lower Kittanning (No. 5), which lies midway in the Allegheny formation, averages between 28 to 46 inches thick. The Lower Kittanning has been historically deep mined and surface mined during the mid 1800's through the mid 1900's. For current production and remaining reserves, the Middle Kittanning (No. 6) has the most economic importance.

Soils

The dominant soil in the watershed, upstream from Mineral City and west of Ohio Route 542, is identified as the Bethesda soil series, which has a pH range of 3.5 to 5.5 in the upper 40 inches. However, there are many relatively small areas, identified on Map Sheet # 18 in the *Soil Survey of Carroll County, Ohio* with a "Toxic spoil" symbol, where the spoil material has a pH of less than 3.5. The upper half of the watershed includes few mined areas, and the dominant soils in the area are identified with the Westmoreland and Coshocton soil series. Westmoreland soils are the more common of the two soils, particularly in the steeper parts of the watershed. Coshocton soils are more common in the gently sloping and strongly sloping areas that are common on ridges near the watershed boundary east of Ohio Route 542. Westmoreland soils are better drained and more permeable than Coshocton soils. The somewhat poorly drained Fitchville soils and the moderately well drained Glenford, Coshocton, and Guernsey soils are the most common soil series in the residential areas in and near Mineral City. Most of the non-mined soils of the watershed are rated with a severe limitation for septic tank absorption fields because of wetness, slow permeability, shallowness to bedrock, or slope.

For more information about the soils in the Huff Run Watershed, see the *Soil Survey of Carroll County, Ohio* (including Map Sheets 12, 18, 19, and 25) and the *Soil*

Survey of Tuscarawas County, Ohio (including Map Sheets 10 and 63) as well as the six Soil Maps prepared for the Watershed Plan found in the Soil Maps folder.

There are 12,159.4 acres of highly erodible soils in the Huff Run Watershed. The potential soil loss for this land is three to five tons per acre per year. The remaining 615.6 acres of soil that is not highly erodible sits adjacent Huff Run.

Biological Features

Fauna

The wildlife habitat found in the Huff Run Watershed has been tremendously impacted due to the past mining history found in the watershed. The lack of aquatic species found in certain stretches of Huff Run itself has been well documented. Although not as well documented, terrestrial species were subject to the loss of significant amounts of habitat as well. Significant areas of wildlife habitat within the watershed were disturbed, never restored and still exist with no cover. With their habitat eliminated, the wildlife originally found in the watershed has moved on.

Significant positive impacts on local populations of wildlife could be achieved in this watershed if reclamation projects were implemented to restore the original contours and establish vegetation. Wildlife needs quality food, cover, and water in order to survive and inhabit an area.

The Natural Heritage Data Base maintained by the ODNR, Division of Natural Areas and Preserves was reviewed to determine which rare, threatened or endangered animal species have been recorded in the Huff Run Watershed. No information was found to document the presence of any threatened or endangered terrestrial species of wildlife in the Huff Run Watershed area. Due to the historical impacts of mining in the area, it would be surprising to find any endangered species habitat.

Appendix 6 contains a list of mammals found in Carroll and Tuscarawas Counties. One should assume that these animals would be found in Huff Run.

Flora

Again, the Natural Heritage Data Base, maintained by the ODNR, Division of Natural Areas and Preserves, was reviewed to determine which rare, threatened or endangered plant species have been recorded in the Huff Run Watershed. No information was found to document the presence of any threatened or endangered plant species in the Huff Run Watershed area. Appendix 7 is a list of invasive plant species found in Huff Run.

Water Resources

Climate and Precipitation

The Huff Run Watershed area is cold in the winter and hot in the summer. The winter precipitation, frequently in the form of snow, results in a good accumulation of soil moisture by spring and minimizes drought during the summer. An average of approximately 40 inches of precipitation falls on the watershed annually. Based on a 30-year record from 1961 to 1990, the average precipitation is 3.3 inches per month with January (2.4 in.) typically being the driest month and July (4.5in.) the wettest. There can be extreme variations of these averages. (OSUE fact sheet, Tuscarawas Soil Survey)

Wetlands

Marshes, swamps, and bogs have been well known terms for centuries, but only recently have attempts been made to group these landscapes under the single terms of "wetlands."

The value of wetlands is becoming well known. We know that wetlands help control floodwaters and can filter pollutants. In the Huff Run Watershed, wetlands are especially helpful in removing iron and manganese from acid mine drainage. We also know that wetlands provide habitat for waterfowl and other wildlife, lend support for fisheries and are sanctuaries for rare and endangered species. Many birds, especially waterfowl, raise their young in wetlands. Migratory birds depend on wetlands as a food source. Amphibians and reptiles make wetlands their homes. Salamanders, frogs, and toads, turtles and snakes live in wetlands.

In general terms, wetlands are lands where saturation with water is the dominant factor, determining the nature of soil development and the types of plant and animal communities living in the soil and on the surface. The water creates severe physiological problems for plants and animals, except for those adapted for life in water or saturated soil. Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. Wetlands must have one of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytic (water loving) plants, (2) the substrate is predominantly undrained hydric soil, and (3) the substrate is saturated with water or covered by shallow water at some time during the growing season of each year.

It should be noted that none of the soil series within Huff Run Watershed were identified as hydric (i.e. soils occurring under saturated conditions which are gleyed or have low chroma colors and/or distinct mottling). But several of the soil series are identified as non-hydric soils with hydric components. In order to determine if hydric soils do exist at any one location, a site survey must be completed.

The National Fish and Wildlife Service has conducted a National Wetland Inventory (NWI). The NWI generates and distributes maps and information on the characteristics and extent of wetlands. The NWI maps are excellent sources of general wetland locations, boundaries, and characteristics. However, they are not a substitute for specific onsite information when detailed information is required. The U.S. Army Corps of Engineers, implementing Section 404 of the Clean Water Act, controls dredging and deposition of materials into "waters of the United States, including wetlands". A 404 permit must be obtained prior to disturbing a wetland.

In order to identify wetlands within the watershed of Huff Run, the NWI maps were reviewed. The maps identify two wetland system types, Riverine and Palustrine within the watershed. Riverine systems are associated with river systems and Palustrine systems are associated with marsh systems. The predominant wetland classes identified on the NWI maps are associated with unreclaimed surface mine pit impoundments and the floodplain of Huff Run. They are listed as follows:

1. PEMY – (Huff Run Floodplain) Palustrine; Emergent; Saturated /Semipermanent/ Seasonals
2. P FO/SS IY (Huff Run Floodplain) Palustrine; Forested/Shrub/scrub; Broadleaved deciduous; Saturated/Semipermanent/Seasonals
3. P SS1/EM Y (Huff Run Floodplain) Palustrine; Scrub/Shrub; Broadleaved deciduous; Emergent; Saturated/Semipermanent/Seasonals

4. POWZX (Farm Ponds) Palustrine; Open Water Intermittently Exposed/Permanent; Excavated
5. POWZ (Mining Impoundments) Palustrine; Open Water; Intermittently Exposed/ Permanent.

The riparian area around Huff Run is always changing. Many of these areas become wetlands due to beaver activity downstream. These wetlands serve as very effective buffers to nonpoint source pollution as well as filter out metals from AMD. Once the beaver have moved on and the dams are removed or broken, the wetlands recede.

Other Surface Water

As previously mentioned, the Huff Run Watershed is composed of 72 subwatersheds. Not a single one of Huff Run's many, small tributaries are named and only one tributary is considered perennial. This single tributary runs through Mineral City and is 0.625 mile long. Its watershed is 68.9 square acres and it runs through the Mineral City Park. None of the tributaries are listed in the Gazetteer of Ohio Streams.

Water Supply

Residents within the watershed depend on drilled wells for domestic water supplies. Within Huff Run water supply resources are inadequate because of the poor quality and low quantity conditions. Residents within Mineral City municipal limits are currently on a public water supply.

Ground Water

Aquifers throughout much of the Huff Run Watershed consist mostly of sandstone and thin fractured limestone. The Ohio Department of Natural Resources, Division of Water publication*, Groundwater Resources of Carroll and Tuscarawas County(s),* reports that most groundwater within the Huff Run Watershed is obtained from interbedded sandstone and sandy shales.

The valley along the lower course of Huff Run, before it enters Conotton Creek, is filled with unconsolidated alluvial sediments and can be up to 100 feet thick in certain areas. These alluvial materials consist of interbedded clay to coarse gravel deposits making well development difficult. Wells developed in these deposits can yield in the range of 5 gpm to 25 gpm. Wells developed in the alluvial fill valley are cased through to the bedrock below.

Groundwater quality has been severely impacted as a result of natural resources extraction within the Huff Run Watershed. Acid mine drainage from abandoned underground mines and unreclaimed surface mines seeps down through the more permeable sedimentary rock strata and through fracture zones of the less permeable sedimentary rock strata contaminating groundwater.

In addition, there has been extensive oil and gas well development within the watershed. Although there are more recent laws regulating the disposal of brine to prevent contamination to surface and groundwater, many pre-law oil and gas wells in the area have been abandoned and highly mineralized saline water is still escaping from improperly sealed or cased wells into the groundwater system.

Groundwater sampling generally reveals domestic wells of average to poor water quality. This typically includes higher levels of iron, manganese, sulfates,

dissolved solids, specific conductance, and hardness, all of which reflect water quality characteristics of impacts from natural resource development.

Previous and Current Water Quality Studies

Various studies conducted over the years have targeted low pH and metal loading as the major contributors of habitat degradation. Two studies have also documented bacteria influences on Huff Run. A total of thirteen studies have been identified and the data is presented in the following sections. These studies include:

- 1976 United States Geological Survey (USGS) Study
- 1985 Benatec Associates Study
- 1996 OEPA Intern Staff - Low Flow Data
- 1996 Mount Union College Fall Semester Restoration Ecology Class Macroinvertebrate and Habitat Assessment Data
- 1997 OEPA/Mount Union College - Electrofishing Data
- 1997 Mount Union College Winter Semester Hydrology Class - High Flow Data
- 1998 and 1999 Ohio Department of Natural Resources, Division of Mineral Resources Management Monthly Sample Data
- 1999 Gannett Fleming - AMDAT Study
- 1999 Bacteriological Sampling by Kleski Environmental Consulting
- 2001-2002 Mount Union Senior Project Hester-Dendy study in Reach Six
- 2003-Present Watershed Coordinator and ODNR/MRM - Monthly sampling data
- 2004, 2005 Tuscarawas County Health Department - Bacteria sampling
- 2004 Mount Union Senior - Project Hester-Dendy study

The 1976 USGS Study includes flow measurement and water chemistry data for five stations along the mainstem and 24 sample points along various tributaries. The data was collected in late August 1976. A description of the methods used to evaluate the quality and quantity of the flow is not provided in the study. A small map portrays the sampling locations, allowing a rough correlation of the data to the more recent sampling locations.

The 1985 Benatec Associates Study includes a water quality assessment similar to the USGS assessment, but which includes data for an additional 36 tributaries. The report only indicates that the data was collected in “the late Spring of 1985”. Results are dated March 29, 1985. The report indicates that the quality of the flow was determined through the collection of catch water samples. The report also states that “flow rates are estimated with great difficulty and considerable inaccuracy without weir installation” (Benatec, 1985). A map of significantly more detail than the 1976 USGS map is provided as part of the study. All tributaries sampled are shown. Sampling locations on the mainstem are identified by station number. Sampling locations on tributaries are not identified, but the report indicates that “water samples were taken at tributary entries along the stream” (Benatec, 1985).

The 1996 OEPA Intern Staff low flow data includes flow measurement and water chemistry data for 32 sampling locations throughout the entire watershed. The data was collected in late July and early August. A digest of the report indicates that the quality of the flow was determined through the collection of catch water samples. The

method used to determine the quantity of flow is not indicated. Sampling locations were located using Global Positioning System (GPS) technology.

The 1996 Mount Union College Fall Semester Restoration Ecology Class macroinvertebrate and habitat assessment data includes the collection of data and subsequent compilation of Cumulative Index Values (CIV) and Qualitative Habitat Evaluation Indices (QHEI) for nine mainstem stations. The data was collected in October 1996. The CIV is a measure of the density and diversity of macroinvertebrates present. Two different collection techniques were used. With the kick-net technique, a one-meter square area of streambed upstream of a one-meter square net was "kicked" around to dislodge the invertebrates. All dislodged invertebrates then floated downstream and into the net. With the other technique, artificial habitats (Hester-Dendy samplers) were placed on the streambed at each site during the month of October. In both cases, all invertebrates collected were taken to the laboratory for identification. The QHEI is a "physical habitat index designed to provide an empirical, quantified evaluation of the general lotic macrohabitat characteristics that are important to fish communities" (OEPA). Data collection consisted of manually rating and scoring stream characteristics using best professional judgment.

The 1997 OEPA/Mount Union College electrofishing data includes the collection of data and subsequent compilation of Indices of Biotic Integrity (IBI) and QHEI scores for three stations along the mainstem. The data was collected in June and September 1997. The IBI is a measure of fish species diversity and species populations. Data was collected by electrofishing approximately 0.15 kilometer of stream reach at each site. All stunned species were collected, counted, and identified.

The 1997 Mount Union College Winter Semester Hydrology Class high flow data includes water chemistry data for the same 32 sampling locations identified in 1996. The data was collected in February 1997. A digest of the report indicates that the quality of the flow was determined through the collection of catch water samples. The method used to determine the quantity of flow is not indicated.

The 1998 and 1999 Ohio Department of Natural Resources, Division of Mineral Resources Management data includes monthly sample collections and measurements at prospective project sites. This data focuses on point source discharge sites. The quality of the flow was determined through the collection of catch water samples. The method used to determine the quantity of flow is not indicated.

The 1999 Gannett Fleming Report includes data from a sampling sweep that included eight mainstem and 25 tributary and point source samples conducted on March 1 and 2, 1999. Field testing and measurements were collected for flow, pH, temperature, conductivity, and dissolved oxygen. Tributary and point source flows were measured with a portable flume. Stream flows were measured and calculated using a portable velocity meter. Two grab samples were collected at each sampling location. One sample per sampling location was preserved with acid. Laboratory testing of samples was performed for the following parameters: pH, specific conductivity, total acidity (HOT), total alkalinity, total aluminum, total calcium, hardness, total iron, total

magnesium, total manganese, sulfate, total dissolved solids, and total suspended solids.

Within the AMDAT study, Huff Run is partitioned into eight stream reaches. Based on the characteristics of the watershed and on previous sampling efforts, certain mainstem points were selected as partitions or end points for particular stream reaches. The stream length between each partition is collectively referred to as a reach. These points and their associated reaches are identified in Figure 5: Huff Run Watershed Study Map. Mainstem sampling points are numbered in a top-down manner, whereas the Reaches are numbered in a bottom-up manner.

The 1999 Bacteriological Sampling by Kleski Environmental Consulting tested for total coliform bacteria (found in the intestinal tract of warm blooded mammals – humans, cows) from 12 different sample sites throughout the watershed. Ten of these 12 tested positive for the bacteria. These ten sites were then tested for Escherichia coli (E. coli) (a direct result of fecal contamination). All ten sites were positive.

The 2001-2002 Mount Union Senior Project Hester-Dendy study in Reach Six made use of the two different collection methods used in the 1996 study: the kick-net technique and, artificial habitats (Hester-Dendy samplers). Hester-Dendy samplers were placed in the streambed at sites in Reach Three and Seven for controls along with Reach 6 from June 2001 until August 2001. In both cases, all invertebrates collected were taken to the laboratory for identification. The CIV was used to rate the study's findings. Reach 6 was determined to have poor water quality.

The 2003-Present Watershed Coordinator and ODNR/MRM Monthly sampling data includes monthly sample collections and measurements at prospective project sites (which still focus on point source discharge sites) and completed project sites. The quality of the flow was determined through the collection of catch water samples.

Tuscarawas County Health Department bacteria sampling was conducted in mid August of 2004 with the Watershed Coordinator and the Huff Run intern and again in August 2005. Samples were taken at six sites from the main stem of Huff Run and its tributaries. Three sites showed elevated levels of fecal coliform: from the main stem under the Brass Road bridge, from the tributary running though the ball fields from the Mineral City Sewer Plant and the main stem along Huff Run Road.

The 2004 Mount Union Senior Project Hester-Dendy study again used Hester-Dendy samplers to measure water quality through its inhabitants. Six sites were chosen to study, however due to flooding, the Hester-Dendy traps were only found at three sites. These sites were at HR-0, HR-1 and HR-28, extreme upstream and downstream points. Results showed that the downstream reach still had poor water quality.

Studies' Findings

The 1999 data, in conjunction with the historical data, provides chemical water quality, habitat quality, and biological quality data over seasonal conditions representative of both high and low flow conditions. The historical data serves to augment the more recent data, particularly with its ability to depict long-term mainstem, tributary, and point source trends.

Chemical Water Quality

The two main chemical factors investigated to determine water quality as related to acid mine drainage were pH levels and metal concentrations. There is a dramatic change in water quality west of State Route 542 due to mining activity. See Figure 6: Huff Run Location Map.

pH

The first chemical water quality parameter investigated was pH. Most organisms have a well-defined range of pH tolerance. If the pH falls below this range, death will occur due to respiratory or osmoregulatory failure. Low pH causes a loss of sodium ions from the blood and a loss of oxygen in the tissues. Low pH also increases the permeability of fish gills to water, which adversely affects gill function. Studies have indicated that a pH of 4.5 and a total acidity of 15 mg/L have accounted for complete loss of fish in 90% of streams studied. Concentrations of metals were not taken into account during these studies with respect to lethal toxicity levels. The pH tolerance level of aquatic organisms generally tends to decrease as the concentration of dissolved metals increases. Studies have indicated that a combination of pH less than 5.5 and dissolved aluminum greater than 0.5 mg/L will generally eliminate all fish and most macroinvertebrates (Earle, 1998).

Subwatersheds in Huff Run contributing the greatest acid loads are located at points HR-12, HR-16, and HR-25. (See Figure 7: Problem Area Acid Loads) These areas are discharging greater than 250 lb/day of acid to Huff Run.

The available data from the mainstem of Huff Run indicates that stream pH levels gradually decline below sample site HR-6. Even though stream pH levels gradually decline, the pH rarely reaches a level that would be considered toxic to aquatic life. The data collected to this date only shows the pH dropping below 4.5 and total acidity exceeding 15 mg/L at sample sites HR- 24 and HR-28 in 1976, sample sites HR-28 and HR-32 in 1996, and sample site HR- 32 in 1997. Except for the one instance in 1997, all instances have occurred in the lower reaches during low flow conditions. A pH excursion does not have to be continuous to affect aquatic life. It can be an episodic event and still result in the same level of degradation to the aquatic community as a continuous event.

Metal Trends

The second chemical to investigate when dealing with AMD is dissolved metal concentrations, in particular dissolved aluminum and iron concentrations. Elevated aluminum and iron concentrations can affect both water quality and suitability of habitat. Aluminum and iron can either be found in a dissolved form or in a precipitated form. In the dissolved form, the metals can act as metabolic poisons, mainly by reducing aquatic life pH tolerance levels, increasing carbon dioxide tensions and osmotic pressure, causing synergistic effects, and decreasing oxygen availability as they form precipitates. Once in the precipitated form, they may coat gills and body surfaces (further reducing oxygen transfer), smother eggs, and cover the stream bottom, filling in crevices and rocks. The scouring of the precipitate also increases turbidity that may inhibit fish feeding (Earle, 1998).

Of the two major metals present in mine drainage, aluminum has the most severe adverse effects on stream aquatic life. Aluminum rarely occurs naturally in water

at concentrations greater than a few tenths of a milligram per liter. The addition of aluminum ions compounds the effect of low pH by interacting with hydrogen ions, further decreasing sodium uptake, and increasing sodium loss in blood and tissues. Dissolved aluminum is most toxic to fish at a pH between 5.2 and 5.4, and least soluble between pH 5.7 and 6.2. Precipitated aluminum coats the stream substrate, causing slippery surfaces and making it difficult for insects to maintain position in the current. The deposition of aluminum hydroxide particles on macroinvertebrates blocks surfaces important for respiratory or osmoregulatory exchange. Precipitated aluminum can accumulate on fish gills and interfere with their breathing. Aluminum precipitate also eliminates most of the filter feeders, which normally comprise a major portion of total stream macroinvertebrates (Earle, 1998).

Subwatersheds contributing the greatest acid loads are located at sites HR-16, HR-25, and HR-30 (Reaches 4, 2 and 1 respectively). (Figure 8: Problem Area Metal Loads) These areas are discharging greater than 30 lb/day of metals to Huff Run.

Data indicates an increase in the dissolved aluminum concentration generally beginning around sample site HR-11 (which separates Reaches 4 and 5). A jump from about a tenth of a milligram per liter to several tenths of a milligram per liter generally occurs around sample site HR-11 and generally culminates at over a milligram per liter in the lower reaches. The data also indicates that Huff Run pH values typically fall within and very close to the pH ranges where aluminum is most toxic to fish and where precipitation is most likely to occur.

Iron precipitates at a pH greater than 3.5. Because iron can form precipitates at a lower pH, it is difficult to separate the effect of iron in solution from the effect of low pH. The precipitation of iron hydroxide, however, is a discernible problem. It can clog the gills of fish and cause a complete blanketing of the stream bottom. Iron precipitate particles often cover the bodies of macroinvertebrates which otherwise appear healthy. This allows the assumption that the iron precipitate is less toxic than aluminum precipitate (Earle, 1998).

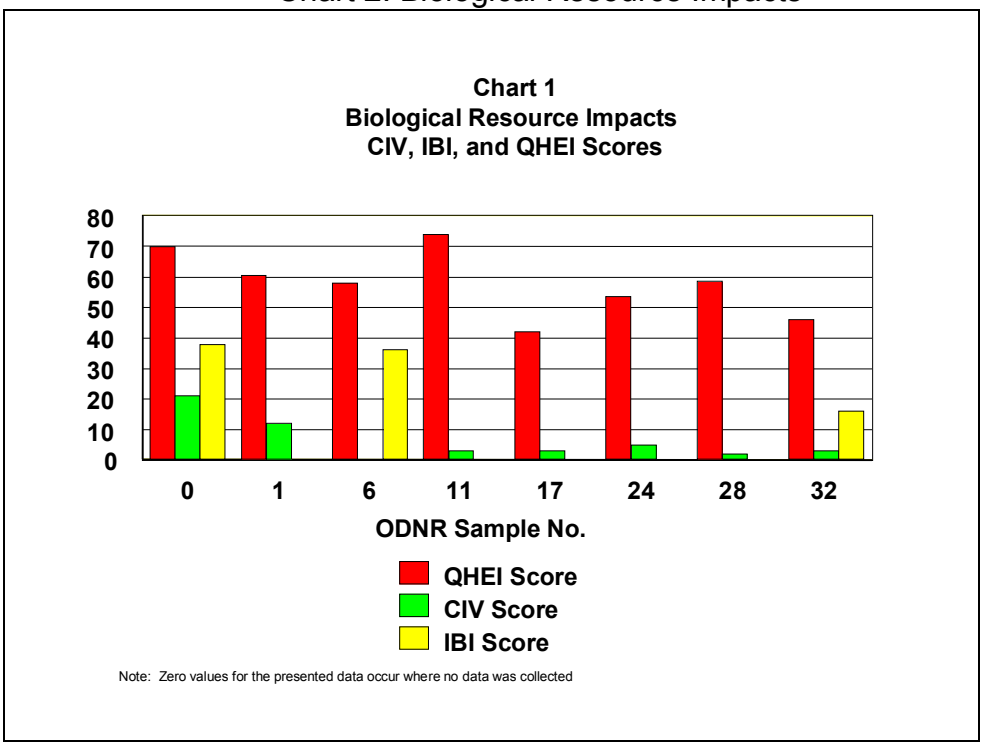
Habitat Quality

The Qualitative Habitat Evaluation Index (QHEI) represents habitat data for the study. The QHEI is a physical habitat index designed to provide an empirical, quantified evaluation of the general habitat characteristics of a stream that are important to fish communities. It consists of six principal metrics that are scored individually and summed to provide the total QHEI site score. The maximum QHEI site score is 100. The six principal metric categories are: substrate, instream cover, channel morphology, riparian zone and bank erosion, pool/glide and riffle/run quality, and gradient. The higher the score for each individual metric, the closer that metric is to having characteristics present that are important to fish communities (OEPA).

A review of the QHEI data reveals a marked decline in scoring between sample site HR-11 and sample site HR-17 (Reach 4). Further analysis indicates that the marked decline in the total QHEI score is mostly a result of a decline in the scores for Metric 1 and 2. Metric 1 evaluates substrate type and quality while Metric 2 evaluates instream cover type and amount. The substrate and instream cover are thus being impaired to a greater extent in the lower four reaches than in the upper four reaches. Sedimentation and the precipitation of metals are suspect causes of this degradation.

Further evaluation is necessary to pinpoint the exact causes of this decline in habitat. Results of the QHEI score are present in Chart 2: Biological Resource Impacts.

Chart 2: Biological Resource Impacts



Biological Quality

The biological quality of Huff Run was assessed using two groups of organisms: aquatic macroinvertebrates, fish and coliform/ e-coli. .

Aquatic Macroinvertebrates

Aquatic macroinvertebrates are organisms that lack a backbone and are visible to the naked eye. In fresh water streams, they include the insects, crustaceans (crayfish and others), mollusks (clams and mussels), gastropods (snails), oligochaetes (worms) and others. In most streams and rivers, the larval insects dominate the macroinvertebrate community.

These organisms provide an excellent tool for stream assessment. Because some species are less tolerant of pollution than others, the types of species present serve as indicators of the long-term water quality. Thus when assessing water quality, the total number of individuals within a species is recorded (density) along with the number of different species present (diversity).

The Cumulative Index Values (CIV) method was used to assess the aquatic macroinvertebrate community of Huff Run. The CIV is a measure of the density and diversity of macroinvertebrates present. Three groups of taxa are represented. Group 1 Taxa are weighted the heaviest. CIV scores can range from 0 to 42. A score less than 11 indicate poor stream quality. Scores between 11 and 16 equate to a fair stream quality. Scores between 17 and 22 depict good stream quality. A score greater than 22 indicates excellent stream quality.

An examination of the data indicates that Huff Run has a macroinvertebrate population indicative of good to fair water quality in Reaches 7 and 8 (above HR-1). The macroinvertebrate population, however, changes to one indicative of poor water

quality in the lower six reaches. Results are presented in Chart 1: Biological Resource Impacts (Reach Six information was not available when this Chart and related maps were made.)

Fish

The Index of Biological Integrity (IBI) is an approach used to assess and evaluate the biological conditions of a stream through the collection of fish. The IBI is a measure of fish species diversity and species populations. The IBI is based on a comparison of a sample site to an ecoregion reference reach site. Five ecoregions have been identified in Ohio. Characteristics reflecting the biological performance exhibited by natural or least impacted aquatic habitats have been identified and quantified. The IBI uses three broad categorical groupings to determine biological integrity: species richness and composition, trophic composition, and fish abundance and condition. These three groupings are broken down into twelve principal metrics, each of which is scored individually and then summed to provide the total IBI score.

Each metric is scored based on whether its own specific characteristics approximate, partially deviate, or strongly deviate from what is expected in a least impacted stream. The minimum possible IBI score is 12. The maximum possible IBI score is 60. The higher the score, the healthier the aquatic ecosystem (OEPA). A review of the data indicates that the IBI scores for sample site HR- 0 and sample site HR- 6 are indicative of a much healthier aquatic ecosystem than the score for sample site HR- 32. With a score of 16, sample site HR- 32 would be considered to strongly deviate from what is expected in a least impacted stream. With scores of 38 and 36, sample site HR- 0 and sample site HR-6 are close to representing what is expected in a least impacted stream.

Results are presented in Chart 1: Biological Resource Impacts and a list of the fish species encountered are listed in Table 9 below.

Table 9: Fish Species collected during fish shocking studies

Upstream of Rt. 542 (sample site HR- 0)	At Indigo Road (sample site HR- 6)	At Sattler's Bottom Road (sample site HR- 32)
Redside Dace	Redside Dace	Green Sunfish *
Southern Redbelly Dace	Blacknose Dace	
Blacknose Dace	White Sucker	
White Sucker	Johnny Darter	
Bluntnose Minnow	Fantail Darter	
Bluegill Sunfish	Green Sunfish	
Green Sunfish	Creek Chub	
Creek Chub	Bluntnose Minnow	
Johnny Darter		
Fantail Darter		
Least Brook Lamprey		
Redside Dace		

* (A very pollution-tolerant species) Only 13 specimens of this one species were collected in this segment. Collected by Jim Grow, OEPA 2000.

Bacteria

The most common indicator of sewage influences on water quality is the presence of bacteria, specifically Total Coliform and E. coli. Coliform bacteria are a natural part of the microbiology of the intestinal tract of warm-blooded mammals, including man and livestock. Coliform bacteria can also be found in soils, other animals and insects. The total Coliform group is relatively easy to culture in the lab and therefore is usually used as a preliminary test before E. coli is tested. E. Coli comes from the intestines of warm-blooded animals and is the direct result of fecal contamination. In other words, it could be origination from human waste (i.e., malfunctioning septic or sewer systems) or from other animal sources (i.e., livestock access to surface waters). A positive test for E. coli is a stronger indicator of the presence of disease causing bacteria and organisms than the detection of Total Coliform.

Coliform bacteria are not pathogenic (disease causing) organisms, and are only mildly infectious. If large numbers of Coliform are found in water, there is a high probability that pathogenic bacteria and organisms are present. In addition, less than 10% of the 140+ stereotypes of E. coli bacteria cause gastroenteritis in humans and even if a pathogenic strain is present, a dose of 100,000 bacteria may be required to cause the disease that indicates a problem. (See Specific Impairments and Goals, Septic Issues section for further information.)

Although there have been very few studies in the watershed concerning bacteria, all studies have indicated that there are very few areas in the watershed that are not affected by raw sewage. The Partnership hopes to work more closely with the County Health Departments and to start annual sampling in the summer months. Table 10 demonstrates the results of past studies.

Table 10: Results of Bacteria Sampling Studies

Study	Location	Coliform presence	E. coli presence
1999 Kleski Environmental	South side of County Road 23, 3700 feet from Morges	Positive	Positive
1999 Kleski Environmental	Off County Road 26, 3900 feet from Morges	Positive	Positive
1999 Kleski Environmental	Wellhead access road off Lindentree Rd, 4820 feet from St Rt 542/ Township Rd 170 intersection	Positive	Positive
1999 Kleski Environmental	State Route 542, east side of bridge, 400 ft north of St Rt 542/ Brass Rd. intersection	Positive	Positive
1999 Kleski Environmental	Under Brass Road bridge	Positive	Positive
1999 Kleski Environmental	Under Hope Road bridge	Positive	Positive
1999 Kleski	Coal Tipple Access Road	Positive	Positive

Environmental	bridge		
1999 Kleski Environmental	South of County Road 110, east side of gas line crossing	Positive	Positive
1999 Kleski Environmental	East side of Slats and Nails bridge	Positive	Positive
1999 Kleski Environmental	Beside USGS station	Positive	Positive
1999 Kleski Environmental	North side of Huff Run Road, 200 feet from Farr Project	Positive	Positive
1999 Kleski Environmental	West side of Sattler Bottom Road bridge	Positive	Positive
1999 Kleski Environmental	County Road 23, north of road at culvert	Positive	Positive
1999 Kleski Environmental	Intersection of St Rt 542 and Brass Road	Positive	Positive
1999 Kleski Environmental	1800 feet east of county line on Brass Road	Positive	Positive
1999 Kleski Environmental	400 feet north of County Rd 26 and Township Rd 170 intersection	Positive	Positive
1999 Kleski Environmental	400 feet west of County Rd 26 and Township Rd 170 intersection	Positive	Positive
1999 Kleski Environmental	3200 feet west of County Rd 26 and Township Rd 170 intersection	Positive	Positive
1999 Kleski Environmental	250 feet from intersection of St Rt 542 and County Rd 36	Positive	Positive
1999 Kleski Environmental	600 feet east of pipe crossing on Lindentree Rd	Positive	Negative
1999 Kleski Environmental	Lindentree Rd. culvert at ball field	Positive	Positive
1999 Kleski Environmental	North of St Rt 800 below train tracks	Positive	Positive
1999 Kleski Environmental	1250 feet east of Huff Run rd and St Rt 800 intersection	Positive	Positive
1999 Kleski Environmental	1100 ft east of Township Rd 184, west of wellhead	Positive	Negative
2004 Tuscarawas Health Dept.	Huff Run main stem under Brass Road bridge	Positive, Very high levels	Not applicable
2004 Tuscarawas	Tributary running along ball fields on Lindentree Road	Positive, Very high levels	Not applicable

Health Dept.			
2004 Tuscarawas Health Dept.	Tributary running through Mineral City Park	Positive	Not applicable
2004 Tuscarawas Health Dept.	Tributary at intersection of State Route 800 and Dutchtown Road	Positive	Not applicable
2004 Tuscarawas Health Dept.	Tributary under Cline Hill Road bridge	Positive, Very high levels	Not applicable
2004 Tuscarawas Health Dept.	Huff Run main stem under New Cumberland Rd. bridge	Positive	Not applicable

Results from the 2005 Tuscarawas Health Department study have not been released yet.

Other Physical Features

Channelization

Based on a review of aerial maps, not much of the stream has been changed due to channelization by human exploits. It has only been channeled in the Tuscarawas portion of the watershed, mostly around commercial areas, and totals only .43 miles. Very little of the Carroll County portion of the watershed has been channelized. There have been an estimated total of six culverts put in place to redirect the stream, mostly for roads. Overall, however, there has been very little human impact to the stream itself.

Riparian Corridors

The riparian buffer along Huff Run is, for the most part, effective in controlling erosion and attached nutrients reducing instream sediment loads during flooding, reducing nutrients in overland and subsurface flow, moderating stream temperatures, and maintaining fish habitat.

This strong riparian buffer also provides an important transition zone between the water and adjacent uplands. These zones have a diverse population of plant species. The zones also serve many functions critical to wildlife by providing food, cover, travel, and escape routes, roosting sites, nesting areas and den areas.

Riparian buffer zones also reduce the total volume of surface runoff. The vegetation in the buffer zone slows the flow of surface runoff and allows it to percolate through the soil. Surface runoff is inversely proportional to the density of vegetation present. Leaf litter and humus add to the ability of other vegetation to slow runoff. This results in a more gradual release of water from the watershed and stabilizes the watercourses and the ecosystem.

As characterized from stream walks and aerial maps, much of Huff Run's riparian corridors are of good quality but are not all connected. See Figure 9: Huff Run Riparian Buffer map. According to these studies, 6.0 miles of the stream has good quality riparian buffers while 3.0 miles are of poor quality. Just under one stream mile has unknown riparian buffer quality.

With proper management, the riparian ecosystem can be more productive and provide better non-point source pollution control. Proper management will also enhance the sediment and nutrient buffering capacity of these ecosystems.

Dams and Levees

There are no dams in the Huff Run Watershed.

There is one small levee around the former Slats and Nails factory along Lindentree Road.

Ditches and Ponds

There are no officially classified or unofficially maintained petition ditches in the Huff Run Watershed.

There are many private ponds in the Huff Run Watershed however the vast majority of them are related to abandoned mines and are of poor water quality.

Floodplains

With the formation of the Muskingum Watershed Conservancy District (MWCD) on June 3, 1933, periodic controlled inundation became a reality for a fraction of the Huff Run Watershed. Originally conceived as a flood control project after the disastrous 1913 Ohio floods, the MWCD's mission has evolved over the past sixty-five years to include conservation and recreation management operations as well.

Dover Dam, one of fourteen original structures in the Muskingum project, was completed on November 13, 1938, and is located approximately three miles downstream from the terminus of Huff Run. Operated as a "dry" project, Dover Dam does not normally impound a standing body of water, or reservoir, behind it. As the main control for the Tuscarawas River Basin, Dover Dam is owned and operated by the U.S. Army Corps of Engineers to minimize periodic flood crests in the Dover-New Philadelphia area and downstream to the mouth of the Tuscarawas River at Coshocton. In doing so, floodwaters are temporarily impounded behind the dam to a maximum level of 916 feet above sea level, which represents the spillway elevation of Dover Dam. Draining approximately 1,404 square miles, Dover reservoir would inundate 10,100 acres if it were ever filled to its spillway capacity, an event that has yet to occur. On January 16, 2005, Dover Reservoir crested at 907.35 feet, its highest level recorded to date. During this event, the reservoir peaked at 62.3 percent of its maximum flood storage capacity. Based upon climatogical data collected for many years and engineering studies, a rainfall event severe enough to fill Dover Reservoir to capacity can be anticipated once every 205 years.

Huff Run Watershed, with a drainage area of 14.7 square miles, represents 1.06 percent of the drainage area behind Dover Dam. Approximately 3.73 percent of the Huff Run Watershed lies below the 916 feet spillway elevation of Dover Dam and is subject to controlled inundation during maximum flood storage. The historical high water crest at 907 feet can be expected to occur on average once every 30 years.

Huff Run's floodplain itself is listed as only special flooding hazard areas inundated by 100-year floods on local floodplain maps from County Floodplain offices. Also, none of these maps have base flood elevations determined. Areas directly adjacent to Huff Run in Mineral City and on Sattler Bottom Road (Township Road 47 located near the confluence into the Conotton Creek) are occasionally flooded.

IV The Huff Run Watershed Restoration Partnership, Incorporated

General HRWRP Information

The Huff Run Watershed Restoration Partnership, Inc. (HRWRP) started with a small group of concerned watershed residents and ODNR/MRM employees at a meeting in August of 1996. In its beginnings, the group implemented a set of bylaws (see Appendix 8), selected leaders and adopted their mission statement, which is **"To restore the Huff Run watershed by improving water quality and enhancing wildlife habitat, through community support and involvement."** The group is a 50(c)3 organization, registered with the IRS as identification number 31396. Its DUNS number is 00-220-6675. As stated in the bylaws, the HRWRP has a group of elected executive officers: President, Vice President, Treasurer and Secretary. These volunteers hold two-year terms. Each dues paying member may vote at meetings, except the President. The President will vote to break a tie. Meetings are held monthly on the third Tuesday of each month at 5:30pm in the Mineral City American Legion Hall. Meeting minutes and other up to date information about the group can be found at www.huffrun.org. Persons wishing to contact the HRWRP are directed to the Watershed Coordinator or may write to them at PO Box 55, Mineral City, Ohio 44656.

Rural Action is the administrator of the Huff Run Watershed Coordinator Grant and the sponsor of the HRWRP. Rural Action is a membership-based non-profit organization promoting social, economic and environmental justice in Appalachian Ohio. Rural Action takes a comprehensive, integrated approach to rural community development that creates economic opportunities, preserves and restores the environment, and strengthens communities. This approach builds on the assets of the region to create long-term solutions for problems. Huff Run is one of four watersheds in Appalachian Ohio that are part of Rural Action.

Activities

Other than monthly meetings, the Huff Run Watershed Restoration Partnership has many other activities, all of which are meant to educate the community about their cause.

The HRWRP holds litter pick ups, stream clean ups, tree planting events, and other activities. Annual events include the Huff Run Fun Day and Awareness Days. The Huff Run Fun Day is a watershed festival held at the Mineral City town park around the end of August. Many other environmental groups or agencies are invited to participate and have a booth. Community organizations such as churches, 4-H groups, scout troops and others also have booths. Awareness Days involve field trips for middle school classes. Usually these days are held in May but they have also been in the Fall. The school children are given tours around an area of Huff Run (either an unreclaimed site or a current restoration project) and given an AMD water quality demonstration. Other activities that have been included are Streamulator demonstrations, Enviroscape demonstrations, fish shocking instructions, time spent searching for and learning about macroinvertebrates and QHEI education.

There are also many other ways that the group informs the public of their activities. Successful membership drives have been held. The group also has an active webpage (www.huffrun.org). The bi-annual newsletter is distributed to local residents and interested parties. Two bulletin boards are located in popular establishments in the area (the Mineral City Village Café and the Mineral City Senior Center), which are used to display information about the group's activities. The Huff Run Watershed Coordinator or the VISTA also informs HRWRP members the most up to date information through an email list. Two signs have been posted at two separate Huff Run bridge crossings, one on State Route 800 and one on State Route 542. The signs identify the watershed group and site meeting times and location. There have been tours and many displays of the groups' accomplishments as well.

The group is also in the process of creating a citizens' watchdog program to empower citizens to take action when they seen environmental problems in the watershed.

Stakeholders

There are many other agencies and institutions interested in the restoration of the Huff Run Watershed in addition to the members of the HRWRP. Below is a list of stakeholders and their roles. This list continues to change as new stakeholders are identified.

Table 11: Stakeholders and their roles in watershed restoration

Stakeholder	Individuals/ groups involved with HRWRP	Their Role
HRWRP	Approximately 30 dues paying members, 15 or so members that attend monthly meetings – landowners and watershed residents	Make final decisions about HRWRP plans, the action plan will address their concerns and their land, also help in gathering input from local citizens, knowledge of available resources, support and developing solutions
ODNR/MRM	Cheryl Socotch, Jim Gue, Harry Payne, AMD Engineer, Douglas Leed, Scott McDiffit, Mark Smith, Jason McClarren, Dan Terrell	Developing solutions to AMD related problems, engineering designs, funding, and expertise in land reclamation and water quality improvement, also process all water quality testing lab work
OEPA	Dan Imhoff, Natalie Farber, Jodi Bowman	Funding, environmental expertise, Orphan Barrel Removal
ODNR/SWC	Jan Voelker, John Kessler, Chris Kasselmann	Funding, administration, water quality expertise
Crossroads RC&D	Sandy Chenal, Nancy Summers	Sponsor and author of past and current of 319 grants for HRWRP. Their grant writing knowledge and ideas will continue to be an asset to the project.
Tuscarawas SWCD/ NRCS	Julie Gordon, Marsha Zollar, Lee Finley, and Tracy Haney Terry Scott, Felicity Weatherspoon	Technical expertise, help form solutions, and information on potential programs to offer to landowners and schools. Help with outreach and environmental education activities.

Carroll SWCD/NRCS	Linda Yeager, Kevin Swope	Technical expertise, help form solutions, and information on potential programs to offer to landowners and schools. Help with outreach and environmental education activities.
Mineral City Village Council	Mayor Terry Nill and Village Council members	Gathering input from local citizens, knowledge of available resources, support and developing solutions
Mount Union College	Dr. Chuck McClaugherty, Dr. Lin Wu and their students	Conduct studies in the watershed.
Township Trustees	Sandy and Rose Townships	Gathering input from local citizens, knowledge of available resources, support and developing solutions
County Health Departments	Tuscarawas and Carroll Counties	Resources and data, develop solutions and technical assistance
Recycling and Litter Prevention	Tuscarawas and Carroll Counties	Environmental education
Office of Surface Mining	Max Luehrs, Dave Agnor, Phil Fantazier, Eric Perry, Jay Hawkins	Funding, water chemistry sampling expertise VISTA program
Army Corps of Engineers	Barry Passmore – Huntington District, Stan Rosenblatt – Dover	Provide funding for and assist in design and development remediation projects as part of Water Resources Development Act for aquatic ecosystem restoration projects.
US Geological Survey	Lowell Trimble, Steven Frum	Manage (calibration, construction, maintenance) the USGS constructed stream gauging station located at Mineral City (Huff Run).
OSU Extension	JP Leiser, Joe Bonnell	Training, Watershed planning expertise, environmental education
Local schools	Buckeye JVS, Carroll County and Tuscarawas County middle schools	Buckeye has helped with creating donor gifts and volunteers, HRWRP does field trips for local middle schools
Muskingum Watershed Conservancy District	Mark Jukich, Mark Swigert	Common water quality goals
County Commissioners	Tuscarawas and Carroll County	Funding, Gathering input from local citizens, knowledge of available resources, support and developing solutions
Mineral City Village Cafe	Sandy Wine, Owner	The group has a “community bulletin board” in this only restaurant in Mineral City where most residents frequent. The board lists events and news.
Mineral City Volunteer Fire Department	Greg Wine, Chief	The group has a “community bulletin board” in their hall where the Senor Center holds its daily meetings. The Fire Department also helps the Huff Run Fun Days.
Kleski Environmental	Jennifer Kleski, Environmental Consultant	Long distance member of Technical Advisory Committee, as needed

Technical Advisory Committee

To more forward with restoration of Huff Run, the HRWRP requested that a Technical Advisory Committee (TAC) be established to call on the expertise of various individuals from Federal, State and local governments and organizations. The TAC first met on October 15, 1997 and began the process of collecting data about the watershed, which was incorporated within the first edition of the Huff Run Watershed Plan. Members of the TAC are listed below:

Jim Gue, Environmental Specialist II, ODNR/MRM
Cheryl Socotch, Hydrologist, ODNR/MRM
Sandy Chenal, Coordinator, Crossroads RC&D
Dan Imhoff, Non-Point Source Coordinator, OEPA
AMD Engineer, ODNR/MRM
Nancy Summers, Development and Special Projects, Crossroads RC&D
Mark Smith, Environmental Specialist II, ODNR/MRM
Maureen Wise, Watershed Coordinator
VISTA Volunteer
Jennifer Kleski, Environmental Consultant, Kleski Environmental, as needed

One of the Technical Advisory Committee's first tasks was to determine water quality impairments and bring the list to the HRWRP for prioritization and consideration. The TAC listed water quality, wildlife habitat and environmental quality within forested areas as concerns with water quality identified as having the highest priority. They further defined anthropogenic impacts, which are adversely affecting the listed concerns. These anthropogenic impacts included surface and underground mining activities; oil and gas development; agriculture; open/ illegal dumping; removal of riparian forest buffers and raw sewage entering the stream. The impacts have imparted wide spread ecosystem degradation within the watershed. Pervasive habitat limitations, as a result of these impacts, are suppressing the full aquatic and terrestrial biological potential of the watershed.

V Watershed Plan Development

There was a great deal of public participation in the 2000 edition of the Huff Run Watershed Plan. Much of this information will be used in this second edition along with the information gathered more recently.

Stakeholder Participation

With water quality identified by the Technical Advisory Committee as having the highest priority of the listed concerns, the watershed group decided that the public participation portion of the process would focus on this issue. Two methods of public participation were employed for the first watershed plan. A public survey was conducted using a mass mailing of information flyers and an official public meeting was held.

Public Survey

A public survey was mailed out in June of 1998. The survey was sent to all individuals living in the zip codes of Huff Run Watershed. The survey focused on the public's perception of water quality within the Huff Run Watershed. In addition, based on the publics perception, water quality within Huff Run was ranked very poor with the majority of individuals believing that Huff Run is polluted as a result of acid mine discharge, with abandoned mine lands and sediment ranked as the top two contributing pollutant sources. The majority of the responses reflected concern as to what water quality would mean for future generations and were most optimistic for water quality improvement over time. (A brief description of the watershed group and its objectives was included in the survey.)

A total of 38 questionnaires were returned. This was considered a light response in relation to the number mailed. The questions and their top ranked responses are listed in Table 12: Public Survey Questionnaire and Comments Summary.

Public Meeting

On July 8, 1998, a public meeting was held in the Mineral City Fire Station Hall. The purpose of the meeting was to introduce the Huff Run Watershed Restoration Partnership to the public and solicit their perception of water quality issues and concerns within the Huff Run Watershed.

The public was introduced to the watershed concept. A brief history was given of the partnership and a chronology of its achievements. The public was then provided with a non-point source educational demonstration followed by an introduction to the process used in the development of a watershed management plan. The public was then asked to provide their opinion as to the water quality issues in Huff Run.

Three questions were posed and their responses ranked according to importance, as listed below:

Table 12: Public Survey Questionnaire and Comments Summary

Question	Response
1. In your opinion, what are the primary causes of water quality problems in the area?	1. Acid mine drainage
	2. Abandoned mines/gob piles/deep mines/soil erosion associated with exposed spoil materials
	3. Illegal dumping
	4. Sediment in streams
2. In your opinion, what should be done to fix these problems?	1. Reclaim abandoned mine sites/seal deep mine openings
	2. Treat acid mine drainage
	3. Compile water quality data
	4. Remine
3. What are your other primary environmental concerns in this area?	1. Drinking water quality
	2. Industrial Pollution
	3. Sewers
	4. Pubic apathy
	5. Sludge application

Second Edition

After taking into consideration the first meeting's conclusions, the HRWRP decided to hold another public meeting in 2005 to ask community members to reprioritize the problem issues in the watershed. A meeting was held on March 29, 2005 at the Mineral City Fire Hall. Those in attendance were broken into three groups and were asked to rank problems in two categories: severity and action items. The groups conclusions are listed in Table 13.

Table 13: HRWRP Issue Priorities

Severity	Action Items	Priority
Acid Mine Drainage	Acid Mine Drainage	1
Raw Sewage	Illegal Dumping	2
Oil & Gas Impacts	Poor Riparian Buffers	3
Illegal Dumping	Raw Sewage	4
Poor Riparian Buffers	Oil & Gas Impacts	5
Agricultural Impacts	Agricultural Impacts	6

Conclusions

With the input from the Technical Advisory Committee and the public, it was clear that water quality issues pertaining to mining and acid mine drainage were of the most prevalent problem identified within the watershed. AMD discharges originate from many of the abandoned deep mines located throughout much of the central and western portions of the watershed. A map depicting the approximate limits of the documented deep mines within the watershed is presented in Figure 10: Approximate Limits of Abandoned Deep Mines.

Extensive surface mining of the Lower Kittanning and Middle Kittanning coals has also occurred within in the watershed. This mining has left exposed highwalls, spoil ridges and impoundments which are present within the central portion of the watershed. Runoff from these areas is a significant source of contamination. The approximate limits of currently unreclaimed surface mined areas within the watershed are presented in Figure 11: Approximate Limits of Surface Mining. Current surface mining operations are responsible for the remining and reclamation of many of the unreclaimed areas. The approximate limits of currently active mining permits within the watershed are also presented in Figure 11.

VI Specific Impairments and Goals

Acid Mine Drainage

AMD and gob at Thomas Project

Gob at Lyons Project

Problem Statement: The Huff Run Watershed has high levels of acidity and problem metals such as iron, aluminum, manganese, and low pH levels from abandoned coal mines and other poor mining practices predating mining laws and regulations.

See Figures 5, 7, 8,10, and 11 for more reference.

Causes: Acid mine drainage is caused by polluted water flowing from, or caused by, deep mining, surface mining, or left over coal refuse piles (commonly referred to as gob piles). This drainage is usually orange in color and may be acidic or alkaline with high levels of dissolved metals. AMD can lower water quality and impair aquatic life.

Pyrite, an iron sulfide mineral, is frequently found in coal mine refuse piles and underground coal mines. When water and air come in contact with acidic material such as pyrite, there is a chemical reaction. It produces iron hydroxide and sulfuric acid, which contaminates surface and sub-surface waters. This contamination is known as acid mine drainage.

pyrite (in coal) + oxygen + water = iron hydroxide + sulfuric acid +
aluminum +manganese + sulfate = acid mine drainage

Acid mine drainage often occurs in the down-dips of underground coal mines. AMD forms in the void space where the coal was exploited long ago. In the abandoned coal mines there are coal pillars supporting the roof of the mine and waste coal that was left behind. This coal contains the pyretic materials needed to make sulfuric acid once exposed to air and water. Air enters the mine due to the void space left during mining and through fractures in the overburden. Water also enters the mine through fractures and subsidence features. Subsidence features form when the 'rooms' of a coal mine collapse leaving moderate to large depressions in the earth. Rainwater and surface stream water funnels down through these holes and collects in the collapsed mines providing the needed air and water for the AMD reaction to occur. Then the AMD drains down-dip through the mine until it reaches an old portal (a mine opening) and then drains into the surrounding streams. In some cases the portals to the mines were closed off and the mine water collects until the water pressure busts a hole up to the surface where the overlying rock is weak or very thin. This mine water then drains to the surrounding stream.

Effects: AMD from mining, both surface and underground, discharge to surface waters and leaches into the groundwater system. In surface waters, AMD results in low pH and elevated metals concentration (i.e. iron, aluminum, and manganese). This degrades habitat allowing the survival of only the most pollution tolerant aquatic species. In groundwater, high mineralization from AMD renders the water supply source unpotable. A complete review of surface water quality effects resulting from acid mine drainage is provided within the AMDAT plan In addition, sediment from unreclaimed surface mines aggrades the stream channels causing a loss of habitat and increases flood frequency. The extent of sedimentation within this watershed needs to be quantified.

Wildlife habitat within the Huff Run Watershed has been severely impacted by previous surface mining activities, both reclaimed and unreclaimed. Indigenous terrestrial species have been subjected to the loss of significant amounts of habitat as a

result. Reclaimed areas, although providing some cover, have been converted from forested to grasslands, creating an alternate prairie like habitat which is not its original form. Significant positive impacts on local populations of wildlife could be achieved if reclamation and reforestation projects would be implemented. Restoring unreclaimed areas to their approximate original contour and establishing vegetation would provide wildlife habitat. In addition, reforestation of reclaimed grasslands would provide much needed quality habitat for wildlife indigenous to the region's forested areas.

The environmental quality of the forested areas has been severely impacted by the unreclaimed surface mines and discarded tailings from deep mines. The unreclaimed areas have open highwalls, pit impoundment, exposed gob and spoil ridges. Many of the exposed gob and spoil ridges lack vegetation due to acidic soil conditions and/or inadequate topsoil. These areas can be reclaimed to the approximate original contour and planted in trees and grasses enhancing wildlife habitat. In some areas vegetation has reestablished overly successful populations of opportunistic plant species. Here, species such as wild grape inhibit the growth of a diverse woodland plant community.

Goals: Reduce the impacts of AMD to restore the stream to a condition that allows it to fully attain its aquatic life designated use class of warm water habitat. Buffer lower reaches of Huff Run against episodic pH excursions during low flow conditions with additional of alkalinity above HR24. Improve the in-stream habitat and water quality below Reach 7 with a reduction in metal loads.

> **Goal Indicators:** The entire length of Huff Run reaches warm water habitat quality and has an IBI score of 44 (+/-4 points) and an Invertebrate Community Index (ICI) score of at least 36.

Objective One: Implement remaining restoration projects in the AMDAT plan plus projects added since printing, adding new projects as needed.

> **Objective Action Items:**
> 1) Complete/ fund Lyons Project
> 2) Complete/ fund Mineral-Zoar Project (Phase Two as well)
> 3) Complete/ fund Thomas Project
> 4) Complete/ fund Harsha North Project
> 5) Complete/ fund Harsha South Project
> 6) Complete/ fund Fern Hill Project
> 7) Complete/ fund Belden Project
> 8) Complete/ fund Farr ALD Project* (Phase Two as well)
> 9) Complete/ fund Linden Bioremediation Project*
> 10) Complete/ fund HRWRP Acid Pit #1* (Phase Two as well)
> 11) Complete/ fund Lindentree Project*
> 12) Complete/ fund Huff Run AML Project*
> 13) Complete/ fund Jobes Reclamation Project*
> 14) Add new projects as needed
>
> *Completed at printing of 2005 edition of Watershed Plan

See AMD project timeline (page 47) for dates of completion and how far along each project is.

Objective Indicators:
1) Grants obtained for funding projects.
2) AMD projects completed
3) Projects are successful according to post-construction water quality data and biological sampling.

See implementation section for further details.

Objective Two: Conduct water quality monitoring at each Reach to document water quality improvements quarterly.

Objective Action Item:
1) Conduct quarterly sampling at each Reach point.

Objective Indicator:
1) Water sampling accomplished. Comparisons made annually.

Objective Three: Create wildlife habitat in formerly inhabitable areas affected by acid mine drainage or related landscape (gob, highwalls etc.)

Objective Action Items:
1) Whenever possible, work with ODNR/Forestry or ODNR/AML to obtain trees for wildlife plantings
2) When ODNR does not have trees available, apply for grants for tree plantings (especially the National Fish and Wildlife Foundation).

Objective Indicator:
1) Number of trees (or acres) planted on completed restoration projects.

Objective Four: Educate surrounding communities of AMD issues and HRWRP AMD projects.

Objective Action Items:
1) Conduct/ plan Huff Run Fun Day annually
2) Conduct/ plan Huff Run Awareness Day annually
3) Send out press releases as projects finish, new programs start etc.
4) Continue to use Community Boards and pamphlets to highlight HRWRP activities

Objective Indicators:
1) Number of citizen's that attend Annual Huff Run Fun Days, testimonies from citizens that attend.
2) Number of students that attend Annual Huff Run Awareness Days, testimonies from children that attend. Pre and post tests conducted by teachers.

3) Number of press releases per year
4) Number of new citizen members in the HRWRP

Septic Issues:


Sewer Line to be updated


Septic System Sludge

Problem statement: Fecal coliform levels are above Ohio EPA's primary contact standard in parts of Huff Run and its tributaries as measured by County Health Departments.

Cause: Failing septic systems have been identified as a concern affecting water quality within Huff Run as well as an out dated sewer system in Mineral City. Many rounds of bacteriological sampling have been conducted along Huff Run and its major tributaries. Most test results were positive for E-coli and high levels of fecal coliform, chemical biological oxygen demand (CBOD) and ammonia. The sewage discharge to Huff Run Watershed is documented in Figure 12: Sewage Discharge to Huff Run Watershed.

Effects: Many human health risks can be attributed to improper sewage disposal. Raw sewage contains various pathogens that are easily transmitted through open waterways. This is a particular concern in the recreational areas in Huff Run. The Jerry Shuman Ball fields and the Mineral City Park both have tributaries running right along them that are affected. Individuals coming into contact with contaminated water can contract illnesses such as typhoid, tuberculosis, dysentery, cholera, tetanus, hepatitis, and several types of gastroenteritis. Several types of internal parasites are also present in sewage, along with a number of fungal diseases.

Also, the health of aquatic species can be adversely impacted leaving them vulnerable to disease after coming in contact with fecal coliform.

Goals: Decrease the levels of fecal coliform to the EPA standards below 1000 colonies per 100ml of water in Huff Run and its tributaries.

Goal indicators: The levels of fecal coliform in Huff Run have decreased.

Objective One: Work with Tuscarawas County Water and Sewer Department, Mineral City Village Council and other partner entities to upgrade and add to existing Mineral City sewer lines.

Objective Action Items:

1) Write letter of support for Tuscarawas County Water and Sewer Department's grant application along with additional information for them to use.
2) Complete fecal coliform sampling prior to and after construction of new sewer systems.
3) Attend necessary meetings.

Objective Indicators:

1) Number of homes added to sewer line
2) Decrease in fecal coliform levels in Huff Run and tributaries in these areas.

Objective Two: Aid landowners in Lindentree and Morges areas in septic system upgrades and improvements.

Objective Action Items:

1) Obtain funding for help in septic upgrades and field days
2) Work with Carroll County Health Department to assess problem areas
3) Hold community meetings to inform area of opportunities
4) Talk to additional landowners

Objective Indicators:

1) Grant obtained to fund an agreed upon percentage of upgrades
2) Number of landowners informed through community meetings, testimonies from landowners that attended.
3) Number of landowners that upgrade septic systems.
4) Decrease in fecal coliform levels in Huff Run and tributaries in these areas. Work with the Dover Lab and County Health Departments to pay for and take samples.

Objective Three: Educate the Huff Run community about the dangers of improperly treated sewage.

Objective Action Items:

1) Give out pamphlets at the Huff Run Fun Day on the issue.
2) Add information about septic issues on webpage.
3) Include article in newsletter about issue.
4) Highlight HRWRP actions in septic treatment on Community Boards.

Objective Indicators:

1) Number of pamphlets given away at Huff Run Fun Day on the issue, testimonies from some people that received pamphlets.
2) Number of hits on webpage once information on subject is added.
3) Number of newsletters sent out with article on septic issues.
4) Number of inquires about program. Conversations with these people about what they have learned from the group about the issue.

Open/ Illegal dumping:

Illegal dumping in forested area

Open illegal dump in valley created by mining

Problem Statement: Open/ illegal dumping in the watershed within isolated forested areas, along roads and within unreclaimed strip pits is a problem.

Causes: Trash disposal fees are too high for low-income residents to dispose of major items (especially for tires and large appliances). Communities and individuals are uninformed about alternatives to and the effects of illegal dumping.

Effects: Harmful impacts to the watershed and water quality from open illegally dumped trash include: debris jams which increase the impacts of flooding, surface water contamination from dump site runoff containing chemicals, and significant health risks. Some health risks include: injury due to sharp objects, increase in rodents, the potential spread of diseases (West Nile Virus, encephalitis and Dengue Fever) from mosquito breeding in scrap tires. Perhaps the most important component of the illegal trash dumping problem is the continued lack of respect for the environment and how that can affect future economic development in the area. Economic impacts caused by illegal trash dumping include: decreased property values because communities become unattractive, and increased cost because of government clean-up expenditures leading to higher local, state, and federal taxes (EPA 905-B-97- 001 March 1998). See Figure 13: Huff Run Illegal Dump Sites.

Goals: Decrease the number of open surface dumpsites in Huff Run to EPA specifications.

Objective One: Identify and map dump sites in Huff Run.

Objective Action Items:

1) Work with landowners, Recycling and Litter Prevention offices and HRWRP members to identify sites
2) Map dump sites

Objective Indicators:

1) Completed Dumpsite Map

Objective Two: Clean up dumpsites.

Objective Action Items:

1) Work with HRWRP and other local citizens' groups to clean up smaller areas. Partner with Township Trustees for this work.
2) Ask ODNR/ Recycling and Litter Prevention offices to implement Nail- a-Dumper signs at public land sites. Implement HRWRP open dumping signs where they can not.
3) Work with ODNR/ Recycling and Litter Prevention offices, Township Trustees, EPA Orphan Barrel program and others to clean up larger areas as needed.
4) Apply for help from local landfills and solid waste districts.

Objective Indicators:
1) Number of sites cleaned up by citizens
2) Number of Nail-A-Dumper signs established
3) Number of barrels removed
4) Number of large dump sites cleaned up

Objective Three: Eliminate access to current open dumpsites.

Objective Indicators:
1) After mapping is complete, create list of dumps that still have public access.
2) Talk with the owners of the dump sites and work with them to put up gates and fencing so that dumpers do not have access.

Objective Indicators:
1) Number of sites that are cut off from public access.

Objective Four: Educate the Huff Run community about the environmental problems illegal dumping can cause.

Objective Action Items:
1) Give out pamphlets at the Huff Run Fun Day on the issue.
2) Add information about illegal dumping on webpage.
3) Include article in newsletter about issue.
4) Highlight HRWRP actions in illegal dumping removal on Community Boards and at office.

Objective Indicators:
1) Number of pamphlets given away at Huff Run Fun Day on the issue. Testimonies from people at the Fun Day on the issue.
2) Number of hits on webpage once information on subject is added.
3) Number of newsletters sent out with article on illegal dumping.
4) Number of phone calls inquiring about illegal dumping. Conversations with these people about what they have learned from the HRWRP about the issue.

Unconnected riparian corridors


Poor Riparian Buffers along Huff Run

Problem Statement: Huff Run's riparian corridors have been degraded to the point that there is little to no overhanging vegetation in approximately three of the 9.9 miles of streamside land which is 29% of the entire length.

Causes: Many landowners and farmers do not understand the value of riparian corridors and mow them or allow farm animals to graze in them.

Effects: Discontinuous riparian forest buffers can result in increased non-point source pollution. An effective riparian buffer can control erosion (sedimentation) and nutrient enrichment, reducing instream loading. In addition, riparian buffers aid in stabilizing local climate variation along the stream.

Unconnected forest buffers along Huff Run also reduce wildlife habitat. The zones serve many functions critical to wildlife by providing food, cover, corridors for travel and escape routes, roosting sites, nesting areas and dens.

Riparian corridors provide a diverse population of plant species. Riparian areas provide an important transition zone between the water and adjacent uplands. Overstory canopy and overhanging vegetation moderate stream temperatures and provide cover, enhancing fish habitat. Lower stream temperatures raise oxygen levels, which promotes aquatic life. The vegetation also drops wood debris and leaf litter. Fish and macroinvertebrates live among wood debris and smaller organisms feed off decomposed leaf litter. Without the riparian vegetated buffers, aquatic life is very degraded. See Figure 9: Huff Run Poor Riparian Buffers.

Goals: Work with streamside landowners to gain 15% riparian corridors along Huff Run to create quality buffers along 90% (8.8 miles) of the stream.

Objective One: Map degraded riparian areas.

Objective Action Items:

1) Note known areas of discontinuous riparian corridors.
2) Walk Huff Run and document other unconnected riparian corridors.
3) Map areas of need.

Objective Indicators:

. 1) Map of degraded riparian areas in Huff Run.

Objective Two: Work with streamside landowners to protect and create riparian buffers along Huff Run.

Objective Action Items:
1) Complete informational packets for landowners
2) Obtain information about where to get trees and grasses at reasonable prices
3) Approach streamside landowners who are known to have problem riparian areas

Objective Indicators:
1) Number of landowners approached.
2) Number of landowners that enroll in program, their testimonies.
3) Number of miles of stream that have been planted with CRP dollars
4) Number of miles of stream replanted all together.

Objective Three: Approach area government officials to create riparian set backs along Huff Run.

Objective Action Items:
1) Meeting with Mineral City Village Council to present set back proposal
2) Meeting with Rose Township Trustees to present set back proposal
3) Meeting with Sandy Township Trustees to present set back proposal

Objective Indicator:
1) Adoption riparian set back easements.

Objective Four: Educate the Huff Run community about the importance of riparian corridor buffers.

Objective Action Items:
1) Give out pamphlets at the Huff Run Fun Day on the issue.
2) Add information about riparian corridors on webpage.
3) Include article in newsletter about issue.
4) Highlight HRWRP actions in riparian corridor program on Community Boards and at office.

Objective Indicators:
1) Number of pamphlets given away at Huff Run Fun Day on the issue.
2) Number of hits on webpage once information on subject is added.
3) Number of newsletters sent out with article on riparian corridors.

Agriculture

Cows drinking from tributaries of Huff Run

Problem Statement: Woodlot grazing along riparian corridors by livestock is taking place in some areas causing bank erosion. Also, livestock drink directly from tributaries of Huff Run causing high nutrient loadings from their defecation in the streams as well as erosion.

Cause: Somr farmers do not have alternative water sources (spring developments, man made ponds, well water lines) for their animals beyond tributaries and streams. They may not be aware of government sources of funds to help them find such water sources. Also, many landowners and farmers do not understand the value of riparian corridors and allow farm animals access the streams. See Figure 14: Huff Run Agricultural Influences.

Effects: In areas where woodlot grazing occurs, low light conditions hinder grass regeneration creating potential non-point source pollution by increasing sediment yields to Huff Run. This also harms valuable wildlife habitat and causes severe degradation of riparian buffers.

In areas where animals have access to the streams and drink directly from the tributaries, stream beds are impacted due to repeated ingress by animals. At these same drinking stations, manure deposits from the livestock are created high levels of nutrients and bacteria. See Septic and Sewer Effects for complete effects of high nutrient levels.

Goals: Work with landowners to install fencing adjacent to streams to reduce livestock access.

Objective One: Map areas where animals are allowed in riparian corridors.

Objective Action Items:

1) Note known areas of concern.
2) Map areas of need.

Objective Indicators:

1) Map of grazed riparian areas.

Objective Two: Create program with presentation and flyer for landowners to use NRCS CRP dollars for streamside fencing to keep livestock away from stream and alternative water sources for future livestock drinking water.

Objective Action Items:
1) Complete informational packet for the program for farmers
2) Ask landowners with livestock in streams or riparian corridors to enroll

Objective Indicators:
1) Number of landowners approached
2) Number of landowners that enroll in program, their testimonies.
3) Number of miles of stream fenced
4) Number of alternate water sources installed.

Oil and Gas Development

Improperly installed access road crossing Huff Run that often washes out

Abandoned Oil Well

Problem Statements: Abandoned and/or improperly sealed production wells could potentially fail creating an oil hazard threatening aquatic and terrestrial species. Not all wells have properly installed dikes around them to protect against surface leaks.

Also, many access roads are poorly installed and cause severe erosion and probable sedimentation.

See Figure 2: Huff Run Oil and Gas Wells and Appendix 8 for correlating information.

Cause: Many areas in Huff Run have absentee landowners who are not aware of the impacts of abandoned wells. Some abandoned wells are improperly sealed and are not maintained.

Oil and gas planners or engineers that design access roads perhaps have not been on site to see the roads they install.

Effects: Impacts to surface and ground water resources are evident as a result of historic well development. Ground water resources contaminated as a result of oil and

gas development experience elevated levels of sodium (having the same effects as high salt diets), chloride (which is corrosive to plumbing and fixtures), calcium, magnesium (Calcium and magnesium together create “total hardness.”), potassium, barium (Barium is very toxic.), strontium and sulfate (Sulfate causes laxative effects.). In addition, oil and gas leach into developed aquifers from leaking production wells and improperly sealed abandoned wells.

Often, access roads for new oil and gas wells are not planned, only created. As the case in the photo above, these roads are susceptible to washing out and causing additional sedimentation to the stream.

Goals: Work with ODNR oil and gas inspectors and oil and gas companies to raise the quality of oil and gas wells and their access roads therefore decreasing the potential negative environmental impacts.

Objective One: Investigate and map all oil and gas wells.

Objective Action Items:
1) Investigate gas and oil wells
2) Map of gas and oil wells

Objective Indicator:
1) Completed map of wells.

Objective Two: Plug orphan oil and gas wells in the Huff Run watershed.

Action Items:
1) Identify locations of orphan wells as they are discovered
2) As abandoned wells are identified, submit them to ODNR/MRM’s Orphan Well program.

Objective Indicator:
1) Number of wells added to program list.
2) Number of wells plugged.

Objective Three: Inspect ground water quality data to determine if leaking oil or gas wells are impacting ground water.

Objective Action Item:
1) Gather ground water quality data
2) Present data at TAC meeting to decide if and where ground water has been affected by oil and gas wells

Objective Indicator:
1) Analysis of water quality data
2) Number of sites determined to be affected by leaking wells

Objective Four: Host or organize a meeting between NRCS or ODNR engineers that properly design roads and the engineers who design the oil and gas well access roads.

Objective Action Items:
1) Partner with civil engineers
2) Organize meeting
3) Hold meeting

Objective Indicators:
1) Number of engineers who attend meeting
2) Number of access roads redesigned after meeting
3) Number of properly installed and designed access roads after meeting

VII Implementation

Priorities

Previous surveys and present conversations with citizens, both members of the HRWRP and residents of the area, agree that AMD is the most important issue in the Huff Run Watershed. For this reason, AMD has been the major focus for the group.

HRWRP members rate illegal dumping and broken riparian corridors as the next problems in line to be addressed. Septic issues are a tough problem to address but should also be taken into consideration. Agricultural impacts and oil and gas development issues take the lowest priority. These issues are listed in Table 13.

AMD Priorities

The HRWRP prioritized AMD projects in importance (how soon it should be implemented due to public interest or funding availability) and impact to Huff Run (worst loadings etc). Below is the prioritized list.

Table 14: Prioritized AMD Projects

Project Name	Importance Priority	Impact Priority	Huff Run AMDAT Number
Jobes Reclamation Project	1	13	--
Huff Run AML	2	6	--
Farr	3	5	31
Linden	4	3	13a
HRWRP Acid Pit #1	5	7	19
Lindentree	6	8	10, 43
Lyons	7	4	27, 33a, 33
Mineral Zoar Road/ Mineral City Park	8	11	--
Thomas	9	10	13a, 13b
Harsha South	10	1	17, 17a, 17b
Harsha North	11	2	15, 15a, 15b, 16, 16a

Fern Hill	12	9	42, 41
RL James/ Belden	13	12	12, 12a, 14

AMD Implementation Timeline

AMD Project Implementation Timeline

Study | Design | Construction

Project	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Jobes	1988												
Huff Run AML													
Farr ALD													
Linden													
Acid Pit #1													
Lindentree													
Lyons													
Mineral Zoar Rd.													
Thomas													
Harsha South													
Harsha North													
Fern Hill													
Belden													
HR 7 and 9*													
HR 25*													
HR 5*													
HR 2 and 3*													

* Have yet to be named

AMD Projects Description

Jobes Reclamation Project: This project involved grading and revegetation of 16.1 acres of barren Lower Kittanning mine spoil, mitigation flooding to Huff Run Road, reduction in well contamination at one private residence and reduction in toxic effects of acid mine drainage to Huff Run. Fourteen hundred linear feet of highwall and one three acre AMD impoundment were eliminated and Huff Run stream flow and water quality was improved over a 0.25 mile stretch. Construction commenced on May 21st, 1987 and was completed on April 13th, 1988 for a total cost of $188,550.

Huff Run AML Project: The Huff Run AML Reclamation Project was the first major project in the watershed. It was completed in 1998 to reduce sedimentation and acid loading from a large, unreclaimed surface mine. The project involved the resoiling and revegetation of over 60 acres, 109,000 cubic yards of earthwork, 1600 linear feet of stream reconstruction and removal of an AMD impoundment. This project was in Mineral City, in the area of the American Legion Hall. This project was funded by an OSM Appalachian Clean Streams grant and in kind contributions from ODNR/MRM.

Farr Anoxic Limestone Drain (also called the South Side Tipple Site): The Farr Project is also located in the lower reaches of the Huff Run Watershed in Tuscarawas County. This problem area has a high visibility factor due to its close proximity to the village of Mineral City and was therefore completed early in the implementation phase. An AMD discharge, sampling point HR-31A, emanated from a discrete location that may have been an old deep mine entry or portal drain for an extensive deep mine complex of the Lower Kittanning (#5) coal seam. The discharge was dispersed through a mound of iron precipitate making it difficult to collect accurate sampling information.

Based on the remediation recommendations within the AMDAT Plan, two phases were completed. The first phase included regrading much of the area and installing an open limestone channel. The second phase focused on the AMD discharge, establishing a series of cells consisting of an ALD, an aerobic pond cell, an aerobic wetland cell and a rock filter cell. Once the precipitate block was removed from in front of the mine entry, flows increased dramatically and elevations were found to be lower than anticipated. The passive system was reevaluated based on new water quality information. Adjustments were made to expand the system to the extent possible within the horizontal and vertical space available. The construction was completed in late August 2002.

This project was funded by an EPA 319 grant, an OSM Appalachian Clean Streams grant and in kind contributions from ODNR/MRM.

Studies since construction completion indicate that largely due to the unanticipated, increased flow rates post construction loadings have not been decreased.

Linden Bioremediation System: The Linden Project, (Site #13A) is located in Reach 4 and is located in the upper reaches of the watershed. It includes mine-impacted discharges from a Lower Kittanning (#5) underground coal and clay mine, and other drainage associated with approximately 10 acres of open pit impoundments and eroding spoil. The AMD discharge flows from a drift mine entry that is directly below an old access road, which serves, in part, as a dam for the impoundment. Several open water-filled impoundments are located immediately adjacent to the mine opening on the north side of the access road. The remaining pits and unreclaimed spoils are a result of subsequent surface mining of the Middle Kittanning (#6) coal seam following the abandonment of underground mining activities in the Lower Kittanning (#5) coal seam.

The Linden AMD Bioremediation Project is an experimental passive treatment alternative with potential for low maintenance, high metals reduction and the generation of alkalinity. The system consists of a wetland cell and a large limestone-filled bed that has been inoculated with microorganisms cultured using the Pyrolusite® Process, developed by the Allegheny Mineral Abatement Company (AMA). This patented process uses highly selected groups of aerobic microorganisms that grow on limestone while oxidizing iron and manganese into insoluble metal oxides. To date, the project has been very successful.

This project was funded by an OSM Appalachian Clean Streams grant and in kind contributions from ODNR/MRM.

HRWRP Acid Pit #1: The HRWRP Acid Pit #1 was a very small area with a large acid pit beside a gob pile. Construction of this project was in the winter of 2003/2004. The acid pit was treated and the water pumped out. The gob pile was regraded and used to

refill the acid pit. A series of limestone channels were also constructed to treat the remaining discharges. This site is located West of the Harsha locations.

This project was funded by an OSM Appalachian Clean Streams grant (that the HRWRP administered) and in kind contributions from ODNR/MRM.

Lindentree: This site is just northeast of Linden and consisted of many acidic ponds, high walls and exposed gob piles. The restoration project drained four of these acidic impoundments with alkaline treatment of AMD during dewatering thereby eliminating the main sources of AMD seepages. These impoundments were excavated, backfilled, and graded to provide positive drainage. Grass-lined and alkaline rock channels (limestone riprap and/or basic steel slag) for collection and treatment of acid mine drainage were constructed. Alkaline rock channels were constructed followed by settling ponds and aerobic wetlands as part of passive treatment system. Post construction monitoring shows that the system and reclamation has had a positive effect but not to the fullest potential. Monitoring will continue.

This project was funded by an EPA 319 grant, and in kind contributions from ODNR/MRM.

Lyons: This site is one of the highest contributors of AMD within the lower reaches of the watershed. It is located between Lindentree Road and New Cumberland Road. Sources of the contamination include unvegetated coal refuse and unreclaimed Middle and Lower Kittanning coal surface mining with open highwalls, pit impoundments and exposed spoil. A seep zone, which appears to be the primary source of AMD on the site, is located at the base of a spoil ridge that impounds water behind it at the elevation of the Number 5 coal seam (Lower Kittanning). Deep mine discharges may be providing recharge to the pit impoundment and the seep.

A grant from the National Fish and Wildlife Foundation has been secured to reforest the project area. The reclamation project itself is be funded by an EPA 319 grant with in kind contributions from ODNR/MRM.

Mineral-Zoar Road (also known as Mineral City Park Project): The project area is located to the north and south of Mineral City–Zoar Road at its intersection with an abandoned railroad bed. It drains into an unnamed tributary to Huff Run that runs through the Mineral City Park. The source north of Mineral City–Zoar Road is an indiscrete AMD discharge upwelling into an existing wetland from reported backfilled mine entries from Mine Unit TS-417. The AMD source south of the roadway is a discrete AMD discharge from an apparent collapsed mine opening. Proposed treatment involves the construction of a passive treatment system that includes an interceptor drain, a reverse alkalinity producing system (RAPS), an aerobic wetland, an aggregate mine drain and an anaerobic wetland. A RAPS is similar to a SAPS (successive alkaline producing system) cell, but flow direction is from bottom to top, and compost is placed below the limestone because of the reversed flow direction. The RAPS will be used to neutralize acidity from the northern mine entries. Additional treatment to remove the anticipated metal precipitates will be provided by an aerobic wetland. An anaerobic wetland will be used to treat the acidic discharge from the southern mine entry.

An OSM Appalachian Clean Stream grant with In kind contributions from ODNR/MRM has been secured for funding. Construction is expected to commence in the Spring of 2005.

Thomas: Thomas is broken up into two locations surrounding the Linden project. The site is composed of approximately twenty acres of surface mine water impoundments and toxic mine spoil (gob). The impoundments are recharging a shallow deep mine, allowing for large contributions of metals and acidity to Huff Run. Plans for restoration include a series limestone channels for drainage and erosion control plus regrading and revegetation of the spoils and pits. Steel slag may also be used in open channels to provide extra alkalinity.

This project will be funded by an EPA 319 grant with in kind contributions from ODNR/MRM.

Harsha South: This site was selected as having the highest priority ranking by the watershed group. It is just east of the Carroll County line to the south of the stream. The problem area has a combination of unreclaimed surface mining, exposed coal waste and abandoned mine land facilities (removed in 2000) along with AMD discharges. Two AMD discharge points are located within the area, sample site HR-17A and sample site No. 17B. Both discharge to Huff Run from the south.

Sample Site Hr-17A is identified as a seep zone which collects in a road ditch and discharges through a small culvert to Huff Run. This discharge falls at the base of a regraded area and does not correspond to the elevation of either the Lower or Middle Kittanning coals. This seep exhibits low pH and elevated concentrations of iron, aluminum and manganese.

Sample Site HR-17B is also a seep zone poised along the toe of a previously mined area. The main flow within this area emanates from a single large seep area which appears to be an undocumented deep mine drift entry. This series of seeps, identified as sample site No. 17B, does not correspond to the reported elevations of the Lower and Middle Kittanning Coals. This seep, like sample site Hr-17A exhibits low pH, and elevated concentrations of iron, aluminum, and manganese.

A peizometer study has been conducted at this site and plans for restoration are in the works. Funding has not been established for this project at this time.

Harsha North: The Harsha North site, identified as sample site HR-16, just north of Harsha South, is documented as contributing the greatest amount of AMD contamination to Huff Run. This site was selected as having the second highest priority ranking by the watershed group. Problem area, sample site HR- 16, has a tributary entering Huff Run from the north which contributes elevated concentration of aluminum and iron with a low pH. Sources of the contaminants include discharging deep mine drift entries in the Lower Kittanning (No. 5) and Middle Kittanning (No. 6) coal seams, unreclaimed contour surface mines in Lower Kittanning and Middle Kittanning coal seams with open highwalls, pit impoundments, exposed spoil ridges and toxic coal refuse piles. The remediation methods applicable for abatement of the water quality impacts emanating from sample site HR-16 area include a combination of reclamation and passive treatment systems. The reclamation plans include possible remining, regrading and revegetation. Reclamation actions will reduce AMD flow and/or loading, but will not entirely eliminate the problem. Passive treatment can be used to treat any

remaining AMD discharge. The passive treatment employed will need to be capable of generating alkalinity in order to increase pH levels and allow for the precipitation of iron and aluminum.

This project will be funded by an EPA 319 grant and in kind contributions from ODNR/MRM.

Fern Hill (also known as HR-42): Fern Hill consists of a few acidic impoundments and a large AMD plume that sits directly adjacent Huff Run itself and dumps severe amounts of AMD directly into the stream. It is just east of Hope Road near the Linden Project. Plans for reclamation includes two phases. First, impoundments will be dewatered and reclaimed to determine if they are feeding the AMD plume. After further investigation, the AMD plume will be reclaimed but design plans have not been developed to date. Passive treatment is the most likely route.

This project will be funded by an OSM Appalachian Clean Streams grant and in kind contributions from ODNR/MRM.

Belden (also known as R.L. James): For some time the HRWRP partnered with the Army Corps of Engineers to study, design and construct this project; however, their funding has been cut and the project has been abandoned. At this time, ODNR/MRM engineers are working on a design for the project.

Belden discharges large acid loads directly into Huff Run. The area is much like Harsha North with deep mine discharges, large exposed high walls, and gob piles. This site is directly adjacent to the east of Harsha North. Preliminary plans include regrading the area, revegetating and constructing in a successive alkaline producing system. Funding will be secured through a US EPA Targeted Watershed grant with in kind contributions from ODNR/MRM.

Additional Sites

Additional AMD related sites will be added as information becomes available. These thirteen projects/sites listed are just the beginning of AMD clean up in Huff Run and certainly do not cover the full extent of the AMD problems in the watershed. There have been preliminary studies conducted with monthly water quality monitoring on several other sites. Examples include HR-25, HR 2, HR 3, HR-7 and HR-9. With additional study investigation, these sites will become projects and other sites will be added to the monthly sampling roster.

Additional Project Implementation Timelines

Unconnected Riparian Corridors Timeline

Action Items	2004	2005	2006	2007	2008	2009	2010
Document problem areas							
Create program							
Approach landowners, Visit farms with Carroll SWCD/ NRCS							
Hold public meeting (if needed)							
Attempt set backs with local officials							
Raise public awareness							

Unconnected Riparian Corridors Priorities

See Riparian map (figure 9) for correlating area letters and subwatersheds. Priority is based on present relationships with landowners and severity of buffer problems.

Landowners' names and addresses have been deleted for web use, privacy and security.

Area	Notes	Priority
B	Buffer ok on north side of stream but needs work on south	3
D	Will never be buffer	No priority
F	Extends to former Arnold property and Kopp Clay – part of this area will never be good buffer on north side of stream because the road is so close along Kopp Clay. Mows up to stream. Extensive erosion extant.	High priority, very low landowner interest – talk to them last 5
H	South side of stream ok for all houses Green house Mows to stream Goats/ ponies Mows to stream Owns her home and the trailer to the east – mows to stream Mows to stream Do not own home Mows to stream	 1 1 1 1

	House is being remodeled – no one living there but mail is delivered	1
J	Stream now on north side of road – between road and stream ok, needs work on north side	3
	Needs buffer and needs to get rid of household trash dump along stream	2
	Only has five feet of buffer in some places	2
J	Has a place where he drives his tractor across the stream, needs a bridge. Otherwise has one small area with poor buffer.	2
	Has horses in stream for a small stretch, has fence along the rest with no vegetation other than grass Sort of a Farm	2
	Tree farm Needs wider buffer Sort of a Farm	2
M	Poor buffer along road and bridge	4
O	No buffer at all, Farm	4
	No buffer at all, Farm	4
	No buffer at all, Farm	4

	No buffer at all, Farm	4

Illegal Dumping Timeline

Action Items	2004	2005	2006	2007	2008	2009	2010
Litter Pick Up Days							
Implement Nail- a-Dumper signs as needed							
Document dump sites							
Clean up dump sites							
Raise public awareness							

Dump clean up priorities

See Illegal Dump map for correlating dump letters.

Priority is based on available funding and severity of dump as well as relationship with landowners.

Landowners' names and addresses have been deleted for web use, privacy and security.

Dump	Priority	Appx. Area	Description	Notes
A	3	Up to 1,689 tons	Construction rubble, drums, cans	Funding may be possible in Tuscarawas Co.
B	3	633 tons	Household trash, oven, mattresses, furniture, carpet	Funding may be possible in Tuscarawas County
C	2	Very small	Tires, refrigerator, water heater	Small, able to clean up with HRWRP manpower
D	2	Very small	Tires, television	Small, able to clean up with HRWRP manpower
E	2	Very small	Roofing shingles, wood	Small, able to clean up with HRWRP manpower
F	1	1500 tons	Four separate dumps: Construction rubble, tires, barrels, household trash, appliances	Funding obtained through ODNR/MRM and local Solid Waste Districts to clean up three dumps in conjunction with reclamation project.
G	5	1.75 acres	Construction rubble, vehicles, wood, drums, bricks	

H	5	0.25 acres	Abandoned vehicle, construction rubble, heavy equipment	
I	4	No delineation conducted to date	Household trash	
J	4	No delineation conducted to date	Household trash	
K	5	0.1 acres	Household trash, wood, drywall, car parts, paint and oil cans	
L	4	No delineation conducted to date	Household trash	Need to contact about riparian buffer as well

Septic Issue Timeline

Action Items	2004	2005	2006	2007	2008	2009	2010
Support for TCWSD grant application							
Fecal coliform sampling in summer							
Partner with Carroll CHD to create septic plan							
Obtain grant for septic upgrades and field day							
Hold public meetings							
Talk to add'l landowners							
Raise public awareness							

Septic problem priorities

Priority is based on available funding and severity of problem as well as relationship with landowners. Other problem areas have not been found in the watershed and these spots directly affect the main stem and so will be targeted first.

Area	Priority	Number of houses	Approximate # of problem houses	Estimated Gallons of Sewage/ Day*	Notes
Mineral City	1	331	95	38,000	Septic to be updated by

					Tusc. Sewer & Water Dept.
Lindentree	2	18	17	6,800	Lower income area. Have yet to find funding for assistance.

*based on design basis calculations of 400 gal/day for a single family home per the Tuscarawas Sewer and water Department.

Agricultural Issues Timeline

Action Items	2004	2005	2006	2007	2008	2009	2010
Note known areas of grazed riparian areas.							
Find/ map areas of need							
Research information to give farms							
Send information to local farmers							
Hold public meeting							
Raise public awareness							

There are very few farms in the watershed that have not worked with a Soil and Water Conservation District Office or the Natural Resources Conservation Service to put agricultural best management practices in place. Below is simply a list of farms that have been observed to not have these practices in place. More research and evaluation is needed to complete the list. See agricultural impacts map for correlating letters.

Deleted for web use

Oil and Gas Development Timeline

Action Items	2004	2005	2006	2007	2008	2009	2010
Investigate gas and oil wells as found							
Map wells							
Talk to oil and gas companies about road construction and BMPs							
Submit wells to Orphan Well Program							
Raise public awareness							

Wells that have been abandoned take higher priority than active wells to act on working with landowners to cap the well. All 18 oil and gas companies active in the watershed will be given the same treatment and priority when discussing proper access road construction and other BMPs because all wells have the potential to become problems.

See Appendix 8 for numbers that correlate to oil and gas wells in Figure 2 as well as owners and companies that operate the wells.

Resources

The HRWRP realizes that these timelines are somewhat lofty and have taken into consideration the resources needed to complete these goals. Table 15 summarizes these concerns.

Table 15: Resources needed to complete timelines

Resources*	Action Items
Acid Mine Drainage Issues	
ODNR/MRM	AMD restoration projects funding, reforest project areas, Inspection and bidding aid as well as sampling equipment and funding
EPA 319 grants	AMD restoration project funding
US EPA Targeted Watershed Grants	AMD restoration project funding
OSM Appalachian Clean Stream Funds	AMD restoration project funding
NFWF grants	Reforest project areas funding
Community Awareness	
EPA 319 grants	Funding for Fun Days, Awareness Days, webpage, newsletters
US EPA Targeted Watershed Grants	Funding for Fun Days, Awareness Days, webpage, newsletters, new pamphlets for all programs
Citizens' volunteer hours	Fun Days, Awareness Days, Tree Planting events as well as additional events.
Riparian Buffer Goals	
Landowners' cooperation	Plant buffers on their property
NRCS	Funding for buffers
ODNR/ MRM or Forestry	Funding for trees for buffers
Citizens' volunteer time	Help plant buffers
OSM	Aid in creating mapping
Illegal Dumping Goals	
Local landfills	Aid in illegal dump clean ups
Citizens' volunteer time	Aid in cleaning up smaller dumps, litter pick up events
Recycling and Litter Prevention Offices	Aid in organizing litter pick up events, information about dump removal
Solid Waste Districts	Information about dump removal, potential funding sources
EPA Supplemental Environmental Program (SEP) Grants	Potential funding sources
EPA Orphan Drum Program	Removal of abandoned drums
OSM	Aid in creating mapping

Raw Sewage Issues	
Tusc. Water & Sewer Dept.	Updating and extension of present Mineral City sewer lines
Co. Health Depts.	Inspection of home septic systems, Creation of plan for updating systems
EPA 319 grant	Potential funding for cost share with landowners to update septic systems
Landowner cooperation	Partner with EPA to update septic systems
Corporation funding/ grants	Potential funding and/or cost share to update septic systems
OSM	Aid in creating mapping
Agricultural Impacts Goals	
NRCS	Funding for fences, alternative water sources
Carroll SWCD	Planning and engineering for fences and alternative water sources, relationships with landowners
Landowner/farmer cooperation	Agreement to use alternative water sources and fencing
OSM	Aid in creating mapping
Oil and Gas Development Issues	
ODNR/MRM Orphan Well Program	Removal and capping of abandoned oil/ gas wells
NRCS/ ODNR Engineers	Meeting with Oil and Gas companies to plan better access roads to wellheads
Oil and Gas Companies	Agreement to create/ plan better access roads
OSM	Aid in creating mapping

*HRWRP staff is assumed to be a resource in all goals.

Fundraising

Funding to Date

Current funding for the efforts in Huff Run come from state (ODNR, OEPA) and federal (NRCS, OSM, EPA) sources as well as some private foundations. A summary of funding is listed below.

Table 16: Summary of Funds

Year	Source	Grant Type	Amount	Use
1997	ODNR	Citizens Action Grant	$300	Environment, letterhead, mailing costs
1997	ODNR/USGS		Initial $50,000 Annual $32,000	Stream gage installation
1997/98	OSM	AML Block Grant	$360,000	Huff Run AML Site
1998	OEPA	319 Planning Grant	$10,000	Public education monitoring

1998	ODNR	Planning Grant	$5,000	Public education and awareness, monitoring stream gage
1999	ODNR	Set aside AMD Program	$114,000	AMDAT Plan
1999	OSM	Summer Intern Grant	$2,500.00	12 week intern public education and awareness
1999	OSM	AML Block Grant	$365,000	Linden Bioremediation
1999	NRCS	Rural Abandoned Mineland Program	$100,000	Linden Bioremediation
2000	OEPA	319 Implementation Grant $	286,000	Southside Tipple Phase II/Design Harsha, Lyons/public education awareness
2000	ODNR	319 State Match	$109,000	Southside Tipple Phase II/Design Harsha, Lyons
2000	OSM	Summer Intern Grant	$2,500	Water monitoring GIS lab
2000	OSM	Summer Intern Grant	$2,500	Public education/awareness, water monitoring
2000	ODNR	Watershed Coordinator Grant	$138,000	Hire Watershed Coordinator
2000	OSM	AML Block Grant	$92,000	Southside Tipple Phase I reclamation
2001	OSM	Appalachian Clean Streams $	$100,000	Linden Phase I Bioremediation System
2001	ODNR	Set Aside AMD Program	$200,000	Linden Phase I Bioremediation System
2001	OSM	AML Block Grant	$120,227	HRWRP Acid Pit #1 Reclamation
2001	ODNR	Operations Support Grant	$7,675	To support Watershed Coordinator
2003	EPA	319 Implementation Grant $	$1,719,979	Lyons, Harsha North, Lindentree, Thomas Public awareness, education
2004	National Fish and Wildlife Foundation	Foundation Grant	$10,500	Reforesting Lyons Project Site

2005	OSM	AML Block Grant	$112,035	Mineral-Zoar Rd project
2005	OSM	ALM Block Grant	$74,544	Fern Hill Impoundments
2005	US EPA	Targeted Grant Program	$1,047,894	Belden project, Public awareness, administration

Future Funding

Many projects are not completely funded yet and there are always more ideas and needs. To meet these financial requirements, additional funding will be necessary. This funding will need to be obtained through the application for additional grants. The group will apply for additional grants on an annual basis from the current sources utilized. The group will look to different sources for additional funding such as U.S. Army Corps of Engineers, and Muskingum Watershed Conservancy District and foundation funding. The group's nonprofit 50(c)3 status will continue to help along with Rural Action. This non-profit status opens up the group to private and corporate donations, endowments and additional state and federal funds. A corporate membership drive may be an avenue for funding. The HRWRP also conducts fundraising activities at the Fun Day and other events to raise unrestricted funds.

VII Evaluation

The ultimate goal for evaluation of the Huff Run Watershed Restoration Partnership, Inc. is for the non or partial attaining stream segments and tributaries to move into full attainment as a result of Huff Run Watershed restoration implementation strategies.

Watershed Improvement

The HRWRP expects to see many changes to the watershed during the restoration process.

The Ohio counties surrounding the Huff Run Watershed have been extensively mined in the past. Even after some surface reclamation, many of these practices have severely impacted the existing watershed, which is a component of the larger Muskingum River basin in central Ohio. Historically, the Muskingum River and its' tributaries have been recognized for their diverse and productive aquatic resources. The mussel (bivalve) and fishery resources of the basin were renowned for their richness both in the state and in the region. Malacologists and the ODNR discovered a new population of the Purple cat's paw bivalve in a tributary of the Muskingum River in the late 1990's, attesting to the past diversity and resiliency of many organisms as well as to the promise for species recovery in the future. Accordingly, ecosystem restoration efforts similar to the Huff Run remediation project are deemed highly worthwhile endeavors toward this goal of partial reestablishment of healthy and diverse aquatic environments in the basin. Restoration projects, such as Huff Run, will ultimately reduce treatment costs incurred by municipalities for public water supplies and even water contact recreation, through savings to personal and public health.

Typical species to be benefited from any restoration activities include (but are not limited to) panfish, darters, minnows, shiners, stream lamprey and possibly bass

and catfish. Aquatic insects and other fish-food organisms would likewise be benefited. Additional food chain benefit would include small mammals, furbearers, reptiles and amphibians, and riparian and forest songbirds.

There is potential for the extensive grasslands planted on reclaimed strip-mined areas to provide habitat for barn owls, northern harriers, or Henslow's sparrows which are all state listed as special interest bird species in Ohio.

The lack of many aquatic species records may be a reflection of a lack of investigation in this area or degraded habitat conditions in streams within the watershed. Huff Run is within the known range of several rare species including the hellbender (Salamander), mountain and northern madtoms and several darters.

Evaluation Process

The following table has been created to set up evaluation activities that will track the success of the Huff Run Watershed Action Plan. Evaluation of the goals and implementation phases will be carried out by the following activities. The ultimate evaluation tool will be if non-attaining or partial attaining streams will move into full attainment. However, other efforts such as education and stakeholder participation will also be evaluated to determine the overall effectiveness and success of the watershed project. Load reductions are the most critical area of evaluation and will be focused on as implementation practices are set into place. However, the timeframe for noticeable water quality improvements may be over a longer period of time.

A HRWRP Annual Report will be given annually.

Table 17: Evaluation Grid

Issue to address	Evaluation Activity	Who	When
AMD	Pre and post monitoring at each project	ODNR/MRM Watershed Coordinator OSM/VISTA TAC, HRWRP	A year before and a year after each project
AMD	Quarterly monitoring at each Reach segment in Huff Run	ODNR/MRM Watershed Coordinator OSM/VISTA TAC, HRWRP	For the duration of the project
Riparian Corridor connecting	Number of landowners who participated in riparian program, miles of corridor that was restored or planted	Watershed Coordinator TAC, HRWRP	Annually after program commences and quarterly for grant reporting
Septic upgrades	Number of septic upgrades	TAC, HRWRP	After septic upgrades are complete
Septic upgrades	Fecal coliform % decrease	Watershed Coordinator County Health Departments TAC, HRWRP	Before and after septic upgrades are complete
Illegal dumping clean up	Number of sites cleaned up, number of volunteers and agencies who aided process, if possible total the tons of trash collected	Watershed Coordinator TAC, HRWRP OSM/VISTA	Annually and quarterly for grant reporting
Agricultural loadings	Number of farmers who	TAC, HRWRP	Annually after program

	participated in fencing program, yards of fence installed		commences and quarterly for grant reporting
Oil and gas development	Number of oil and gas well roads updated, number of dikes upgraded, number of oil and gas personnel that attend our meetings with other engineers	TAC, HRWRP	Annually after program commences and quarterly for grant reporting
Overall project	USGS gauge readings to measure changes in stream health	USGS Watershed Coordinator TAC, HRWRP	Give reports annually
Public awareness	Number of people involved, use sign up sheets	Watershed Coordinator TAC, HRWRP OSM/VISTA	At each activity, and annual totals

IIX Plan Updating and Revisions

The Huff Run Watershed Coordinator will be the keeper of all records and documents related to the Huff Run project including water sampling data, watershed plan revisions and member information. This Huff Run Watershed Coordinator will be responsible for keeping the watershed plan up to date and sending out updated pages to persons on the distribution list.

Distribution List

The distribution list will include all the partners listed in Table 11. Our webpage will also have a downloadable version of the plan will be available to any interested party.

X List of Acronyms

ALD- Anoxic Limestone Drain
AMA- Allegheny Mineral Abatement Company
AMD-Acid Mine Drainage
AMDAT-Acid Mine Drainage Abatement and Treatment
BMPs-Best Management Practices
CRP- Conservation Reserve Program
DO-Dissolved Oxygen
GIS-Geographical Information Systems
HR- Huff Run
-#- A number suffix denotes a sampling site or point named in the AMDAT
HRWRP- Huff Run Watershed Restoration Partnership, Inc.
IBI-Index of Biological Integrity
ICI-Invertebrate Community Index
MRM-Mineral Resources Management
MWCD- Muskingum Watershed Conservancy District
NRCS-Natural Resources Conservation Services
NWI- National Wetland Inventory

ODNR-Ohio Department of Natural Resources
-AML-Abandoned Mine Land
-MRM-Mineral Resources Management
-RLP- Recycling and Litter Prevention
Ohio EPA-Ohio Environmental Protection Agency
OSM- Department of the Interior, Office of Surface Mining
-ACSI-Appalachian Clean Streams Initiative
QHEI-Qualitative Habitat Evaluation Index
RAPS- Reverse Alkalinity Producing System
RC&D-Resource Conservation & Development
SAPS- Successive Alkaline Producing System
SWCD-Soil and Water Conservation District
TAC-Technical Advisory Committee
TMDL-Total Maximum Daily Load
USDA-United States Department of Agriculture
VISTA-Volunteers in Service to America

XI Works Cited

Benatec Associates. "Final Report – Preliminary Design for Huff Run Reclamation Project". 1985.

Brodie, G.A., "Achieving compliance with staged, aerobic, constructed wetlands to treat acid drainage," Proceedings of the 1991 National Meeting of the American Society of Surface Mining and Reclamation, 1991.

Brodie, G.A., Britt, C.R., Tomaszewski, T.M. and Taylor, N.H., "Use of passive anoxic limestone drains to enhance performance of acid drainage treatment wetlands," Proceedings of Reclamation 2000: Technologies and Successes, 1991.

Buchanan, Thomas J. and William P. Somers. "Techniques of Water Resources Investigations of the United States Geological Survey. Chapter A8. Discharge Measurements at Gaging Stations." United States Government Printing Office, Washington: 1969.

Cravotta, C.A. and M.K. Trahan. 1996. Limestone drains to increase pH and remove dissolved metals from an acidic coal-mine discharge in Pennsylvania. pp. 836-840 In Proceedings of the 1996 National meeting of the American Society of Surface Mining and Reclamation, Knoxville, Tennessee.

Dietz, J.M. and Stidinger, D.M., "Acidic Mine Drainage Abatement in an Anaerobic Subsurface Flow Wetland Environment – Case History of the Treatment System at Corsica, PA," Presented at the 1996 Annual Meeting of the American Society of Surface Mining and Reclamation, May 1996.

Dietz, J.M., Watts, R.G. and Stidinger, D.M., “Evaluation of Acidic Mine Drainage Treatment in Constructed Wetland Systems,” Proceedings of the International Land Reclamation and Mine Drainage Conference and the Third International Conference on the Abatement of Acidic Drainage, April 1994.

Dietz, J.M., Water quality monitoring data from a subsurface flow wetland treatment system constructed for Kaiser Refractories, Inc. for the Potato Ridge Mine, 1993. (Personal Records).

Dietz, J.M. 1994. Personal data from the Potato Ridge, township road wetland treatment system.

Dietz, J.M., R.G. Watts and D.M. Stidinger, 1993a. Evaluation of wetlands constructed for the treatment of acidic mine drainage. Commonwealth of Pennsylvania, Department of Environmental Resources, Publication ISBM No. 0-8182-0186-X

Dietz, J.M., J. Gruver and D.M. Stidinger, 1993b. Technical investigation of the abatement of acid mine drainage in a sub-surface wetland environment. Report to the U.S. Bureau of Mines, Pittsburgh, PA. Contract J0209007

Earle, Jane, and Thomas Callaghan. “Effects of Mine Drainage on Aquatic Life, Water Uses, and Man-Made Structures*.” Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania.* The Pennsylvania Department of Environmental Protection, 1998.

Gannett Fleming, Inc., “Abatement of Acid Mine Discharges on Schrader Creek, Franklin and Bradford Townships, Bradford County, Pennsylvania,” for the Pennsylvania Department of Environmental Resources, March 31, 1995.

Griffith, D.M., D.M. DiGiovanni, T.L. Witzel, and E.H. Wharton. 1993. Forest Statistics for Ohio, 1991. Resource Bulletin NE-128. USDA Forest Service, Forest Inventory and Analysis, Northeastern Forest Experiment Station, Radnor, PA.

Hedin, R.S., Nairn, R.W., and Kleinmann, R.L., “Passive treatment of coal mine drainage,” U.S. Department of Interior, Bureau of Mines, Information Circular 9389, 1994.

Hellier, W. W., Jr. 1996. The Bark Camp Run demonstration constructed wetlands: Findings and recommendations for future design criteria. Final Report to the U.S. Environmental Protection Agency, Project 13: USEPA 205 (j)(5) Grant, Volume II, 457pp.

Kepler, D.A. and McCleary, E.C. “Successive alkalinity producing systems (SAP’s) for the treatment of acidic mine drainage.” Proceedings of the 1994 International Land Reclamation and Mine Drainage Conference, 1994.

Kleinmann, R.L., Hedin, R.S., Nairn, R.W., Hyman, D. and Brodie, G., "Passive Treatment of Coal Mine Drainage," Course notes for Jennings Environmental Center RAMP program workshop in Butler, Pennsylvania, 1992.

Skousen, J.G. and Ziemkiewicz, P.F., (editors) "Acid Mine Drainage Control and Treatment," West Virginia University and the National Mine Lands Reclamation Center, 1995.

Skousen, J.G., Burnett, M., Bassage, D., Black, C., Ziemkiewicz, P., and Zucker, D. "The Watershed Approach to Acid Mine Drainage Abatement: Sovern Run," Greenlands, Vol. 27, No. 1, Winter 1997.

Socotoch, C. "Harsha AMD Mitigation Project." *Huff Run Water Quality Improvement Project*. May 1997.

State of Ohio. Department of Natural Resources. Division of Mines and Reclamation Monthly Point Source Sampling Results. 1998-1999.

State of Ohio. Environmental Protection Agency. Ecological Assessment Section. Division of Water Quality. Planning and Assessment (OEPA). "Biological Criteria for the Protection of Aquatic Life." 3 Vols. July 24, 1987. Updated February 15, 1988.

Stoertz, M. "Hydrogeologic Characteriszation in AMD Remediation: Lessons from Monday Creek." Proceedings of the 19th Annual Conference of the Association of Abandoned Mine Land Programs, August 1997.

U.S. Army Corps of Engineers, "Ecosystem Restoration in the Civil Works Program," Circular No. 1105-2-210, June 1, 1995.

Ziemkiewicz, P.F., D.L. Brant and J.G. Skousen. "Acid mine drainage treatment with open limestone channels." pp. 367-374In Proceedings of at the 1996 National Meeting of the American Society of Surface Mining and Reclamation, 1996.

Ziemkiewicz, P.F. and J.G. Skousen. "Overview of Acid Mine Drainage At-Source Control Strategies." Greenlands, Vol. 26, No. 1, 1996.

Zurbuch, P.E., "Early Results from Calcium Carbonate Neutralization of Two West Virgina Rivers Acidified by Mine Drainage," Proceedings of the Seventeenth Annual West Virginia Surface Mine Drainage Task Force Symposium, April 1996.

Zurbuch, P.E., Menedez, R. and Clayton, J.L., "Limestone Neutralization of Dogway Fork, West Virginia, by Means of a Rotary-Drum System," Restoration Ecology, Vol. 4, No. 3, September 1996.

Zurbuch, P.E., “The Self-feeding Rotary Drum Stream Neutralization System, Final Report,” WVDNR Federal Aid D.J. Project F-24-R, Job I-2, 1989.

Website References

Conotton Creek, Map of Hydrologic Group, Group 12 www.epa.state.oh.us/dsw/watershed/grp/group12.htm

Conotton Creek, Water Quality Monitoring, Group 12 Water Resource Inventory (305b Report) www.epa.state.oh.us/dsw/watershed/attain/305b12.htm

Crowell, Douglas L., *History of the Coal Mining Industry in Ohio*, Bulletin 72, Ohio Department of Natural Resources, Division of Geological Survey, Columbus 1995

Huff Run Watershed, *Acid Mine Drainage Abatement and Treatment Plan*, Gannett Fleming, March 2000

Lamborn ,Raymond E.*, The Coal Beds of Western Carroll County and The Coal Beds in Southeastern Mahoning County*, Columbus 1942

Lamborn , Raymond E., *Geology of Tuscarawas County*, Bulletin 55,State of Ohio, Division of Geological Survey, Columbus, 1956

Office of Strategic Research, *Ohio County Profiles*, Ohio Department of Development Tuscarawas County, Ohio Department of Development Carroll County www.odod.state.oh.us/osr/profiles/default.htm

Ohio EPA*, A Guide to Developing Local Watershed Action Plans in Ohio*, Division of Surface Water

Ohio EPA, *Ohio Water Quality Standards*, Chapter 3745-1 of the Administrative Code, Division of Surface Water, Adopted July 21, 1999, Effective July 31, 1999

United States Department of Agriculture, *Soil Survey of Carroll County, Ohio*, Soil Conservation Service, May 1983

United States Department of Agriculture, *Soil Survey of Tuscarawas County, Ohio*, Soil Conservation Service, March 1986

Conotton Creek, Map of Hydrologic Group, Group 12 www.epa.state.oh.us/dsw/watershed/grp/group112.htm

Conotton Creek, Water Quality Monitoring, Group Water 12 Resource Inventory (305b Report) www.epa.state.oh.us/dsw/watershed/attain/305b12.htm

Huff Run Watershed Restoration Partnership www.huffrun.org

Office of Strategic Research, Ohio County Profiles, Ohio Department of Development Tuscarawas County, Ohio, Ohio Department of Development Carroll County
www.odod.state.oh.us/losr/profiles/default.htm

Ohio EPA www.epa.state.oh.us

United States Department of Agriculture (USDA) www.usda.gov

United States Geological Survey (USGS) www-oh-er.usgs.gov