Table of Contents

Introduction

The Ramcat Run Coldwater Conservation Plan is the result of a cooperative effort between many organizations, agencies and individuals and was made possible by a grant award from the Coldwater Heritage Partnership (CHP) to the Fayette County Conservation District (FCCD).

Why Study Ramcat Run?

Ramcat Run is a scenic, high gradient, small freestone stream located just southeast of Ohiopyle, PA (please reference Attachment A – Watershed/Topographic Map). The watershed is largely comprised of wooded areas with some field and meadow areas included. It supports a human population of both year round and seasonal residents who utilize the watershed predominately for recreation.

With all of the recreational interest in the region including the Great Allegheny Passage hike/bike trail, the Youghiogheny River, Ohiopyle State Park and plenty of public game lands, there is interest from a variety of sources in ensuring that streams are reaching their maximum potential for not only recreational purposes but also for the good of the environment.

That being said, Ramcat Run is listed in the Chestnut Ridge Trout Unlimited (CRTU) Middle Youghiogheny River Conservation Plan (RCP) as a high priority watershed and several members of CRTU indicated to FCCD that this was a stream they were interested in learning more about.

Early visual evidence suggested that the stream, which once held a large population of native Brook Trout, was being impacted by abandoned mine drainage (AMD). So, FCCD approached the Pennsylvania Department of Environmental Protection (PADEP) Bureau of Mining & Reclamation about possibly conducting a base survey of the watershed. PADEP agreed to work with FCCD to complete a basic bioassessment and water quality study in 2006.

During the 2006 survey, native Brook Trout were discovered near the mouth and in the headwaters of Ramcat Run but nothing could be found in the central portion of the watershed. White staining on the rocks in the central portion of the watershed combined with a pond near the mouth that was apparently impacted by AMD indicated that further study was necessary.

The FCCD believed that by completing a Coldwater Conservation Plan on Ramcat Run a clearer picture of the threats to this watershed would appear and that an appropriate conservation and protection plan could be developed; including the definition of any additional detailed studies that might be necessary.

When Did Work Begin on Ramcat Run & Who Was Involved?

The first samples on Ramcat Run were collected in 2006 with additional samples taken in 2007. PADEP was assisted at various points during the survey by multiple FCCD staff as well as representatives of PADEP Greensburg District Mining Office, PADEP California District Mining Office, PADEP Southwest Regional Office, PADEP Ebensburg Mining Office and others from PADEP Bureau of Mining & Reclamation as well as representatives from Western Pennsylvania Conservancy (WPC). This core group of individuals formed the beginning of the Ramcat Run Technical Advisory Committee and upon receiving the CHP grant, the committee was expanded to include representatives from CRTU, Pennsylvania Department of Conservation & Natural Resources (PADCNR), Pennsylvania Fish & Boat Commission (PFBC) and private individuals in-

terested in the watershed. For a complete list of committee members, please reference Attachment B.

Goals & Objectives of Project Partners:

All project partners expressed a vested interest in figuring out what is negatively impacting Ramcat Run and discussing options to improve the health of the stream and restore a more complete fishery.

Additionally, the committee agreed that public support and involvement is important and that trying to keep areas of the watershed open to public access for fishing is a priority.

Above: Field team members Chris Saber, Scott Alexander & Geoff Lincoln, from PADEP, in front of waterfall on Ramcat Run.

Background

Impacts on Ramcat Run

Upon review of the baseline information gathered in 2006, all project partners agreed that there were negative impacts to Ramcat Run.

These impacts were originally suspected to be mining related but, after a closer look, now appear to primarily be a combination of acid precipitation interacting with local geology. While mining impacts are indeed present in the lower portion of the watershed, it does not appear that mining is causing the problems witnessed in the central portion of the watershed.

Before discussing the data collection and analysis completed through this grant, a thorough description of the Ramcat Run watershed is provided.

Description of the Watershed

Topographic

Ramcat Run is an approximately 2,584-acre (4 square miles) watershed located in Henry Clay Township, Fayette County, Pennsylvania (please reference Attachment A – Watershed/Topographic Map). This second order stream is approximately 4.7 miles in length and empties into the Youghiogheny River approximately 2.2 miles downstream of the Youghiogheny Dam outlet. According to the Henry Clay Township Subdivision and Land Development Ordinance and the Fayette County Comprehensive Land Use Plan, 1,984 people live in the 34,240-acre (53.5 square miles) area of Henry Clay Township. The Ramcat Run watershed represents roughly 7.5% of the total township area and, based on this information, the population of the watershed can be estimated to be less than 150 people, many of whom are seasonal residents. This watershed is found on the Ohiopyle United States Geological Survey 7.5 minute quadrangle (please reference Attachment A – Watershed/Topographic Map).

The Ramcat Run watershed is characterized by several different land uses. Of the 2,584 total acres, 2,254 acres or 87% of the watershed is forested. These forested areas are large contiguous areas separated by small fields. Field represents a much smaller portion of the watershed, approximately 297 acres or 12% of the total watershed area while residential land use comprises the smallest portion of the watershed at approximately 33 acres or 1%. No small communities are located within the watershed. In addition, approximately 457 acres of land owned by the Commonwealth of Pennsylvania is within the watershed and includes a portion of the Great Allegheny Passage Rails-to-Trails hike/bike trail (~2.4 acres) as well as the Ramcat Run boat launch (~1.2 acres) (please reference Attachment C – Commonwealth of Pennsylvania Property Map). Review of topographic maps also shows evidence of past mining activities within portions of the watershed.

The multiple land uses of this watershed encompass activities that impact the watershed such as mining (past), logging and minor residential development. After review of available background information as well as field visits to the watershed, the FCCD and its project partners have determined that these land uses combine to contribute varying amounts of acidic water, heavy metals, sediment, nutrients and household waste to the stream.

Biologic

Ramcat Run lies within a mesic forest dominated by numerous species including: Tuilptree (*Liriodendron tulipifera*), Red Oak (*Quercus rubra*), Red Maple (*Acer rubrum*), Black Cherry (*Prunus serotina*), Scarlet Oak (*Quercus coccinea*), Chestnut Oak (*Quercus prinus*), Yellow Birch (*Betula alleghaniensis*) and Slippery Elm (*Ulmus rubra*). Other canopy species include American Basswood (*Tilia americana*) and Eastern Hemlock (*Tsuga canadensis*). Common understory species include Striped Maple (*Acer pennsylvanica*), Rosebay Rhododendron (*Rhododendron maximum*), Witch-Hazel (*Hamamelis virginiana*), Sassafras (*Sassafras albidum*) and Wild Hydrangea (*Hydrangea arborescens*). Herbs present in the watershed may include Virginia Waterleaf (*Hydrophyllum virginianum*), Jewelweed (*Impatiens* spp.), Marginal Shield Fern (*Dryopteris marginalis*), Hay-Scented Fern (*Dennstaedtia punctilobula*), Indian Cucumber Root (*Medeola virginiana*), Round Leaf Violet (*Viola rotundifolia*) and Virginia creeper (*Parthenocissus quinquefolia*).

In addition to the many plant species found within the watershed, there are also numerous species of mammals indigenous to Pennsylvania present. Some of the more common species found in the Ramcat Run watershed include white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), several squirrel species (*Sciurus* spp.), opossum (*Didelphis virginiana*), skunk (*Mephitis mephitis*), chipmunk (*Tamias striatus*) and cottontails (*Sylvilagus* spp.). Other species which have a high likelihood of being within the watershed include black bears (*Ursus americanus*), bobcat (*Lynx rufus*), mink (*Mustela vison*), fisher (*Martes pennanti*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*) and coyote (*Canis latrans*). There are also numerous species of birds, small mammals, reptiles and amphibians that can be found in the watershed including Eastern Timber Rattlesnake (*Crotalus horridus*), as seen by field team, and Copperhead (*Agkistrodon contortrix*), as seen by local logging crews.

An initial Pennsylvania Natural Diversity Index (PNDI) search was completed on the Ramcat Run watershed and resulted in fifteen potential threatened and/or endangered species (flora and/or fauna) hits including one potential mammal and fourteen potential plants (please reference Attachment D – PNDI Search Results).

The Pennsylvania Game Commission indicated that "Allegheny Woodrats (*Neotoma magister)*, a state listed threatened species, are known to inhabit the steep rocky slopes along the Youghiogheny River in the adjacent Ohiopyle State Park and on State Game Lands #111, north of the Ramcat Run Watershed Boundary" (please reference Attachment D – PNDI Search Results). Therefore, "potential woodrat habitat may exist on the steep slopes along Ramcat Run from the confluence with the Youghiogheny River upstream for about one mile." The PA Department of Conservation & Natural Resources indicated that Stiff Cowbane (*Oxypolis rigidior*) is known to be found in the watershed while ten additional species are known to be found within one mile of the watershed and may be found in the Ramcat Run Watershed. These additional species include: Blue Monkshood (*Aconitum uncinatum*), Mountain Bugbane (*Cimicifuga americana*), Soapwort Gentian (*Gentiana saponaria*), Creeping Bluets (*Houstonia serpyllifolia*), Large-Flowered Marshallia (*Marshallia grandiflora*), Purple-Fringeless Orchid (*Platanthera peramoena*), Buffalo-Nut (*Pyrularia pubera*), Carolina Tassel-Rue (*Trautvetteria caroliniensis*), New England Grape (*Vitis novae-angliae*) and Sand Grape (*Vitis rupestris*).

The *Fayette County Natural Heritage Inventory*, completed by the Western Pennsylvania Conservancy (WPC) (2000), identifies two significant natural places within the Ramcat Run watershed; the Youghiogheny River Biological Diversity Area and the Youghiogheny River Landscape Conservation Area (please reference Attachment E – Biological Diversity Areas Map).

The significant natural places are listed in the inventory as Biological Diversity Areas (BDA) and Landscape Conservation Areas (LCA). A BDA includes "one or more occurrences of plants, animals or natural communities recognized as a state or federal species of special concern" and "high quality examples of natural communities of areas supporting exceptional native diversity." An LCA is described as "a large contiguous area, important because of its size, open space, habitats and/or inclusion of one or more Biological Diversity Areas." Although an LCA "includes a variety of land uses, it typically has not been heavily disturbed and thus retains much of its natural character."

According to the *Fayette County Natural Heritage Inventory* (Western Pennsylvania Conservancy. 2000.), the Youghiogheny River BDA is the largest as well as the top ranked BDA in Fayette County, is of exceptional significance and has importance on both regional and national levels. The Youghiogheny River BDA is a complex and diverse community extending from where the river exits Chestnut Ridge upstream to the town of Confluence. Along the way, the BDA encompasses a varied array of habitats and harbors many species of special concern.

The lower portion of the Ramcat Run watershed is located in the upper section of the Youghiogheny River BDA; upstream of the Borough of Ohiopyle and downstream of the town of Confluence. This segment of the BDA is characterized by the *Fayette County Natural Heritage Inventory* (Western Pennsylvania Conservancy. 2000.) as having more gentle gradients than the remainder of the BDA displaying cobbly shores and narrower ice-scour zones. Emergent vegetation takes root easily in the cobble areas resulting in Water-Willow (*Justicia americana*) mats. Directly adjacent to the river and the stream are forests consisting of Sycamore (*Platanus occidentalis*) and Box Elder (*Acer negundo*) while further in, the BDA woodlands exhibit Maple (*Acer sp.*) and Oak (*Quercus sp.*) communities with a common understory represented by Spicebush (*Lindera benzoin*), Striped Maple (*Acer pennsylvanica*) and Witch-Hazel (*Hamamelis virginiana*).

The lower portion of the Ramcat Run watershed is also located in the Youghiogheny River LCA. This area is listed by the *Fayette County Natural Heritage Inventory* (Western Pennsylvania Conservancy. 2000.) as being a "biologically diverse, minimally fragmented, forested corridor of striking beauty and great importance to the natural heritage of the county, Pennsylvania and the eastern United States." The Youghiogheny River LCA contains the Youghiogheny River BDA and it is thought that due to "the ruggedness and remoteness of many sections of this watershed, undoubtedly more is yet to be known and documented about the plants, animals and natural communities present." The Natural Heritage Inventory also notes that this significant LCA provides "important habitats and opportunities for the host of more common species that live and migrate through the Allegheny Mountains."

Invasive species represent a significant threat to the diversity of plant life within the Youghiogheny River BDA and LCA as well as the surrounding landscape. Species like Japanese Knotweed (*Polygonum cuspidatum*), Purple Loosestrife (*Lythrum salicaria*), Multiflora Rose (*Rosa multiflora*), Reed Canary Grass (*Phalaris arundinacea*), Garlic Mustard (*Alliaria petiolata*) and Japanese Stiltgrass (*Microstegium vimineum*) thrive in disturbed areas and once gain a foothold, spread rapidly. Invasive species often out-compete native species, especially some of the rare species, for light, space and nutrients (Alliance for the Chesapeake Bay. 2004). This decrease in native biodiversity and increase in invasive species results in additional environmental and economic problems. For example: Japanese Knotweed, a common river and stream bank invader, shades out nearly all other vegetation, decreasing stream stability and contributing to erosion problems. Kaufman and Kaufman (2007), citing a July 2003 speech by then U.S. Forest Chief Dale Bosworth to the Izaak Walton League, state that "all invasives combined cost Americans about $138 billion per year in total economic damages and associated control costs" and "have contributed to the decline of almost half of all imperiled species."

Geologic

When referencing *Geology and Mineral Resources of Fayette County, Pennsylvania* (Hickok IV, W.O. and F.T. Moyer. 1973) Ramcat Run is located in the Allegheny Mountain Section of the Appalachian Plateau Province (please reference Attachment F – Geologic Map with Coal Seams & Extent of Known Mining). This section lies between the Allegheny Front and the western flank of Chestnut Ridge. This is a plateau of strong relief where open folding of rocks and differential erosion has produced linear anticlinal ridges along with intervening synclinal valleys. Devonian, Mississippian and Pennsylvanian strata underlay the surface of the plateau. The older rocks are exposed along the anticlinal ridges and consist predominantly of the Pottsville, Mauch Chunk, Pocono and Upper Devonian strata. The valleys are floored with Allegheny, Conemaugh and in very few places Monongahela strata. There are three major anticlines in the section and they all extend northeast to southwest and run parallel to the Allegheny Front. The three anticlines are named, from east to west, Negro Mountain, Laurel Hill/Ridge and Chestnut Ridge. Ramcat Run flows from the eastern slopes of Laurel Hill/Ridge into the Johnstown Syncline (please reference Attachment F – Geologic Map with Coal Seams & Extent of Known Mining).

Ramcat Run flows though several different rock strata (please refer to Attachment F – Geologic Map with Coal Seams & Extent of Known Mining) including rock from the Mississippian, Pennsylvanian and Recent ages.

Mississippian Age:

From the Mississippian age, there is one stratum within the watershed. This stratum is rock from the Mauch Chunk Formation.

Mauch Chunk Formation

Composed of mostly grayish-red sequences of shale, siltstone, and some conglomerate, the Mauch Chunk Formation includes the fossiliferous Wymps Gap Limestone, the Deer Valley Limestone and the highly crossbedded gray, siliceous Loyalhanna Limestone, which is at the base of the formation. The formation is 400 feet thick in southern Fayette County, thinning to 270 feet at the northern border of the county.

Pennsylvanian Age:

Strata from the Pennsylvanian age within the watershed include the Pottsville Group, Allegheny Group and the Glenshaw Formation of the Conemaugh Group.

Pottsville Group

The Pottsville Group is described as gray to light-gray crossbedded sandstone, quartz-pebble conglomerate, and siltstone, dark-gray, carbonaceous clay shale and clay stone; and thin non-persistent coal. Massive beds of sandstone, up to 100 feet thick, are not uncommon. The group contains the Homewood Sandstone, Mercer Coal and Connoquenessing Sandstone. The formation is thickest in the southern part of the county at 200 feet and decreases to 180 feet in the north.

Allegheny Group

The Allegheny Group is olive to dark-gray, nodular clay stone; light-gray, thin- to massively bedded, fine- to coarse-grained sandstone containing stylolites; gray siltstone; nodules of limestone and siderite; local gray conglomerate; coal and clay. The group is divided into three formations: the Freeport Formation, which has its base at the top of the Upper Kittanning coal; the Kittanning Formation, which has its base at the bottom of the Lower Kittanning coal; and the Clarion Formation, which has its base at the bottom of the Brookville-Clarion coal. The total thickness of the group ranges from 280 to 300 feet. Coals incorporated in the Allegheny Group include the Upper Freeport, Lower Freeport, Upper Kittanning, Middle Kittanning, Lower Kittanning and Brookville-Clarion.

Glenshaw Formation

The Glenshaw Formation is the lower formation of the Conemaugh Group. It is olive- to dark-gray, thin-bedded, fossiliferous, marine limestone and clay shale; red clay stone; locally massive, fine- to coarse-grained sandstone; minor amounts of freshwater limestone; and thin, but generally persistent, coal. It is common to find plant fossils in this formation, which has its base at the top of the Upper Freeport coal. The Glenshaw Formation is 340 to 360 feet thick.

Recent Age:

Deposits from the Recent age within the watershed include Alluvium; a mix of sand, gravel and silt located at the confluence of Ramcat Run with the Youghiogheny River.

Water-Bearing Properties:

The water-bearing properties of the underlying strata may be more important when it comes to well drilling within a certain rock but these properties may also give some insight into natural stream water conditions that can occur when the presence of abandoned mine drainage (AMD) and/or acid deposition is removed.

Basic aquifer evaluations for the strata that occur within Ramcat Run watershed follows. According to *Groundwater Resources of Fayette County, Pennsylvania* (McElroy, Thomas A. 1988.), the Mauch Chunk Formation usually yields water of the alkaline calcium type. The water, however, is of good quality in amounts adequate for domestic use. The outcrop occurs in steep and rugged terrain and it is unlikely that this aquifer would be used to a great extent. The Pottsville Group produces groundwater that is generally of the alkaline calcium type. The group should yield adequate amounts of water for domestic use but will probably have to be treated for iron and manganese. The Allegheny Group produces water of the calcium alkaline type but is a poor aquifer. The yields from this group are low and would require treatment to meet Pennsylvania's water quality standards. The Glenshaw Formation generally yields water of the alkaline calcium magnesium type and provides inadequate amounts of water for domestic use unless storage is provided. The water quality tends to be poor, with dissolved metals like aluminum and lead of particular concern. Alluvium tends to produce water of the calcium sulfate type and while the yields may be larger, quality may be an issue.

Coal Seams:

Coal seams in the mountains (eastern half) of Fayette County are much less defined and consistent than the seam in the western lowland half of the county. Within the Ramcat Run watershed, there are a few mineable coal seams including Brookville-Clarion, Upper Kittanning and Lower Kittanning.

Brookville-Clarion Coal

Brookville-Clarion coal has a persistent occurrence along its line of outcrop and is generally of mineable thickness. The coals are usually considered two separate coal seams but in Fayette County they are usually separated by only a short interval of intervening strata and sufficient information to differentiate the two beds is commonly lacking. The interval between the two beds averages approximately 6 feet along the outcrop and in many places it is only several inches of clay or shale. Due to this thin separation, the two beds are considered one unit and are called Brookville-Clarion coal. The coal seam varies in thickness throughout the county from 3 inches to 9 feet but is only mineable when the depth is 40 inches or greater.

Upper Kittanning Coal

Upper Kittanning coal has a fairly persistent occurrence in Fayette County where the Allegheny formation reaches its normal thickness. It has mineable proportions in the gorges of Jacobs Creek and the Youghiogheny River through Brush Ridge, where the bed is from 20 to 32 inches thick. In the Ligonier Valley the seam is locally mineable and ranges in thickness from 10 to 108 inches and is composed of two or three benches separated by 3 to 6 inches of shale or clay. According to mapping, it appears that Upper Kittanning coal has been mined in the Ramcat Run watershed (please refer to Attachment F – Geologic Map with Coal Seams & Extent of Known Mining).

Lower Kittanning Coal

The Lower Kittanning coal is the last seam found in the watershed and has a persistent, mineable occurrence in Fayette County ranging in thickness from 18 to 60 inches (Coal Resources of Fayette County, Pennsylvania: Part 1. Crop Lines, Mined-Out Areas, and Structure Contours). In the southeast corner of the county, along Laurel Ridge/Hill, thicknesses range between 18 and 55 inches. While generally considered a "clean" coal seam, this seam does have a layer of bony or "dirty" coal ranging between 0 and 12 inches thick at its top. This "dirty" coal tends to be high in sulphur and ash and must be separated from the "clean" coal during mining operations.

Post-Mining Water Qualities:

The different coal seams within the Ramcat Run Watershed produce various types of post-mining water qualities. The mineralogy of the rocks in the overburden, particularly the presence of carbonates and pyrite, ultimately influences post-mining water quality. In the case of underground mines, the post-mining water quality is also influenced by whether the mine is completely flooded or only partially flooded. Completely flooded underground mines generally produce better post-mining water quality. This is due to the reduction of oxygen entering the mine and the mine pool water contacting calcareous material higher in the overburden material. These discharges are generally net alkaline with high iron concentrations and low concentrations of aluminum and manganese. Partially flooded underground mines usually produce poor post-mining water quality. This is due to the presence of oxygen in the mine and the resulting oxidation of the exposed pyretic material. These discharges are generally low pH, net acidic, with high concentrations of iron, aluminum and manganese (Pennsylvania Department of Environmental Protection. 1998.).

The coal seams of the Allegheny Group are divided between the Upper Allegheny Group and the Lower Allegheny Group. The Upper Allegheny Group consists of the Upper Freeport, Lower Freeport and the Upper Kittanning Coal seams. The Lower Allegheny Group consists of the Middle Kittanning, Lower Kittanning and Brookville-Clarion Coal seams. The Upper Allegheny Group coal seams typically produce post-mining discharges with relatively high alkalinity and low metal concentrations. The high alkalinities are due to the presence of the three freshwater limestones (Johnstown Limestone, Upper Freeport Limestone and Lower Freeport Limestone) and calcareous shales associated with the Upper Allegheny Group. This is evident at the Upper Kittanning deep mine discharge located along the north side of Ramcat Run, in the lower section of the watershed. Results from a February 23, 2007 discharge (40 gpm) sample are: pH 7.1, total alkalinity 20.2 mg/L, total acidity -10.4 mg/L, total iron 0.3 mg/L, total aluminum 1.5 mg/L, total manganese <0.05 mg/L and total sulfates 68.1 mg/L. In some situations, particularly in the Upper Kittanning coal, this group of coal seams can produce high acidity, high metal concentration post-mining discharges. This is found in areas where the typically calcareous overburden strata are replaced by thick channel sandstones lacking carbonate materials.

The Lower Allegheny Group lacks the freshwater limestones and associated calcareous shale which are characteristic of the Upper Allegheny Group. Thus, the post-mining water quality of the Lower Allegheny Group is often more acidic. The Lower Kittanning coal overburden contains no true limestones. The Lower Kittanning overburden strata in this section of Fayette County is principally comprised of thick channel sandstones. This often produces post-mining discharges with high acidity and high metal concentrations. The Brookville-Clarion coal and the overlying shales are typically high in total sulfur content. This produces discharges that are

highly acidic with high metal concentrations. The highest acidity concentrations are found where the black brackish shales and thick marine shales predominate in the overburden.

Soils

Soils within the Ramcat Run watershed fall into four main soil associations (please reference Attachment G – Soils Map). A soil association is a landscape that has a distinctive proportional pattern of soils. The association usually consists of one or more major soils and at least one minor soil and is named for the major soils. There is the possibility of the soils in one association occurring in another but in a different pattern (United State Department of Agriculture).

Gilpin-Wharton-Ernest Association:

The first soil association within the Ramcat Run watershed is the Gilpin-Wharton-Ernest association, which makes up approximately 869 acres or 33.62% of the watershed. This association is described as moderately deep and very deep, well drained and moderately well drained, medium-textured, nearly level to very steep soils underlain by acid shale and some sandstone bedrock; on uplands. The Gilpin-Wharton-Ernest association occupies a wide V-shaped area that extends from Point Marion to Perryopolis and from Point Marion to Laurelville. This association makes up around 37% of the soil in the entire county. Of the Gilpin-Wharton-Ernest association about 43% is Gilpin soils, 17% is Wharton soils, 17% is Ernest soils and the remaining 23% is minor soils. Gilpin soils are on the upper, smooth slopes and are well drained and moderately deep. The Wharton soils formed on ridge tops and benches and are moderately well drained. The soils are also deep and have fine textured and moderately fine textured subsoils. The Ernest soils are usually on the lower slopes and have formed in colluvium and have a fragipan. The minor soils consist of Atkins, Brinkerton, Cavode, Lobdell, Philo and Shelocta series. There are areas of mine spoils also within the watershed. The Gilpin-Wharton-Ernest association has some of the best farming soils in the county. The soils in this association have moderate to severe limitations to use as building sites. Springs and wells normally supply enough water for livestock and household use.

Hazleton-Laidig-Buchanan Association:

The second soil association within the Ramcat Run watershed is the Hazleton-Laidig-Buchanan association which makes up approximately 1,647 acres or 63.73% of the watershed. The association is described by the Soil Survey for Fayette County (United States Department of Agriculture) as “moderately deep and very deep, moderately well drained to well drained, nearly level to very steep soils.” The Hazleton-Laidig-Buchanan soils occupy the middle to upper slopes of mountains as well as the tops; where very steep land predominates but mountaintops are “undulating to hilly” and are frequently divided by small streams with narrow floodplains. The association is comprised of “upland soils formed in colluvial and residual materials weathered from sandstone, siltstone and shale.” Minor soils in the association are Clymer, Craigsville, Cookport, Dekalb, Macove, Nolo and Rayne. The Hazleton-Laidig-Buchanan association is predominately used for woodland as the soils tend to be too stony and steep for cultivated crops and/or pasture. Many areas of this association are also utilized for recreational purposed such as camping, fishing and hunting. While “proper woodland management techniques can increase yields and production,” there are limits for equipment use and access since erosion will be high due to the steepness of slope. Additional limiting factors of this soil association are a seasonally high water table coupled with slow permeability and depth to bedrock which when added to the stony, steep slopes makes the soils unfit for most septic tank absorption fields.

Meckesville-Leck Kill Association:

The third soil association within the Ramcat Run watershed is the Meckesville-Leck Kill association which makes up approximately 64 acres 2.48% of the watershed. The association is said to be “deep and very deep, well drained, nearly level to very steep soils on the upper part of the mountainsides and ridges” according to the Soil Survey of Fayette County (United States Department of Agriculture). These soils can be found on the saddle positions and side slopes of mountains with streams crossing the steep slopes and maintaining narrow floodplains. Like the Hazleton-Laidig-Buchanan association, the Meckesville-Leck Kill association consists of “upland soils formed in colluvial and residual materials weathered from red shale, siltstone and sandstone.” This association is roughly made up of 49% Meckesville soils and 20% Leck Kill soils with the remaining 31% comprised of minor soils including Buchanan, Hazleton, Laidig and Macove. The Meckesville-Leck Kill association (considered to be very deep and well drained with medium to moderately fine textured subsoils) is “underlain by residuum from acid, red siltstone, sandstone and shale.” This association has a primary use as woodland with some small areas placed in farmland or valued for recreational uses (camping, fishing, hunting, etc.). Again, these soils are not well suited to septic tank absorption fields due to the steepness of slope while productivity of timber and pulpwood is considered to be moderate to moderately high.

Monongahela-Weinbach Association:

The fourth association within the Ramcat Run watershed is the Monongahela-Weinbach association, which makes up approximately 4.4 acres or only 0.17% of the watershed. This association is described by the Soil Survey of Fayette County (United States Department of Agriculture) as “very deep, moderately well drained, nearly level to moderately steep soils on terraces and floodplains.” According to the Soil Survey, the soils in this association were upland soils formed from materials “weathered dominantly in alluvium from stream and river deposits.” Found predominately on. This association is comprised of approximately 51% Monongahela soils, 9% weinbach soils and 40% made up of minor soils including Ernest, Ginat, Guernsey, Lindside and Lobdell. The uses for this soil association include cropping, hay and pasture and on the steeper slopes, woodland. The main crops for this soils association are “corn, small grain and hay.” Well suited to cultivated crops, the “major management concerns are slope, water table and erosion” (United States Department of Agriculture). These soils can also produce moderately high amounts of wood but are poorly suited to building development due to limitations in “water table, slow permeability, sinkholes, cracks in the bedrock and slope” (United States Department of Agriculture).

An overview of the parent material and chemical properties for the soils in the Ramcat Run watershed shows that there is a heavy tendency towards acidity. Parent materials are largely weathered from acid and soil pHs ranging from 3.5 to 6.5 are quite common. This natural tendency toward acid would be easily exacerbated by addition of acid deposition, especially during spring run-off.

Previous Studies & Analysis of Watershed

Previous Studies

Until this CHP, the Ramcat Run watershed has had few previous studies and/or analysis completed.

The stream and watershed have been referenced in several larger studies already mentioned in this report including the CRTU Middle Youghiogheny River Corridor Conservation Plan and the WPC Fayette County Natural Heritage Inventory both completed in summer of 2000.

The most recently completed study was an in-stream comprehensive evaluation (ICE) conducted by PADEP Southwest Regional Office in November 2006. Please reference Attachment H - Previous Studies for a copy of the ICE data forms. Prior to the PADEP ICE evaluation, PADEP completed an unassessed waters field survey of Ramcat Run in July 1998 (Attachment H - Previous Studies). Both studies looked at only one site located near the mouth of Ramcat Run; the same sampling location is utilized for this CHP and noted as RC01 (please reference Figure: 1 on page 12). Each PADEP study lists the sampled site as having good water quality and habitat; however, neither study fully evaluated the entire length of the stream and therefore did not note the extirpation of fish and reduced macroinvertebrate diversity within the central portion of the watershed.

Analysis of Watershed

Water Quality/Bioassessment Data

In 2006, FCCD partnered with PADEP Bureau of Mining and Reclamation and others to conduct a baseline study of Ramcat Run. Preliminary electrofishing of the stream revealed the presence of Native Brook Trout (***Salvelinus fontinalis***) about 100 yards upstream of the confluence of Ramcat Run and the Youghiogheny River as well as in the very headwaters of the stream located in Ohiopyle State Park. In addition, Mottled Sculpin (***Cottus bairdi***), Blacknose Dace (***Rhinichthys atratulus***) and Creek Chub (***Semotilus atromaculatus***) were found at the downstream site. No fishes were found in the middle sections of the watershed even though this stretch appeared to have the best habitat for supporting reproducing fish populations including optimal in-stream cover, epifaunal substrate, frequency of riffles, etc. (please refer to Attachment I - Qualitative Bioassessment & Water Quality Results).

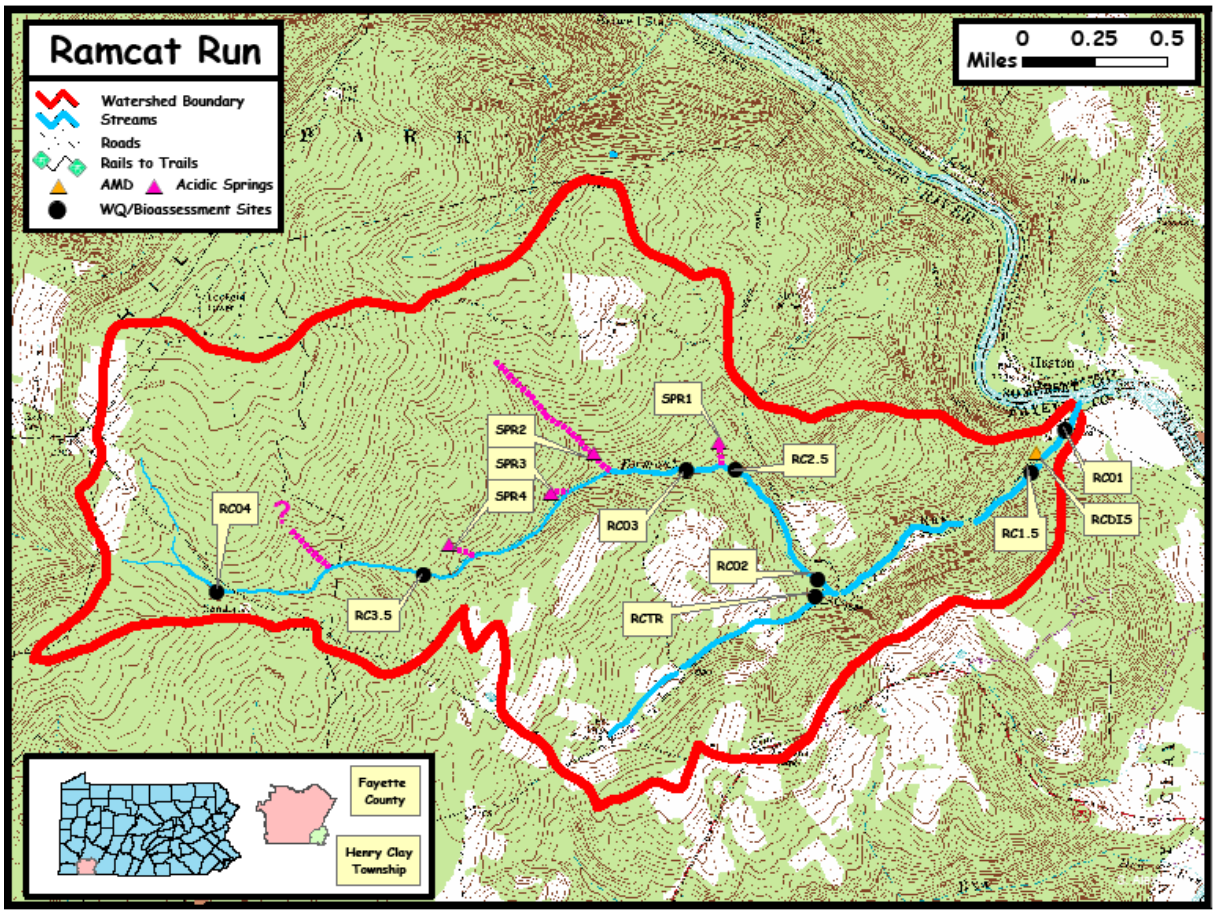
Due to the award of the CHP grant and the dedicated participation of PADEP and technical advisory committee members, Ramcat Run sampling continued through 2007 and 2008 culminating with our last round of sampling in August 2008.

Six rounds of sampling data spanning 13 sampling sites were collected. Dates of sampling were 08/11/06, 02/23/07, 11/20/07, 01/08/08, 06/19/08 and 8/21/08.

Sampling Sites:

The 13 sampling sites were selected by members of the technical advisory committee and were added and/or removed for certain sampling rounds at the discretion of the field team based on past review of water quality, access issues, etc. (please refer to Figure: 1 – Ramcat Run Sampling Sites). For a full page view of the Ramcat Run Sampling Sites Map, please reference Attachment J.

Figure 1: Ramcat Run Sampling Sites



Water Quality Data:

Water quality data was collected on all six sampling dates to help determine the overall health of Ramcat Run as well as to help identify any possible pollution sources.

- Sampling sites RC02 & RC04 were sampled during all 6 rounds.
- Sampling sites RC01, RCDIS and RCTR were sampled during 5 rounds.
- Sampling sites RC1.5 and RC2.5 were sampled during 3 rounds.
- SPR1, RC03, SPR2, SPR3, SPR4 and RC3.5 were sampled during only 1 round.

Parameters tested at all locations and on each sampling date included:

- pH
- alkalinity
- hot acidity
- total dissolved manganese (Mn)
- total dissolved aluminum (Al)
- total dissolved iron (Fe)
- total sulfates

Total dissolved calcium (Ca) and total dissolved magnesium (Mg) were included at the following sites on the dates indicated:

- RC01 11/20/07, 06/19/08 & 08/21/08
- RCDIS 11/20/07, 06/19/08 & 08/21/08
- RC1.5 06/19/08 & 08/21/08
- RCTR 11/20/07, 06/19/08 & 08/21/08
- RC02 11/20/07, 06/19/08 & 08/21/08
- RC2.5 11/20/07, 06/19/08 & 08/21/08
- SPR1 01/08/08
- SPR2 01/08/08
- SPR3 01/08/08
- SPR4 01/08/08
- RC3.5 06/19/08
- RC04 11/20/07, 01/08/08, 06/19/08 & 08/21/08

Total suspended solids were recorded for all sites during each sampling round with the exception of those sites sampled on 08/21/08.

Please refer to Table 1: Water Quality for a brief data summary. For a complete review of water quality results, please refer to Attachment I - Qualitative Bioassessment & Water Quality Results.

Table 1: Water Quality - Averaged

Sample Site	Lab pH	Alkalinity (mg/l)	Hot Acidity (mg/l)	Total Sulfates (mg/l)	Total Dissolved Aluminum (mg/l)	Total Dissolved Iron (mg/l)	Total Dissolved Manganese (mg/l)	Total Suspended Solids (mg/l)	Flow (GPM)
RC01	6.90	13.72	-1.08	18.94	0.37	0.23	0.04	4.25	2353
RCDIS	6.70	21.48	-6.92	91.18	2.16	0.46	0.09	6.50	22
RC1.5	7.10	7.10	0.60	16.66	0.25	0.14	0.04	7.50	935
RCTR	7.29	30.20	-16.68	18.50	0.39	0.37	0.05	10.25	229
RC02	5.25	7.56	4.56	18.33	0.43	0.19	0.09	5.00	1670
RC2.5	4.86	6.86	6.46	16.66	0.53	0.15	0.12	6.50	753
SPR1	4.70	6.20	-15.00	<20.00	0.53	<0.30	0.13	2.00	~
RC03	4.90	7.20	4.40	<20.00	<0.50	<0.30	<0.05	<3.00	~
SPR2	4.60	6.20	8.40	<20.00	0.65	<0.30	0.13	8.00	~
SPR3	4.50	5.60	8.60	<20.00	1.02	0.32	0.99	8.00	~
SPR4	4.50	5.80	5.20	<20.00	0.85	0.03	1.01	4.00	~
RC3.5	5.10	7.40	7.60	<15.00	0.38	0.06	1.49	<5.00	~
RC04	6.36	9.90	0.60	27.13	0.28	0.14	2.09	4.60	286

~=Not Sampled

Electrofishing:

Electrofishing was conducted to establish the presence of any fish populations as well as to aid in the determination of the overall health of Ramcat Run. Electrofishing was conducted at the following sites on 8/11/06 & 10/31/07: RC01, RC1.5, RCTR, RC02, RC2.5, RC03, RC3.5 & RC04. Please refer to Table 2: Electrofishing Results for data summary.

Table 2: Electrofishing Results

Species	**Mouth** (RC01, RC1.5)	**Central** (RC02, RC2.5, RCTR, RC03, RC3.5)	**Headwaters** (RC04)
Mottled Sculpin (***Cottus bairdi***)	23	0	0
Blacknose Dace (***Rhinichthys atratulus***)	10	0	0
Creek Chub (***Semotilus atromaculatus***)	3	0	0
Brown Trout Hatchery (***Salmo trutta***)	1	0	0
Tiger Trout (***Salmo trutta***)	1	0	0
Brook Trout (***Salvelinus fontinalis***)	32	0	16

Macroinvertebrates:

Macroinvertebrate sampling was conducted to establish the presence of any macroinvertebrate colonies as well as to aid in the determination of the overall health of Ramcat Run. Macroinvertebrates were collected from 6 total locations between 10/30/07 & 10/31/07.

Macroinvertebrates were collected at the following sites on 10/30/07: RC01, RC1.5, RCTR and RC02.

Macroinvertebrates were collected at the following sites on 10/31/07: RC2.5 and RC04.

Please refer to Table 3: Macroinvertebrates for a data summary.

Table 3: Macroinvertebrates

Species	RC 01	RC DIS	RC 1.5	RC TR	RC 02	RC 2.5	SPR 1	RC 03	SPR 2	SPR 3	SPR 4	RC 3.5	RC 04
Diving Beetle (Dytiscidae)							~	~	~	~	~	~	R
Crayfish (***Cambarus***)	P		P	P		P	~	~	~	~	~	~	
Snipe Fly (Athericidae)			R				~	~	~	~	~	~	R
Biting Midge (Ceratopogonidae)				R	R		~	~	~	~	~	~	
Midge (Chironomidae)	P		P				~	~	~	~	~	~	
Cranefly (***Tipula***)	R		P				~	~	~	~	~	~	P
Small Minnow Mayfly (***Baetis***)			R	C	R		~	~	~	~	~	~	P
Spiny Crawler Mayfly (***Ephemerella***)	R			R			~	~	~	~	~	~	
Flat Headed Mayfly (***Stenoma***)	R		R	R			~	~	~	~	~	~	P
Sow Bug (Asellidae)	R		P	P	P	A	~	~	~	~	~	~	A
Dobsonfly/Alderfly (***Nigronia***)			R		P	P	~	~	~	~	~	~	
Dragonfly (Aeshnidae)							~	~	~	~	~	~	R
Aquatic Earthworm (Oligochaeta)			R		R	R	~	~	~	~	~	~	
Winter Stonefly (***Capnia***)					R	R	~	~	~	~	~	~	
Green Stonefly (Chloroperlidae)	R			P		R	~	~	~	~	~	~	P
Rolled-Winged Stonefly (***Leuctra)***	R		R	R			~	~	~	~	~	~	
Roach-Like Stonefly (***Peltoperla***)				R	A	A	~	~	~	~	~	~	C
Common Stonefly (***Acroneuria***)	R		R	C	P	R	~	~	~	~	~	~	R
Perlodid Stonefly (***Isoperla***)					C	P	~	~	~	~	~	~	P
Giant Stonefly (***Pteronarcys***)				C			~	~	~	~	~	~	
Common Net-Spinner Caddisfly (***Hydropsyche***)	C		C	P	C	C	~	~	~	~	~	~	C
Northern Casemaker Caddisfly (Limnephilidae)			R				~	~	~	~	~	~	R
Fingernet Caddisfly (***Wormaldia***)			P	R	P	P	~	~	~	~	~	~	C
Free-Living Caddisfly (***Rhyacophila***)			P		R	P	~	~	~	~	~	~	

A=Abundant, C=Common, P=Present, R=Rare, ~=Not Sampled

Flow Measurements:

Flow measurements were taken to help determine the ability of Ramcat Run to sustain a healthy population of in-stream life as well as to gauge water quality parameters that may be altered by seasonal fluctuations. Flow measurements are also critical in determining pollutant loadings as well as in the monitoring of long-term trending such as water quantity losses. Flow measurements were conducted at 7 total sites between 2/23/07, 11/20/07 & 08/21/08.

Flow was measured on all 3 dates at the following sampling sites: RC01, RCDIS, RCTR, RC02 and RC04.

Flow was measured 2 times at RC1.5 and RC2.5 on 11/20/07 & 08/21/08.

Flow measurements were not taken at sites SPR1, RC03, SPR2, SPR3, SPR4 and RC3.5.

Please refer to Table 4: Flow Measurements for a data summary.

Table 4: Flow Measurements

	Flow (GPM)					
	08/11/06	**11/20/07**	**02/23/07**	**01/08/08**	**06/19/08**	**08/21/08**
RC01	~	2020	4646	~	~	394
RCDIS	~	15	40	~	~	13
RC1.5	~	1489	~	~	~	381
RCTR	~	249	396	~	~	44
RC02	~	1256	3419	~	~	337
RC2.5	~	1256	~	~	~	250
SPR1	~	~	~	~	~	~
RC03	~	~	~	~	~	~
SPR2	~	~	~	~	~	~
SPR3	~	~	~	~	~	~
SPR4	~	~	~	~	~	~
RC3.5	~	~	~	~	~	~
RC04	~	285	482	~	~	91

~=Not Sampled

Areas of Concern & Potential Conflicts

Impacts

Upon initial visual inspection and based on reports from individuals, field investigators considered the possible presence of AMD within several areas of Ramcat Run including RCDIS and the area near RC02 (please refer to Figure: 1 – Ramcat Run Sampling Sites or Attachment J). RCDIS is located low in the watershed and empties directly into a small pond which showed visible signs of AMD including water discoloration from the presence of Fe and Al while the area near RC02 exhibited white staining indicating the possible presence of Al.

Water quality results did indeed show the presence of AMD at RCDIS. However, RCDIS empties into a small pond that holds the water and allows the bulk of pollution to settle out rather than enter Ramcat Run (please reference Attachment K - Photographs).

Additionally, the presence of the white staining near RC02 spurred field investigators to survey the watershed searching for any additional AMD discharges, no such discharges were found. However, 4 springs entering Ramcat Run were discovered each of which have a lower pH (mid to upper 4s) than the main stem and when combined with the naturally occurring acid geology of the area (Pottsville Group) and acid precipitation (generally pH of 5.1) create a low pH environment. When the low pH water mixes with RCTR (please refer to Figure: 1 – Ramcat Run Sampling Sites or Attachment J), the boost of more neutral pH water with higher alkalinity allows Al to dropout of suspension and deposit on the streambed likely causing the staining.

The presence of sediment in the stream was also noted and is likely emanating from Ramcat Road (dirt road) and nearby logging activities.

Electrofishing results revealed the presence of fish populations near the mouth of Ramcat Run as well as in the headwaters. It's likely that some of the fish population present near the mouth of Ramcat Run has migrated up from the Youghiogheny River. Both populations of Brook Trout appear to be naturally reproducing in Ramcat Run. Physical barriers exist in the tributary to Ramcat Run (RCTR) that would inhibit the presence of fish populations along this stretch. Additionally, while there are a few barriers to fish migration within the central portion of the watershed we would expect that this section of stream could support a naturally reproducing population as anecdotal evidence supports (local angler knowledge including from technical advisory committee member). It is suspected that the presence of Al within the stream is the result not of AMD but of local geology mixing with acid precipitation to create a toxic environment. Referencing *Organisms and Heavy Metal Tolerance* (Lehigh University), "a combination of pH less than 5.5 and dissolved aluminum concentration greater than 0.5 mg/L will generally eliminate all fish and many macroinvertebrates." Therefore, the likely culprit to fish extirpation in this area of Ramcat Run is a combination of not only dissolved AL but also suppressed pH from acidic geologic formations and acid precipitation which fluctuates seasonally.

In general, more macroinvertebrates were found above the AMD discharge (RCDIS) than below and more acid tolerant species were present throughout the stream. It was determined that this decrease in diversity below RCDIS is more likely attributable to the nature of a high gradient stream (fluctuations in flow and scouring near mouth) than the actual in-stream presence of AMD.

Recommendations & Next Steps

With the findings above in mind, the committee entered into a discussion of project goals and the potential treatment options that might help us to achieve them.

Overall, the committee decided that the overarching goal of the project is to restore a more complete Brook Trout fishery to Ramcat Run. This goal will ideally be served by implementing work to slightly increase the pH of the middle section of Ramcat Run so that it may reach and maintain a level that can better support Brook Trout.

Inherent in the process is limited continual stream monitoring through water sampling and bioassessment work as well as work to reach out to local landowners to support public access for fishing.

Treatment options discussed at selected sites included limestone sand dosing, construction of an anoxic limestone drain (ALD), construction of open limestone channels and the development of treatment barrels containing soda ash briquettes.

Limestone Sand Dosing

Limestone sand dosing is a relatively cost effective and efficient means of creating the necessary pH increase in acid streams to allow for the re-population of aquatic life (Sharpe and Swistock, 2005.). Dosing streams with calcium carbonate ($CaCO_3$) limestone sand has been practiced in several Appalachian states in order to counteract the negative effects of acidic atmospheric deposition (acid precipitation) and AMD; the first successful limestone sand dosing treatment conducted in Pennsylvania can be found in Fayette County in the Glade Run watershed. This method of treatment places limestone sand in and/or along the stream to be carried downstream during high flow events. As the sand dissolves, it neutralizes stream acidity by the reaction: ($CaCO_3 + H^+ = Ca^{+2} + HCO_3^-$). This simple technique is often the most cost-effective way to add alkalinity to a stream since most of the $CaCO_3$ dissolves directly into the stream and because dosing eliminates the expense of constructing either an active or passive treatment system. Furthermore, limestone sand is an inexpensive by-product of limestone quarries and is readily available.

While limestone sand dosing is not appropriate for all streams affected by acid impacts, it can be used to great success and with limited resources under the right conditions. Ramcat Run is such a stream due to its relatively small size and high gradient.

Five potential limestone sand dosing locations for Ramcat Run were discussed and include:

Site 1 Headwaters site in Ohiopyle State Park on Western side of Sugar Loaf Road

Site 2 Headwaters site in Ohiopyle State Park on Eastern side of Sugar Loaf Road

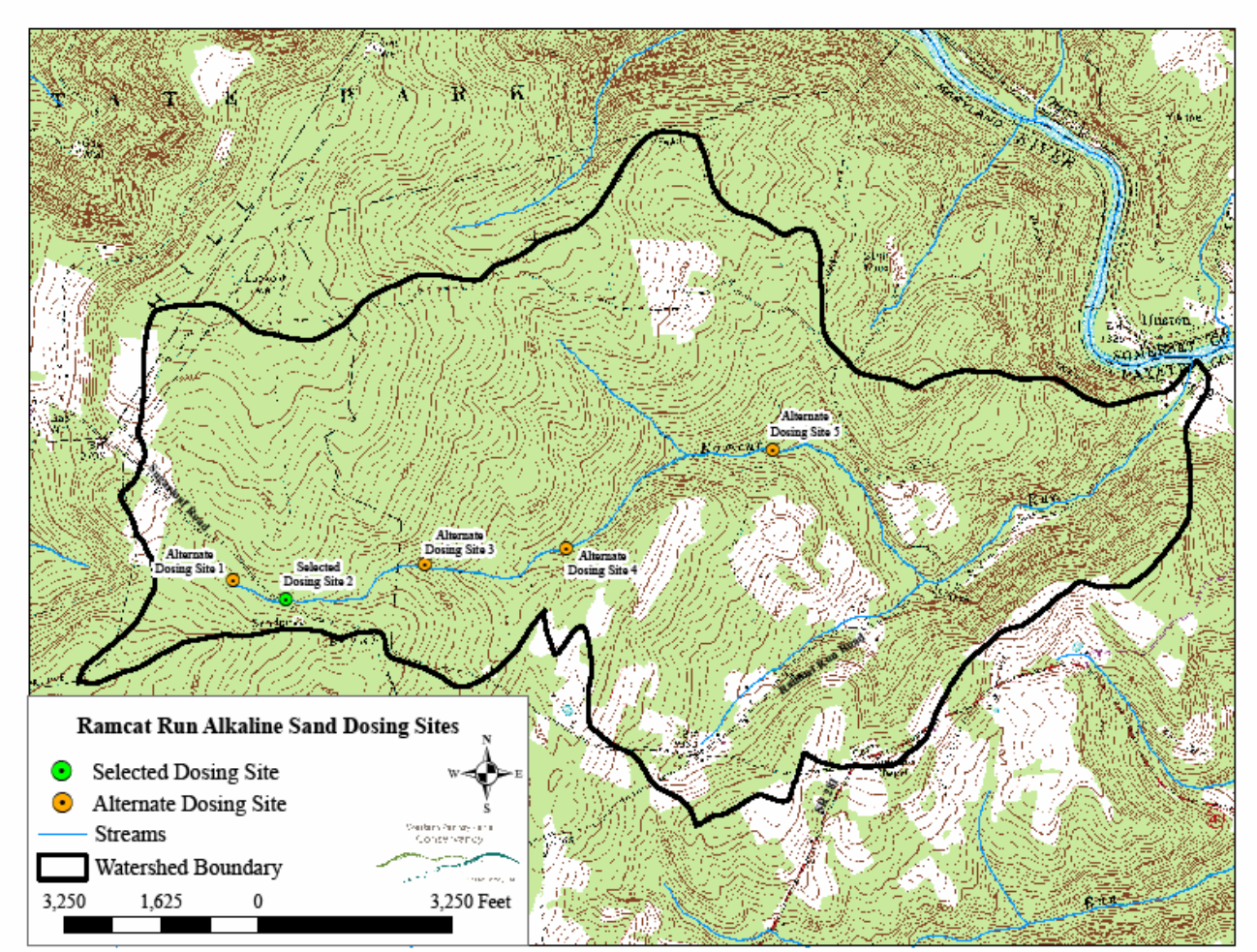
Site 3 Headwaters site on Private Property below Site 2 and above RC3.5

Site 4 Headwaters site on Adah Gun Club Property near RC04

Site 5 Mid-Watershed site on Private Property near RC2.5

For a full page view of the proposed limestone dosing locations, please reference Attachment L.

Figure 2: Ramcat Run Potential Limestone Sand Dosing Sites



Site 1

Site 1 is a headwaters location within the boundaries of Ohiopyle State Park on the western side of Sugar Loaf Road.

This site is relatively flat and easily accessible and could accommodate a turn around for trucks delivering sand.

The primary concern with this site is that the topography feeding Ramcat Run downstream of Site 1 and before Site 2 is relatively flat. Questions arise as to whether the stream would have enough flow and gradient to carry the sand downstream and dispersing it properly within the stream bed. An additional concern with this site is sand laying in the streambed and possibly harming macroinvertebrate life and negatively impacting the Brook Trout population. Some committee members suggested that during high flow events volunteers could gather to help push the limestone sand into the stream to facilitate it moving successfully downstream.

Site 2

Site 2 is also a headwaters location within the boundaries of Ohiopyle State Park but located on the eastern side of Sugar Loaf Road. This site is more desirable to Site 1 since it is also a headwaters location and the stream immediately begins to get steeper downstream.

The site is available for immediate use because it is easily accessible from Sugar Loaf Road. Limestone sand could be placed directly on the ground surface and no trees or shrubs would need to be removed.

A concern with this site would be sand laying in the streambed and harming macroinvertebrate life and possibly negatively impacting the Brook Trout population. Discussion regarding this concern centered on an initial negative impact to macroinvertebrate populations. However, general thinking suggests that they would likely recover enough in time and the Brook Trout populations above the sand dosing site would not be negatively impacted. While the initial loss of some macroinvertebrate populations would be both unfortunate and unavoidable, the potential for improvement in much larger sections of the stream combined with an eventual rebound of macroinvertebrate populations would be of more benefit to stream health than any initial macroinvertebrate losses.

There is also the presence of some debris in this portion of the stream that raised concerns about sand getting clogged up/backed up. The use of volunteers to clear some of the problem areas of debris and distribute the sand during high flow events was discussed. Some committee members feel that there is enough gradient to carry the sand effectively.

Site 3

Site 3, also a headwaters site, is located on private property below Site 2 and above sampling location RC3.5. This location was looked at since there are remnants of what may have been an old logging road and there is a small waterfall in this section of stream.

The waterfall and subsequent steeper gradient downstream would allow the sand to be carried very effectively without getting hung up anywhere.

The primary concern with this site is access. The remnant logging road was barely visible and would need considerably more work to clear and stabilize enough for large trucks delivering sand. Also, the access road would need to be considerably long and may cross multiple tracks of land potentially adding considerable expense as well as extensive negotiations.

Site 4

Site 4 is a headwaters site located primarily on property likely owned by the Adah Gun Club and near sampling location RC04. This site is of interest since it allows access to Ramcat Run just above the portion of stream we'd like to see a pH boost in. The stream contains significant gradient within this section, which would maximize sand distribution downstream and also has the remnants of roads that could be cleared and upgraded up for trucks delivering sand.

Additionally, this site, once cleared near the stream, could easily accommodate a turn around for trucks and would allow trucks to deposit sand in a variety of spots that could easily enter the stream as well as some ephemeral tributaries.

Concerns over this site include the length of road that would be required. This is by far the longest road among the sites considered. Multiple landowner agreements would likely be necessary and determining whether the gun club owns all of the property or if the boundary closest to the stream belongs to another party could add considerable expense, negotiations and time.

In addition, the necessary access road would need to have drainage pipes installed along wet spots for proper stabilization. Some committee members felt that the road could be done with local machine operators for a reasonable price if the right person could be found. Donations and/or discounts on rock for the road, etc. would need to be secured in order to complete the project within a reasonable budget.

Site 5

Site 5 is located mid-watershed on private property and near sampling location RC2.5. This location was primarily looked at for the idea of dosing the stream at more than one location. Multiple locations in the headwaters joined by this location lower in the watershed would create greater distribution of sand throughout the stream length and might help alleviate concerns of placing too much sand in one location.

Since limestone sand dosing success depends on properly "priming" the stream, initial dosing will require 2 to 3 times the amount of sand for subsequent treatments/doses. Concerns of placing that quantity of sand in one location were discussed and Site 5 was discussed as a way to help distribute this.

Site 5 is located on private property near a hunting camp. There is an access road that eventually leads directly to Ramcat Run. However, the road will also require considerable upgrading to handle large trucks.

Concerns over this site included landowner agreement as well as whether or not this site is too low in the watershed to result in enough of a benefit. Arguments include the fact that Site 5 is located below all of the springs (SPR1- SPR4). Since the springs have a lower pH due to the natural geology and enhanced by acid precipitation, placing some sand below them would give an added pH boost to benefit the stream. Some committee members also suggested that treatment above was the only treatment really necessary and that the sand carrying downstream would be sufficient enough for the necessary pH boost.

Additional Options

Based on the discussion of all 5 potential limestone sand dosing sites, the committee also considered additional treatments options. These options were considered to supplement limestone sand dosing as well as to replace sand dosing.

One option discussed was located at Site 3. This site had an area where a tributary to the stream went underground then bubbled back up further downstream and remained a free flowing stream aboveground. The committee discussed possibly digging out around where the tributary emerged and creating an anoxic limestone drain (ALD). This could be in addition to limestone dosing or in place of sand dosing. Concern over this option would be the difficult access as discussed earlier for sand dosing.

Another option discussed was targeting the 4 springs (SPR1-SPR4) with ALDs or possibly just diverting each spring into a limestone channel then having it re-enter the stream after the lime-

stone channel. Again, this idea could be in addition to sand dosing at other sites or in place of sand dosing. This idea was deemed not likely since access to the springs is extremely difficult.

Finally, we discussed the use of a 55 gallon barrel containing soda ash briquettes. The barrel could be constructed, filled with briquettes and water could flow through for treatment. Concerns here were with cost of briquettes as well as with clogging from debris, which would eliminate all treatment, since the watershed is primarily wooded. This idea would require regular maintenance but opinion was that we could find enough staff between the FCCD and Ohiopyle State Park as well as through volunteers from CRTU, local sportsman clubs and Friends of Ohiopyle (FOO) to maintain the barrels. Placement of barrels was considered on Site 1, Site 2 and possibly at SPR1. This idea would be easier to install but much higher on maintenance.

Chemical treatment options were largely excluded from detailed consideration due to associated expenses.

Cost & Funding

Cost for complete limestone sand dosing of Ramcat Run is estimated to range from $5,000 - $10,000 for the first year at a current estimated rate of $21 per ton of sand delivered from a quarry in Cranesville, West Virginia. The total project cost will increase in varying amounts with the addition of any necessary site clearing and preparation including creation of any required access roads.

When developing a dosing schedule, the amount of limestone sand needed is calculated using the size of the watershed combined with estimated flow rates. This calculated amount is generally increased for the first year of treatment to be roughly 2-3 times of the required amount so that the stream can be “primed” to adequately raise the and maintain levels to the desired pH. Second year treatment would see a reduction in the amount of limestone sand required and in the third year, typically amounts can be reduced again to reach the “base” amount initially calculated. Each year after the third can generally be maintained at this base level so long as a regular dosing schedule is maintained.

Therefore, initial dosing costs are highest during the first year and decrease annually until the third year. A certain amount of limestone sand will remain active in the stream allowing for the potential of only semi-annual sand purchases and additions to maintain appropriate pH for sustaining aquatic life. This can be determined through regular monitoring of the stream.
As a cost comparison, an anoxic limestone drain was installed along Shingle Run, in Somerset County, at a cost of $34,586. However, the system only treats a small portion of the stream flow and downstream pH remained in the 4.5-5.0 range. In contrast, limestone sand dosing can treat the entire stream flow; cost ~$1,000 per year and will raise pH above 6.0 and alkalinity above 10-mg/l.

For further comparison, it costs roughly $100 per ton of acidity neutralized using chemical treatment options. Using a rough estimate of about 50 tons per year of acidity at RC 02, it would mean $5,000 in chemical costs alone to neutralize acidity on Ramcat Run. Additionally, if a one ton Aquafix unit was used to disperse chemicals into the stream, the treatment cost would grow to include approximately $20,000. Based on the 50 tons per year estimate, it would mean filling the unit roughly every week with a ton of material (50 bags, 40lbs per bag) and adding in substantial expenses for labor, hauling, etc. Otherwise, a large silo that holds 35 tons could be installed for approximately $100,000 and would require just a couple of loads per year of chemi-

cal. When these costs are compared to roughly 3 trucks of sand (66 tons) a year, once the stream is primed, limestone sand dosing offers substantial cost savings.

Summary/Conclusions

Ramcat Run is a scenic, high gradient, small freestone stream found in the Southern Laurel Highlands. This watershed is largely comprised of wooded areas and supports a human population of both year round and seasonal residents who utilize the watershed predominately for recreation.

With a wide range of nearby outdoor amenities including the Youghiogheny River, Ohiopyle State Park, thousands of acres of public game lands not to mention the Great Allegheny Passage hike/bike trail, there is interest from many sources in ensuring that local streams are reaching their maximum potential for not only recreational purposes but also for the good of the environment.

Ramcat Run shows both visual and physical evidence of abandoned mine drainage. However, after completing this coldwater conservation plan, it appears that the primary impairment is chronic acidification stemming from mixing of acid deposition with naturally acidic springs emanating from acidic geologic formations and soils located within the central portion of the watershed. Due to the poor water quality conditions, aquatic life is severely limited in the central portion of Ramcat Run.

Electrofishing of the stream revealed the presence of ***Salvelinus fontinalis*** (Native Brook Trout) about 100 yards upstream of the confluence of Ramcat Run and the Youghiogheny River as well as in the very headwaters of the stream located in Ohiopyle State Park. No fishes were found in the middle sections of the watershed even though this stretch appears to have the best habitat for supporting reproducing fish populations.

Completion of this coldwater conservation plan allowed the Ramcat Run technical advisory committee to work collaboratively to gather data (current and past) and analyze that information to create a clearer picture of the threats to this watershed as well as to work on a potential restoration plan.

As a result, the FCCD applied for and was awarded a Pennsylvania Association of Conservation Districts (PACD) mini-grant to conduct a demonstration project with the hopes of improving water quality and aquatic life in the central portion of Ramcat Run. The demonstration project is attempting to elevate pH levels in the stream through the addition of alkaline limestone sand. With an improvement to water quality conditions, we hope to eventually reconnect the isolated brook trout population in the headwaters with the fish in the lower watershed to develop a healthy, naturally reproducing brook trout population throughout the entire watershed, thereby establishing a well functioning stream ecosystem and another recreational fishery.

Inherent in both the coldwater conservation grant and the PACD mini-grant is a desire to reach out to the public and involve them in the on-going efforts to improve Ramcat Run as well as to educate them on the lasting value and benefits of coldwater ecosystems. This important aspect was achieved through public meetings, surveys and, in the near future, a field day showcasing the limestone sand demonstration project.

References

Alliance for the Chesapeake Bay. 2004. *Pennsylvania Field Guide: Common Invasive Plants in Riparian Areas*.

Falcone, Abbey and Annette Paluh. 1998. *Unassessed Waters Field Survey– Ramcat Run*. Pennsylvania Department of Environmental Protection.

Fayette County. 2000. *Fayette County Comprehensive Land Use Plan*. Completed by Herbert, Rowland & Grubic, Inc.

Fayette County. 2010. *Fayette County Mountain Area Multi-Municipal Comprehensive Plan*. Completed by Mackin Engineering, Inc.

Fergus, Charles. 2000. *Wildlife of Pennsylvania & The Northeast.*

Henry Clay Township. 1997. *Henry Clay Township Subdivision and Land Development Ordinance*. Completed by Mackin Engineering, Inc.

Hickok IV, W.O. and F.T. Moyer. 1973. *Geology & Mineral Resources of Fayette County, Pennsylvania*. Commonwealth of Pennsylvania Department of Environmental Resources, Bureau of Topographic and Geologic Survey, County Report 26.

Kaufman, Sylvan Ramsey and Wallace Kaufman. 2007. *Invasive Plants: Guide to Identification and the Impacts and Control of Common North American Species*.

Kenderes, Gary. 2006. *In-stream Comprehensive Evaluation – Ramcat Run*. Pennsylvania Department of Environmental Protection.

Lehigh University. *Organisms and Heavy Metal Tolerance.* Available online: http://www.leo.lehigh.edu/envirosci/enviroissue/amd/links/wildlife4.html.

McElroy, Thomas A. 1988. *Groundwater Resources of Fayette County, Pennsylvania*. Commonwealth of Pennsylvania Department of Environmental Resources, Office of resources Management, Bureau of Topographic and Geologic Survey, Water Resource Report 60.

Pennsylvania Department of Environmental Protection. 1998. *Coal Mine Drainage Prediction and Pollution Prevention in Pennsylvania*.

Sharpe, William E. and Bryan R. Swistock. 2005. *Limestone Sand: Pros and Cons Watershed Restoration Notes #2*. School of Forest Resources and Center for Watershed Stewardship, Pennsylvania State University, College of Agricultural Sciences, Cooperative Extension.

Shaulis, James R. 1985. *Coal Resources of Fayette County, Pennsylvania Part 1. Coal Crop Lines, Mined-out Areas, And Structure Contours*. Commonwealth of Pennsylvania Department of Environmental Resources, Office of Resources Management, Bureau of Topographic and Geologic Survey, Mineral Resource Report 91, Part 1.

United States Department of Agriculture. *Soil Survey of Fayette County*. Available online: http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm.

Western Pennsylvania Conservancy. 2000. *Fayette County Natural Heritage Inventory*.

List of Attachments

Attachment A – Watershed/Topographic Map

Attachment B – Technical Advisory Committee Members

Attachment C – Commonwealth of Pennsylvania Property Map

Attachment D – Pennsylvania Natural Diversity Index Search Results

Attachment E – Biological Diversity Areas Map

Attachment F – Geologic Map with Coal Seams & Extent of Known Mining

Attachment G – Soils Map

Attachment H – Previous Studies

Attachment I – Qualitative Bioassessment & Water Quality Results

Attachment J – Ramcat Run Sampling Sites Map

Attachment K – Photographs

Attachment L – Proposed Limestone Dosing Locations