Introduction

Watershed History

The Shoup Run, locally known as Shoup’s Run, watershed drains approximately 13,746 acres or 21.8 square miles, in the Appalachian Mountain, Broad Top region of the Valley-Ridge Physiographic Province. Within this province, the area lies within the northwestern section of the Broad Top Mountain Plateau. This area is characterized by narrow valleys and moderately steep mountain slopes. Shoup Run is located in Huntingdon County, but includes drainage from portions of Bedford County. Shoup Run flows into the Raystown Branch of the Juniata River near the community of Saxton at river mile 42.4. Shoup Run has five named tributaries (Figure 1).

Approximately 10% of the surface area of the Shoup Run basin has been surface mined. Much of the mining activity was done prior to current regulations and few of the mines were reclaimed to current specifications. Surface mining activity ended in the early 1980’s. There is currently no active mining in the watershed.

Deep mines underlie approximately 12% of the Shoup Run watershed. Many abandoned deep mine entries and openings still exist in the Shoup Run Basin. Deep mining was done below the water table in many locations. In order to dewater the mines, drifts were driven into the deep mines to allow water to flow down slope and out of many of the mines. The bedrock in this area is folded and faulted. Tunnels were driven through many different lithologies to allow drainage. An extensive network of tunnels has allowed water and air to contact toxic material. Drainage from these mines is discharged through the mine entries and degrades the surface water (Musser 2000).

In a 1981 study sponsored by the Bedford and Huntingdon County Conservation Districts and Planning Commissions, a total of 11 deep mine drainage points were found to be discharging from abandoned mine openings. One such point with a very large discharge is the Dudley Deep Mine Discharge, located near Dudley Borough. The Dudley Deep Mine Discharge comprises a minimum of 40% of the total volume of Shoup Run. Consequently, mine drainage in the Shoup Run drainage basin is a serious water quality problem. Elevated levels of aluminum, iron, manganese, and depressed pH degrade the streams (Groft et al. 1981).

As a result of mine drainage, the lower portions of Shoup Run are nearly devoid of life. The upper, less affected areas of Shoup Run and unaffected tributaries to Shoup Run exhibit healthy aquatic populations. Miller Run was found to be nearly devoid of life at its confluence with Shoup Run; however, it historically possessed a native population of brook trout in its upper expanses before it was affected by various nonpoint sources.
of mine drainage (Groft et al. 1981). No known significant aquatic populations were
documented in Hartman Run.

The Shoup Run basin essentially went unmonitored and unstudied from the early
1980’s through 1999. The only exception to this was the consistent monitoring of the
This monitoring was done as part of the monitoring plan for a surface mine permit
outside of the Shoup Run drainage basin. L&G Coal Company was operating under a
surface mine permit approximately 4 miles to the south of the town of Dudley and
selected the deep mine discharge as a monitoring point. This monitoring point is
indicative of the connection between the Dudley deep mine discharge, the vast network
of abandoned underground mines, and their hydrologic connection to surface activities.

In March of 2000, Musser Engineering, Inc. developed a report assessing the
Dudley Deep Mine Discharge. The report summarized the mining activities in this area
and concluded that previous surface mining activities have allowed surface water and
precipitation to enter the deep mine workings. The report also concluded that a large
source of the Dudley Discharge water does come from surface mining activities in the
Great Trough Creek watershed, approximately 4 miles to the south of Dudley. Great
Trough Creek was greatly disturbed by surface mining; the stream channel was
fragmented and in some places incidentally removed. Much of the stream flows into
various impoundments, over unconsolidated spoil, and in some cases directly into the
underlying deep mine system. The result is a large volume of water infiltrating the deep
mine complex, with some portion of this water flowing through the deep mine system
along structural dip and reemerging as the Dudley deep mine discharge.

Water Quality Monitoring

The Shoup Run Watershed Association has been monitoring the water quality
and flow at numerous sites in the Shoup Run watershed since 1999. The Pennsylvania
Department of Environmental Protection, Bureau of Abandoned Mine Reclamation, has
provided technical expertise for this volunteer monitoring effort. Quarterly sampling
over the past five years has provided an excellent database for use in designing
treatment options for AMD and acidic deposition problems within the watershed. DEP
Bureau of Mining and Reclamation conducted a biological assessment of the
macrionvertebrates and fish in Shoup Run watershed in 2004 at the request of the
Shoup Run Watershed Association.

DEP has an ongoing program to assess the quality of waters in Pennsylvania
and to identify streams and other bodies of water that do not meet water quality
standards as “impaired.” Water quality standards include the uses that waters can
support and goals established to protect those uses. Established uses include aquatic
life, human health, and recreation, while the goals are numerical or narrative water
quality criteria that express the instream levels of substances that must be achieved to
support the uses. The assessment of the Shoup Run watershed to determine if the
streams meet water quality stands and designated uses was conducted in summer 2004 by biologists with the Susquehanna River Basin Commission.

Shoup Run and two of its tributaries, Miller Run and Hartman Run, were placed on the Clean Water Act Section 303(d) list in 1996 for impairment by low pH and metals from abandoned mine drainage (Figure 2). These streams were placed on the 303(d) listed based on a 1980 aquatic biological investigation conducted by biologists from the DEP Northcentral Regional Office (Hughey 1981). The full listing can be found at http://www.dep.state.PAu/dep/deputate/watermgt/wqp/wqstandards/303d-Report.htm.

**Watershed Association Activities**

In order to address the existing environmental damage and to limit future damage, local citizens formed the Shoup Run Watershed Association in November 1998. The goals of the Association are restoring and preserving local water supplies; safeguarding the natural environment; and addressing the problems of stormwater management, streambank erosion, flood control, AMD abatement, and illegal dumping within the watershed.

The Shoup Run Watershed Association has developed and implemented numerous projects since its formation. A list and brief description of these projects is included under Section 3 of this report. The Watershed Association has taken a holistic approach to watershed restoration by completing projects that address the following: flood control; streambank stabilization; AMD abatement; dirt and gravel road maintenance; illegal dump clean-ups; bulky waste clean-ups; roadside litter clean-ups; fluvial geomorphic (FGM) projects; alkalinity addition in the watershed; and numerous studies and plans addressing flood mitigation and environmental restoration.

The success of the Watershed Association can be attributed to a strong grassroots approach backed by the support of the local community and Local, State, and Federal Government elected officials and agencies.

**Section #1 Problem Identification**

The four environmental problem types identified by the Watershed Advisory Group are prioritized as follows: acid mine drainage, acid deposition, sewage, and flooding. A discussion of these problem categories will follow. A list of projects to deal with these problems can be found in Section #3 of this Plan.

**Abandoned Mine Drainage (AMD)**

Abandoned mine drainage was identified as the most significant water quality impairment in the watershed. The Pennsylvania Department of Environmental Protection, Bureau of District Mining Operations, Cambria Office developed TMDL’s for Shoup Run, Miller Run, and Hartman Run, the degraded streams in the Shoup Run

watershed, for the effects of acid mine drainage. A copy of the report is included in the Appendix of this Plan.

The TMDL’s were developed to address the impairments from abandoned surface and underground coal mines noted on the 1996 Pennsylvania 303(d) list, as required under the Clean Water Act. Elevated levels of metals, and in some areas, depressed pH, have caused impairment of Shoup Run, Miller Run, and Hartman Run. The TMDL’s address the three primary metals associated with acid mine drainage, iron, manganese, aluminum, as well as pH.

The Dudley Discharge is the major source of AMD pollution into Shoup Run. Based on samples collected by Musser Engineering, Inc. from 1985 through 1998, the discharge has an average flow of 2700 gallons per minute (gpm). The discharge has a typical pH of 3.5, an iron concentration of 0.21 mg/l, a manganese concentration of 2.95 mg/l, and an acidity of 51.7 mg/l. On average, the Dudley Discharge contributes 6.81 lbs of iron, 95.7 lbs of manganese, and 1678 lbs of acidity per day to Shoup Run.

The Department of Environmental Protection, Bureau of Abandoned Mine Reclamation, is currently in the design phases of an abandoned mine land reclamation project in the Great Trough Creek watershed approximately 4 miles south of Dudley. The watershed association is hopeful that successful implementation of this AML project will significantly decrease the flow of the Dudley Discharge.

The Army Corps of Engineers has also visited the Dudley Discharge at the request of the Shoup Run Watershed Association. The Corps is also interested in pursuing treatment options for the Dudley Discharge.

Acid Deposition

The Shoup Run Watershed Restoration Plan Advisory Committee identified acid deposition as a serious threat and long-term maintenance concern to the water quality of the Shoup Run watershed. The TMDL plan developed for Shoup Run indicates that elevated metal concentrations and low pH are significant impairments to the water quality of Shoup Run, masking the acidic deposition problem. Streambank stabilization projects and dirt and gravel road BMP’s using high calcium limestone have been identified as possible solutions to the acidic deposition problem. The implementation of these projects will also assist with long-term passive alkalinity addition in the watershed.

Sewage

Malfunctioning on-lot septic systems have been a serious concern in the Broad Top region for many years. Pollution from these systems has seriously impacted groundwater and stream quality throughout the Shoup Run watershed.

The most critical water quality problems related to malfunctioning septic systems were found in the most heavily populated areas of the watershed, in particular, Broad
Top City, Dudley Borough, Coalmont Borough and Carbon Township along State Route 913, Little Valley Road, Black’s Farm Road, and Risbon Hill.

Broad Top City completed the construction of a wastewater treatment facility in 1995. Plans to construct a wastewater treatment facility for the remaining populated areas of Dudley, Coalmont, and Carbon Township have been completed, funding has been secured, and construction has begun.

The construction and operation of the wastewater treatment system for the Dudley, Coalmont, and Carbon Township areas will address the majority of the water quality concerns related to wastewater management in the Shoup Run watershed.

Flooding

Flooding is a major concern in the Shoup Run watershed. The most heavily affected sites are the Middletown Area of Carbon Township and the Borough of Coalmont. The Shoup Run Watershed Association was originally formed to deal with flooding issues, and resolving these issues is still a very high priority for the group. The watershed group initiated the development of a “Flood Hazard Mitigation Plan”. A description of the Plan and its purpose is located in the Appendix of this report.

The Army Corps of Engineers and PA Department of Environmental Protection are both working with the watershed group to evaluate the flooding issues on Shoup Run and to arrive at a strategy to deal with them. Progress has been slow, but the watershed group leadership is maintaining their persistence and will not rest until solutions are developed and implemented.

Flood mitigation BMP’s that could utilize high calcium carbonate limestone and passively add alkalinity to the Shoup Run stream corridor may potentially be developed.

Prioritization of Remediation Initiatives

The Shoup Run Watershed Advisory Committee identified the Miller Run sub-watershed as their highest priority for remediation and long-term maintenance. Numerous projects have already been completed on this stream corridor. Several other projects are designed, funded, and scheduled for implementation.

Water quality in the lower portions of Miller Run has improved dramatically and macroinvertebrate and Brook Trout populations are on the rise. A recent Brook Trout survey located 134 trout at 4 different sampling locations on Miller Run.

Projects scheduled for implementation in 2004 and 2005 will further improve the water quality in the Run. New projects proposed for implementation in this Plan will help maintain the long-term productivity of the stream.
The second priority identified by the Watershed Advisory Committee is the Shoup Run main stem. Although the Watershed Association recognizes that the Dudley Discharge is the most significant source of AMD affecting the main stem, it would appear to be in their best interest to see what flow reductions may be achieved with the implementation of the abandoned mine reclamation project in the Great Trough Creek watershed approximately [4] miles south of Dudley. This project could be under construction as early as 2005.

Projects identified as high priority on the Shoup Run main stem include the Benedict Mine AMD Passive Treatment System; the Old Never Sweat Mine AMD Passive Treatment System; the Green Garden Road AMD Passive Treatment System; the Morelli AMD Passive Treatment System; and the Passive Alkalinity Addition Project on Minersville Road.

Other projects identified on the Shoup Run main stem are the Shoup Run Alkalinity Addition Project and the Wildcat Rocks Sediment Reduction Project. Both of these projects are located in the lower reaches of the Shoup Run stream corridor but will have positive water quality impacts to the downstream watershed. These projects have been rated as a lower priority because of their location in the watershed.

The last priority identified by the Watershed Association is the Hartman Run sub-watershed. A project, the Hartman Run AMD Passive Treatment System, has been developed to treat [2] small seepage locations and larger discharges that appear directly in the base of the Run. This project, although rated as a lower priority, is still a very important component to the overall success of the Shoup Run Watershed Restoration Plan.

Factors considered in the prioritization of the Shoup Run sub-watersheds and the projects within each sub-watershed included project feasibility, land rights, availability of technical services (personnel), water quality impacts, and affordability. Funding, of course, is the most critical factor to the successful implementation of this Plan. All other factors appear to be adequately addressed.

Section #2: Load Reductions Specified in the TMDL’s

States or the U.S. Environmental Protection Agency (EPA) must determine the conditions that would return impaired waters to a condition that meets water quality standards. As a follow-up to 303(d) listing, the state or EPA must develop a Total Maximum Daily Load (TMDL) for each water body on the list. A TMDL identifies allowable pollutant loads to a water body from both point and non-point sources that will prevent a violation of water quality standards. A TMDL also includes a margin of safety to ensure protection of the water. A TMDL is designed to reduce pollutant loads to impaired waters and to enable these waters to meet water quality standards.

The Department of Environmental Protection prepared a Total Maximum Daily Load (TMDL) document for the Shoup Run watershed in 2001. TMDL’s were prepared
to address the impairments noted for the streams on the 1996 Pennsylvania 303(d) list, as required under the Clean Water Act. High levels of metals, and in some areas depressed pH, have caused Shoup Run, Miller Run and Hartman Run to be impaired. The impairments are the result of acid mine drainage from abandoned surface and underground coal mines. The TMDL’s address the three primary metals associated with acid mine drainage, iron, manganese, and aluminum, as well as pH.

One of the major components of a TMDL is the establishment of an instream numeric endpoint, which is used to evaluate the attainment of acceptable water quality. An instream numeric endpoint, therefore, represents the water quality goal that is to be achieved by implementing the load reductions specified in the TMDL. The endpoint allows for a comparison between observed instream conditions and conditions that are expected to restore designated uses. The endpoint is based on either the narrative or numeric criteria available in water quality standards. See Table 1.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Criterion value (mg/l)</th>
<th>Total Recoverable Total Dissolved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum*</td>
<td>0.1 of the 96 hour LC 50 0.75</td>
<td>Total recoverable Total dissolved</td>
</tr>
<tr>
<td>Iron</td>
<td>1.50 0.3</td>
<td>Total recoverable Total dissolved</td>
</tr>
<tr>
<td>Manganese</td>
<td>1.00</td>
<td>Total recoverable</td>
</tr>
<tr>
<td>pH**</td>
<td>6 to 9</td>
<td>NA</td>
</tr>
</tbody>
</table>

Because of the nature of the pollution sources in the watershed, most of the TMDL’s component makeup were Load Allocations (LA) that are specified for the watershed above a point in the stream segment. All allocations were specified as long-term average concentrations. These long-term average concentrations are expected to meet water quality criteria 99% of the time, as specified in PA Title 25 Chapter 93.5(b) as a minimum level of protection.

TMDL Sections and Summary of Load Allocations

TMDL end points were determined for three instream sampling points and at one point on the largest discharge in the Shoup Run watershed, the Dudley Discharge. The TMDL points are listed and discussed from upstream to downstream. Table 2 presents the estimated reductions identified for all points in the watershed. Locations of TMDL points are shown in Figure 1.
Table 2. Summary TMDL Table – Shoup Run Watershed

<table>
<thead>
<tr>
<th>Station</th>
<th>Parameter</th>
<th>Conc. (mg/l)</th>
<th>Load (lbs/day)</th>
<th>LTA Conc. (mg/l)</th>
<th>Load (lbs/day)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR-1</td>
<td>Instream monitoring point on Hartman Run, near mouth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Al</td>
<td>0.88</td>
<td>1.7</td>
<td>0.26</td>
<td>0.5</td>
<td>71%</td>
</tr>
<tr>
<td></td>
<td>Fe</td>
<td>1.11</td>
<td>2.2</td>
<td>0.96</td>
<td>1.9</td>
<td>13%</td>
</tr>
<tr>
<td></td>
<td>Mn</td>
<td>2.13</td>
<td>4.2</td>
<td>0.03</td>
<td>0.6</td>
<td>86%</td>
</tr>
<tr>
<td></td>
<td>Net Alkalinity</td>
<td>-26.16</td>
<td>51.9</td>
<td>0.00</td>
<td>0.0</td>
<td>100%</td>
</tr>
<tr>
<td>Dudley</td>
<td>Monitoring point on Dudley Deep Mine Discharge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discharge</td>
<td>Al</td>
<td>4.78</td>
<td>147.2</td>
<td>0.57</td>
<td>17.6</td>
<td>88%</td>
</tr>
<tr>
<td></td>
<td>Fe</td>
<td>0.34</td>
<td>10.5</td>
<td>0.34</td>
<td>10.5</td>
<td>0%</td>
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<tr>
<td></td>
<td>Mn</td>
<td>3.39</td>
<td>104.4</td>
<td>0.52</td>
<td>16.0</td>
<td>85%</td>
</tr>
<tr>
<td></td>
<td>Net Alkalinity</td>
<td>-62.81</td>
<td>1934.7</td>
<td>0.00</td>
<td>0.0</td>
<td>100%</td>
</tr>
<tr>
<td>MR-1</td>
<td>Instream sampling point on Miller Run at its mouth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Al</td>
<td>1.31</td>
<td>12.3</td>
<td>0.21</td>
<td>2.0</td>
<td>84%</td>
</tr>
<tr>
<td></td>
<td>Fe</td>
<td>0.05</td>
<td>0.4</td>
<td>0.05</td>
<td>0.4</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Mn</td>
<td>0.60</td>
<td>5.6</td>
<td>0.32</td>
<td>3.0</td>
<td>47%</td>
</tr>
<tr>
<td></td>
<td>Net Alkalinity</td>
<td>-10.25</td>
<td>96.4</td>
<td>0.00</td>
<td>0.0</td>
<td>100%</td>
</tr>
<tr>
<td>SR-1</td>
<td>Instream sampling point on Shoup Run at its mouth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Al</td>
<td>3.07</td>
<td>230.6</td>
<td>NA</td>
<td>32.3</td>
<td>64%</td>
</tr>
<tr>
<td></td>
<td>Fe</td>
<td>0.08</td>
<td>6.3</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>Mn</td>
<td>1.72</td>
<td>129.2</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>Net Alkalinity</td>
<td>-23.20</td>
<td>1742.6</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

DESCRIPTION OF TMDL POINTS

Hartman Run

Hartman Run is on the PA 303(d) list for impairment due to pH and metals. The TMDL for Hartman Run consists of a load allocation to all of the area above sampling point HR-1, located near the confluence with Shoup Run, the first stream monitoring point downstream of all mining impacts. Addressing the mining impacts above this point addresses the impairment for the entire length of Hartman Run.

The load allocation for Hartman Run was computed using water quality sample data collected at HR-1, which showed pH ranging between 3.5 and 4.3, and an average flow of 0.238 million gallons per day (MGD). There were no upstream samples available. An allowable long-term average instream concentration was determined at
point HR-1 for aluminum, iron, manganese and net alkalinity. Table 2 shows the load allocations for Hartman Run.

**Dudley Deep Mine Discharge (Dudley)**

TMDL endpoints are usually calculated for stream segments; however, the Dudley deep mine discharge was treated as a separate entity since it is such a large source of water flow to Shoup Run. Although the Dudley Discharge may resemble a stream, it is not included in the DEP stream file, on topographic maps, or on the 303(d) list. Dudley deep mine discharge comprises a minimum of 40% of the total volume of Shoup Run. The Dudley deep mine opening is 200 feet from Shoup Run.

A TMDL point was established for the Dudley Discharge because of its high volume and AMD effects on Shoup Run. The discharge point at the confluence with Shoup Run is the first stream monitoring point downstream of the deep mine discharge.
Addressing the mining impacts above this point addresses the impairment for the discharge to its confluence with Shoup Run.

The TMDL for the Dudley deep mine discharge consists of a load allocation to all of the area upstream of point Dudley. The load allocation for the Dudley Discharge was computed using water quality sample data collected at TMDL point Dudley and an average flow of 3.69 MGD. A pH ranging between 3.1 and 4.0 was used for the TMDL computations. An allowable long-term average instream concentration was determined at point Dudley for aluminum, iron, manganese and net alkalinity. The mean value from this data set represents the long-term average concentration that needs to be met to achieve water quality standards. Table 2 shows the load allocations for the Dudley Discharge. The average iron concentration is below water quality criteria, so no load reduction was established for iron.

Miller Run

Miller Run is on the Pa 303(d) list for impairment due to pH and metals. The TMDL for Miller Run consists of a load allocation to all of the area above the point MR-1, near the mouth or confluence with Shoup Run, the first stream monitoring point downstream of all mining impacts. Addressing the mining impacts above MR-1 addresses the impairment for the entire length of Miller Run.

The load allocation for Miller Run was computed using water quality sample data collected at MR-1 and an average flow of 1.13 MGD. Sample data at MR-1 showed pH ranging between 4.4 and 4.7. There were no upstream samples. An allowable long-term average instream concentration was determined at point MR-1 for aluminum, iron, manganese and net alkalinity. The mean value from the data set represents the long-term average concentration that needs to be met to achieve water quality standards. Table 2 shows the load allocations for Miller Run.

Shoup Run

The entire length of Shoup Run is on the Pa 303(d) list for impairment due to pH and metals. Sample data at point SR-1, near the mouth, was used to characterize the stream and for the TMDL calculations. The pH at SR-1 ranged between 4.5 and 4.6. The existing and allowable loading values for Shoup Run were computed using water quality sample data collected at SR-1 and an average flow of 9 MGD.

The area upstream of Miller Run is the most affected portion of the Shoup Run watershed; however, the watershed is also adversely affected by AMD downstream of Miller Run and requires reductions. To determine necessary reductions at SR-1, the loading reductions for points MR-1, HR-1, and Dudley were summed to show the total load that was removed from upstream sources. This value for each parameter was then subtracted from the existing load at SR-1 and then compared to the allowable load at SR-1. Reductions at SR-1 are necessary for any parameter that exceeded the allowable load at this point. Table 2 shows a summary of all loads that affect SR-1. A
reduction in aluminum is necessary at SR-1 to achieve water quality criteria and the TMDL endpoints. No additional loading reductions are necessary for iron, manganese, or net alkalinity at SR-1. Table 2 shows the load allocations for this stream segment.

Section #3A. Completed Projects

The Shoup Run Watershed Association has taken a holistic approach to watershed restoration through the development and implementation of the following projects:

--Middletown Park Streambank Stabilization Project - This streambank stabilization project was initiated by the Watershed Association, designed by the Natural Resources Conservation Service, and funded by PA Dept. of Environmental Protection. The purpose of the project was to eliminate a very serious erosion problem contributing a huge volume of acidic sedimentation to the Shoup Run stream corridor. Limestone rip-rap was used for bank stabilization and long-term alkalinity addition in the watershed.

--Ford Streambank Stabilization Project - The project was initiated by the Watershed Association, designed by the Natural Resources Conservation Service, and funded by the PA Department of Environmental Protection. The purpose of the project was to eliminate a very serious streambank erosion problem and to protect a private residential dwelling. Limestone rip-rap was used for bank stabilization and alkalinity addition to the watershed.

--Miller Run Streambank Stabilization Project - The Shoup Run Watershed Association initiated the project to protect an exposed section of the Saxton Borough water line. Extensive streambank erosion exposed the Saxton water line and threatened failure of the system. The project was designed by the Natural Resources Conservation Service and funded by the Western PA Watershed Program. Limestone rip-rap was used for bank stabilization and alkalinity addition to the watershed.

--Miller Run FGM Project - Stream encroachment into the State Game Lands #67 access road was causing a safety concern for the PA Game Commission and a water quality concern for the Shoup Run Watershed Association. Acidic sedimentation was being deposited in Miller Run below the eroded streambank and the Natural Resources Conservation Service designed a FGM project to correct the problem. Funding for the project was provided by a grant from the PA Department of Community and Economic Development.

--Kennedy Run Gabion Basket Project - Excessive streambank erosion around a culvert on the headwaters of Kennedy Run prompted the Shoup Run Watershed Association to apply for a grant from the Western PA Coalition of Abandoned Mine Reclamation to stabilize the site with gabion baskets filled with limestone rock. The project helped eliminate the deposition of acidic sedimentation in Kennedy Run and will
add long-term passive alkalinity treatment to the Run. The Huntingdon County Conservation District designed the project.

--Minersville AMD Passive Treatment System - Acid mine drainage is the most critical source of pollution in the Shoup Run watershed. Several discharges in the Minersville area were contributing significant amounts of acidity and metals to both the Miller Run and Shoup Run Stream Corridors. The Shoup Run Watershed Association initiated a project to address these discharges as well as a dangerous high wall and illegal dump sites. The project was funded through the Clean Water Act Section 319 grants program.

--Miller Run Alkalinity Addition Utilizing Dirt & Gravel Road BMP’s - The Shoup Run Watershed Association worked closely with the Huntingdon County Conservation District to initiate a demonstration project utilizing limestone driving surface aggregate on approximately one-half mile of State Game Lands #67 access road. Dirt and gravel roads traditionally maintained with coal spoil produce large volumes of acidic sedimentation with each heavy rainfall. Maintaining these road systems with limestone driving surface aggregate will eliminate this acidic runoff and add alkalinity to the watershed. The project was funded by the Huntingdon County Conservation District.

--Middletown Dike Restoration Project - The existing flood control dike in Middletown was damaged by a heavy rainfall event. The Shoup Run Watershed Association contacted the DEP, Division of Stream Improvement for assistance. DEP partnered with the Carbon Township Supervisors and the Huntingdon County Conservation District to design, fund, and implement the project. Limestone rip-rap was used to repair the dike.

--Bulky Waste/Tire Collection Projects - The Shoup Run Watershed Association actively promotes community bulky waste clean-ups in the municipalities located within the watershed. None of the watershed municipalities had ever sponsored these clean-ups until prompted to do so by the Association. Several of the municipalities have made this an annual event. Illegal dumping in the Broad Top is a serious environmental concern. The Shoup Run Watershed Association is partnering with PA CleanWays of Huntingdon County to provide an alternative to illegal dumping for residents of the watershed.

--Green Garden Road Illegal Dump Clean-Up - The Shoup Run Watershed Association partnered with PA CleanWays of Huntingdon County to clean up an illegal dump site along Green Garden Road in Carbon Township. The Broad Top coal field is littered with illegal dumps that may eventually impact the water quality in the watershed. Cleaning up illegal dumps and preventing future dumping are high priorities for the watershed group.

--Miller Run Acid Neutralization Project - The Shoup Run Watershed Association applied for and received Growing Greener funding to implement a limestone sand dosing project in the headwaters of Miller Run and Kennedy Run, a small tributary to
Miller Run. The project called for the deposition of 1590 tons of limestone sand into Miller and Kennedy Run from 2001 to 2004. The limestone sand was used to reduce the acidity and increase the pH and alkalinity in the stream.

The introduction of alkalinity into Miller Run and Kennedy Run will reduce the acidity and, over time, greatly increase both streams’ function and use as a cold water fishery. The dosing project increased the pH of Miller Run at its confluence with Shoup Run from 4.8 to 6.7, a drastic improvement in the water quality of the stream corridor.

Section #3B. Projects Scheduled for Implementation

---Miller Run AMD Passive Treatment Systems - The Shoup Run Watershed Association received funding through the Clean Water Act Section 319 program for the permitting, design, and construction of AMD passive treatment systems on two small discharges, which contribute substantial quantities of acidity and aluminum to Miller Run. Treatment of these discharges will restore approximately 1.7 miles of Miller Run to its confluence with Shoup Run. The two AMD passive treatment systems were scheduled for construction in late 2004 and will remove an estimated annual loading of five tons of aluminum and increase the alkalinity in Miller Run. Both discharges will be treated with a limestone pond and an associated settling basin.

---Coalmont Bridge FGM Project - The Shoup Run Watershed Association received funding through the Growing Greener grant program for the permitting, design, and construction of FGM measures to prevent flooding and add alkalinity to the Shoup Run stream corridor at the State Route 913 Bridge in Coalmont.

Excessive deposition accumulation at the bridge opening with each substantial rainfall event increased the potential for residential flooding in Coalmont Borough and prompted the PA Dept. of Transportation to frequently dredge the stream at the bridge opening.

The successful implementation of the FGM measures at the bridge opening, utilizing large limestone rock, will help prevent local residential flooding, eliminate frequent dredging and bridge abutment maintenance by PennDOT and add much needed alkalinity to the Shoup Run stream corridor. Project implementation was scheduled for late 2004.

---Shoup Run Watershed Association Streamside Clean-up Project - The Shoup Run Watershed Association received a “Streamside Clean-up” grant through the Susquehanna River Basin Commission to clean up an illegal dump along the banks of Shoup Run. The watershed association plans to partner with the CleanWays Chapter of Huntingdon County to implement the clean up.

Illegal dumping in the Shoup Run Watershed is a serious problem and a threat to ground and surface water sources. The Watershed Association plans to partner with
the CleanWays Chapter for future clean-up activities. Implementation of this project was scheduled for June 2004.

Section #3C. Proposed Projects Implementation

The Shoup Run Watershed Association identified eleven projects in the watershed to improve the water quality of Shoup Run and its tributaries and to address the impairments noted for the streams on the 1996 Pennsylvania 303(d) list, as required under the Clean Water Act. High levels of metals, and in some areas depressed pH, caused Shoup Run, Miller Run, and Hartman Run to be impaired. The impairments are a result of acid mine drainage from abandoned surface and underground coal mines. Treatment of these discharges will address the TMDL’s developed for the Shoup Run watershed and the iron, manganese, and aluminum loading and the low pH.

Following is a brief description of each project developed by the Watershed Association. Grant applications were submitted in March 2004 to the Growing Greener and Section 319 Grants programs to design and/or construct all of these projects with the exception of the Dudley Discharge. The Shoup Run Watershed Association recognizes that the Dudley Discharge is the most significant source of AMD affecting the water quality of Shoup Run, but has decided to wait and see what flow reduction can be achieved by the Great Trough Creek AML reclamation project before pursuing treatment options at the Dudley site. If all of these projects are not funded in 2004, the Association will resubmit these project proposals in each of the upcoming years until all the potential projects are funded.

AMD Projects listed below are in the order of importance as determined by the Shoup Run Watershed Advisory Group.

[1] Kenrock Abandoned Mine Land Reclamation Project

The Shoup Run Watershed Association, in partnership with the Huntingdon County Conservation District and the Southern Alleghenies Conservancy, submitted an application for funding to the United States Office of Surface Mining to implement the Kenrock Abandoned Mine Land Reclamation Project. The Watershed Association has received verbal approval of this project. Project implementation is scheduled for the Fall 2004, if all necessary planning and contract work can be completed.

The purpose of the Kenrock project is to improve the quality of Miller Run by preventing the runoff of acidic sediment to Miller Run, reducing flood flows, and preventing the eventual rupture of the Saxton Borough public waterline, by eliminating an 1800-foot-long highwall and reclaiming 4.5 acres of mine spoil.

Since this is a land reclamation project and no concentrated discharge is associated with the land or highwall area, the loadings of sediment or acid runoff from this site are difficult to determine; therefore, the effect of implementation of this project
on acid loading in Miller Run is unknown. This project will help limit acid runoff during periods of high rainfall or snowmelt and thus help protect Miller Run from water quality fluctuations. This project should be considered as an acid prevention project, not a load reduction project.


Miller Run, a major tributary to Shoup Run, is paralleled by approximately two miles of the State Game Lands #67 gravel access road. This road has been maintained over the years with waste shale from coal mining operations. With each rain event, some of this loose, acidic, and metal-laden material is flushed into Miller Run through eroding roadside ditches and surface runoff from the road surface itself.

The Watershed Association is now working closely with the Huntingdon County Conservation District to construct two additional passive treatment systems on Miller Run that will address the last two major AMD sources on the stream corridor. The construction of these passive treatment systems is scheduled for summer/fall 2004.

Even with all of these projects in place and functioning, the Watershed Association is still concerned about the long-term impacts that the infertile sandstone geology and past mining practices will have on the water quality of Miller Run and its ability to maintain long-term alkalinity. The earlier limestone sand dosing has had a significant positive impact, but only time will tell how long the improvement in pH can be maintained without an additional source of alkalinity from an improved limestone gravel road. The Watershed Association and its partners are optimistic that the dirt and gravel road BMP’s implemented on the State Game Lands #67 access road can eliminate the long-term need for limestone dosing on Miller Run. Successful implementation of this project will have positive local impacts as well as potential regional and statewide significance. This project will also help meet the water quality standards set forth in the TMDL developed for the Shoup Run watershed and approved by EPA.

The Penn State Center for Dirt and Gravel Road Studies has learned that the State of Montana has developed dirt and gravel road best management practices to deal with water quality problems related to AMD and has successfully implemented these practices into AMD-impaired watersheds. This project proposes to use these same BMP’s on the State Game Lands #67 road system to add long-term alkalinity to Miller Run.

The Penn State Center for Dirt and Gravel Road Studies will provide the technical expertise necessary to successfully implement this project. The Center will provide BMP design information, cost estimates for budget preparation, construction oversight and quality control for project implementation.

Since this project will contribute much-needed alkalinity to help neutralize acidity during snowmelt and periods of high rainfall, it is a pollution prevention rather than a remediation project. This project will have a major effect during late winter and spring
by helping to prevent leaching of acid and aluminum from soils and rocks in the watershed. No estimation of load reductions can be made for this project since the amount of acid loading is highly variable and dependent on the amount of snow and spring rainfall and the leaching of acid from the sandstone bedrock.

Benedict Mine AMD Passive Treatment System

This project will consist of the construction of a passive treatment system to treat an acid mine discharge from the Benedict Mine, located in Carbon Township, north of the Village of Barnettstown. The discharge seepage location has been identified and sampled. The water samples collected at the site indicate that contact with limestone will provide adequate treatment. Water quality data for the seepage location to be treated are summarized below.

<table>
<thead>
<tr>
<th>Benedict Mine Discharge</th>
<th>Conc./Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average flow rate</td>
<td>23 GPM</td>
</tr>
<tr>
<td>Maximum design flow rate</td>
<td>50 GPM</td>
</tr>
<tr>
<td>Average acidity</td>
<td>26 mg/L</td>
</tr>
<tr>
<td>Average iron</td>
<td>&lt;1.0 mg/L</td>
</tr>
<tr>
<td>Average aluminum</td>
<td>1 mg/L</td>
</tr>
<tr>
<td>Assumed alkalinity production rate</td>
<td>100 mg/L</td>
</tr>
</tbody>
</table>

Based on the water chemistry and the topographic conditions in the area, a conceptual design package was developed using a limestone channel for collection, transmission and primary treatment of the discharge. Construction of a limestone channel in this area could be accomplished with a reasonable level of excavation. Design assumptions and an engineer’s cost estimate are provided in Appendix X. Construction is planned to occur in summer-fall of the year following award of the grant.

No site specific data are available to accurately estimate the amount of alkalinity that will be generated by a limestone channel at this location, although the data for similar sites suggest that the alkalinity production rate will be limited by the acidity of the discharge. A limestone alkalinity production rate of 100 mg/L was assumed for this conceptual design. This rate will be checked using limestone contact tests prior to final design. Since the average iron concentration is below <1.0 mg/L, there is a reduced threat of iron coating the limestone. Based on the water quality data collected to date and the alkalinity generation assumptions, an anticipated 90% or more of the pollutant loading can be reduced by the completion of this product.

In order to provide adequate retention time with the limestone, 12 tons of limestone per gallon per minute of flow is assumed to provide maximum alkalinity generation. A 25-year design time was selected using the following calculation: (12 tons/gpm x maximum flow in gpm) + (100 mg/L x average flow rate x 0.0022 x 25 years). Using this calculation methodology provides adequate limestone for full treatment of the maximum flow rate after 25 years of limestone dissolution has occurred.
Based on the projected stone size, placement thickness, and channel lengths, approximately 750 tons of limestone will be placed in the channel. The limestone channel will impart alkalinity to provide treatment of the discharges, while the channel slope will aid in washing aluminum from the limestone void spaces. This limestone will not only provide for treatment of the discharge, but will also help stabilize the channel to reduce erosion of the channel and subsequent sediment transport. The preliminary engineering design will provide construction specifications, specify the limestone size based on tractive force exerted on the channel lining, provide cross sections of the limestone channel, and delineate the length of channel which is to be lined.

This project, in combination with the Never Sweat Mine treatment project, will completely restore approximately 0.75 miles of an unnamed tributary to Shoup Run and provide excess alkalinity to Shoup Run. Aluminum and acid loading should be reduced by 90% or more after completion of the proposed treatment project.

Old Never Sweat Mine AMD Passive Treatment System

The Old Never Sweat Mine is located at the headwaters of an unnamed tributary to Shoup Run in Carbon Township, north of the Village of Barnettstown. The discharge originates at the site of a former surface mining operation. The final surface mine pit is filled with water, and the discharge from the pit forms the headwaters of the unnamed tributary. Waste or spoil piles from the past mining remain on the site. The proposed passive treatment system consists of a limestone pond with an associated settling basin and a final wetland polishing area.

This project seeks to address the problem of acid and metal loading to the headwaters of an unnamed tributary to Shoup Run and to provide additional alkalinity to Shoup Run. Because the mine discharge contributes a large portion of the flow to the unnamed tributary, the water quality in the unnamed tributary is highly degraded. The discharge is also a major source of acidity and aluminum loading to Shoup Run. This project seeks to construct a passive treatment system that will remove this pollutant loading from the unnamed tributary and Shoup Run. This AMD treatment project will complement ongoing and future stream restoration activities in the watershed. Construction is planned to occur in summer-fall of the year following awarding of the grant.

The discharge from the final pit displays high acid concentrations and relatively low metals concentrations, with the exception of aluminum, which is present at levels toxic to aquatic life. The pH of the discharge is 3.3, average acidity is 160 mg/L, and average aluminum is 15 mg/L. The Old Never Sweat Mine Discharge is the primary discharge on this unnamed tributary to Shoup Run, and remediation of the discharge would restore a 0.75-mile length of the unnamed tributary. The successful completion of this project will remove an estimated five tons of acidity and over one-half ton of aluminum to Shoup Run yearly.
A secondary goal of this project is the reclamation of two acres of abandoned mine lands surrounding the discharge. Treatment of the discharge and reclamation of an area of mine spoil piles will result in aesthetic improvements and enhancement of quality of life for local residents.

[5] **Green Garden Road AMD Passive Treatment System**

The Green Garden Road Passive Treatment System, located east of Dudley Borough, was designed to treat an AMD discharge that currently serves as the primary water source for the Borough of Dudley. Water quality data collected at the site indicate that contact with limestone will provide adequate treatment. Water quality data for the seepage location to be treated are summarized below.

<table>
<thead>
<tr>
<th>Green Garden Discharge</th>
<th>Flow/ Conc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average flow rate</td>
<td>109 GPM</td>
</tr>
<tr>
<td>Maximum design flow rate</td>
<td>472 GPM</td>
</tr>
<tr>
<td>Average acidity</td>
<td>81 mg/L</td>
</tr>
<tr>
<td>Average iron</td>
<td>&lt;1.0 mg/L</td>
</tr>
<tr>
<td>Average aluminum</td>
<td>8 mg/L</td>
</tr>
<tr>
<td>Assumed alkalinity production rate</td>
<td>150 mg/L</td>
</tr>
</tbody>
</table>

Based on the water chemistry data and the topographic conditions in the area, a conceptual design was developed using a limestone channel for collection, transmission and primary treatment of the discharge. Construction of a limestone channel in this area could be accomplished with a reasonable level of excavation. The net alkaline water would then be routed through pond cells for precipitation and capture of metals.

During alkalinity generation using limestone, much of the aluminum would be initially trapped in the void spaces of the limestone. This aluminum would subsequently be passively flushed using a dosing siphon and captured in the first pond following the limestone pond. A second pond and polishing wetland are proposed to serve as a tertiary treatment for discharge from the first pond. A dosing siphon is proposed to flush aluminum from the limestone bed to the first pond. The second pond/wetland will be sized based on available space and ease of construction. The constructed size will be determined during final engineering design. The water samples indicate average iron concentrations below <1.0 mg/L. Because iron has not been detected in the seeps, there is a reduced threat of iron coating the limestone; therefore, no compost is needed to lower oxygen levels in the water prior to contacting the limestone.

No site-specific data are available to accurately estimate the amount of alkalinity that will be generated by limestone at this location, although the data for similar sites suggest that the alkalinity production rate will be limited by the acidity of the discharge. A limestone alkalinity production rate of 100 mg/L was assumed for this conceptual design. This rate will be checked using limestone contact tests prior to final design. An anticipated aluminum and acid load reduction of 90% or more can be achieved by completion of this project.
Limestone channels are proposed for collection and transport of the discharge from the source to the treatment area. Based on the projected stone size, placement thickness, and channel lengths, approximately 200 tons of limestone will be placed in the channel. The limestone channel will impart alkalinity to provide pre-treatment of the discharges while the channel slope will aid in washing aluminum from the limestone void spaces. This limestone will not only provide for treatment of the discharge, but will also help stabilize the channel to reduce erosion of the channel and subsequent sediment transport. The preliminary engineering design will provide construction specifications; specify the limestone size based on tractive force exerted on the channel lining, provide cross sections of the limestone channel; and delineate the length of channel which to be lined.

Limestone in the pond will be installed with a depth of approximately six feet. An automatic dosing siphon is included in the design for the primary purpose of passively flushing aluminum through the voids in the limestone. The dosing siphon will likely take one to four days to fill the water level within six inches of the top of the stone during typical flow conditions. Once it is filled, the dosing siphon will activate and the water will be drained in a few hours. The dosing siphon will be placed in a manhole and will be hydraulically connected to the limestone channel by a piping network.

Ponds generally work well for metal precipitation and final polishing (metal removal) using filtration mechanisms. Water will enter the settling pond from the limestone pond. The pond will provide metals precipitation as well as some redistribution and equalization of flows to the receiving channel. An aeration drop will be provided from the limestone to the settling pond. The water level in the pond will be controlled using in-line control structures. The in-line structure will be designed to provide redistribution of flow to the receiving channel. The pond/wetland water level can be adjusted in response to buildup of sediment and/or metal accumulation. The lower end of the pond/wetland or a separate wetland area will be created with a shallow water level to establish vegetation for final filtration.


This project proposes to use limestone-based dirt & gravel road BMP’s to provide long-term passive alkalinity to the Shoup Run watershed. The TMDL developed for Shoup Run indicates that elevated metal concentrations and low pH are significant impairments to the water quality of Shoup Run. The source of this impairment can be attributed to a multitude of sources including acid mine drainage, unreclaimed mine spoil, streambank erosion; and, in the Broad Top coal field, poorly maintained dirt and gravel roads.

For years, dirt and gravel roads were maintained with mine shales left over from past strip and deep mining operations. This material was easily obtained and was a perfect fit for the local municipalities’ depressed road maintenance budgets. Township
roads are conduits to local waterways and, with each rainfall; the mine shales are washed into roadside ditches and eventually local streambeds.

The Shoup Run Watershed Association, in partnership with the Penn State Center for Dirt and Gravel Road Studies, has developed a proposal to provide long-term alkalinity addition to the Shoup Run stream corridor utilizing limestone-based BMP’s. This technology has been tested and is working successfully in the State of Montana.

The Penn State Center for Dirt and Gravel Road Studies plans to provide the technical expertise necessary to successfully implement this project. The Center will provide BMP design information, construction oversight, and quality control for project implementation. The partners involved with this proposal are optimistic that the dirt and gravel road BMP’s implemented on the Minersville Road system will provide long-term passive alkalinity addition to the Shoup Run stream corridor. Successful implementation of the project will have positive local impacts as well as potential regional and statewide significance.

As with the other alkalinity addition projects planned for the Shoup Run watershed, this is a prevention project rather than a load reduction or remediation project. The project will help meet water quality standards for the Shoup Run watershed by preventing acid runoff; however, no estimation of load reduction can be made since the effects of acid deposition are not easily quantifiable to an individual site or area. This project will be especially helpful in limiting acid runoff during periods of high rainfall or snowmelt.


This project proposes to construct a passive acid mine drainage treatment system to treat two small seepage locations on the Hartman Run stream corridor and larger discharges that appear directly in the base of Hartman Run.

The general concept employed is to contact the seepage water with limestone material to add alkalinity to the water. The net alkaline water will then be routed through pond cells for precipitation and capture of metals. With the planned design for this project, much of the passive treatment will occur in Hartman Run. Water quality data for Hartman Run is summarized below.

<table>
<thead>
<tr>
<th>Hartman Run Discharge</th>
<th>Flow/ Conc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average flow rate</td>
<td>244 GPM</td>
</tr>
<tr>
<td>Maximum design flow rate</td>
<td>1,071 GPM</td>
</tr>
<tr>
<td>Average acidity</td>
<td>41 mg/L</td>
</tr>
<tr>
<td>Average iron</td>
<td>&lt;1.0 mg/L</td>
</tr>
<tr>
<td>Average aluminum</td>
<td>1 mg/L</td>
</tr>
<tr>
<td>Assumed alkalinity production rate</td>
<td>100 mg/L</td>
</tr>
</tbody>
</table>
Based on the water chemistry and the topographic conditions in the area, a conceptual design was developed using limestone channels and limestone check dams for primary treatment. Construction of these structures in this area could be accomplished with a reasonable level of excavation. The engineering design will incorporate a flushing methodology that utilizes the natural high flows to passively flush aluminum from the limestone voids. Since average iron concentrations are below <1.0 mg/L, the threat of iron coating the limestone is reduced.

The water quality data indicate that contact with limestone will provide adequate treatment. Site-specific data was unavailable to accurately estimate the amount of alkalinity that will be generated by limestone at this location, although the data for similar sites suggest that the alkalinity production rate will be limited by the acidity of the discharge. A limestone alkalinity production rate of 100 mg/L was assumed for this conceptual design. This rate will be checked using limestone contact tests prior to final design.

Limestone channels are proposed at selected locations through the stream system for stabilization and treatment of the acidity. The limestone channel sections will impart alkalinity to provide pre-treatment of the discharges, while the channel slope will aid in washing aluminum from the limestone void spaces. This limestone will not only provide for treatment of the discharge, but will also help stabilize the channel to reduce erosion of the channel and subsequent sediment transport. The preliminary engineering design will provide construction specifications; specify the limestone size based on tractive force exerted on the channel lining; provide cross sections of the limestone channel; and delineate the length of channel which to be lined. Based on water quality data collected to date, it is anticipated that 85% or more of the acid and aluminum loading can be reduced at the mouth of Hartman Run.

[8] Dudley Discharge

The Dudley Discharge contributes a significant pollutant load to the Shoup Run stream corridor. A strategy to deal with this discharge is discussed in Section 1 of this Restoration Plan.


This project proposes to construct an acid mine drainage passive treatment system for the Morelli Discharge, located on an unnamed tributary north of the Village of Barnettstown. Upon successful completion, this project will completely restore approximately 1000 feet of an unnamed tributary to Shoup Run and provide excess alkalinity to Shoup Run.

The general design concept employed is to contact the seepage water with limestone material to add alkalinity to the water. The net alkaline water is then routed through a pond cell for precipitation and capture of metals. Water quality data for the Morelli Discharge are summarized below.
Based on the water chemistry and the topographic conditions in the area, a conceptual design was developed using a limestone pond for primary treatment of the discharge. Construction of a limestone pond and a settling pond in this area could be accomplished with a reasonable level of excavation. During alkalinity generation using limestone, much of the aluminum would be initially trapped in the void spaces of the limestone. This aluminum would subsequently be flushed using a manual flushing technique and captured in a pond. The limestone pond and the aluminum-capture pond will be sized based on available space and ease of construction. The constructed size will be determined during final engineering design.

No site specific data are available to accurately estimate the amount of alkalinity that will be generated by limestone at this location, although the data for similar sites suggest that the alkalinity production rate will be limited by the acidity of the discharge. A limestone alkalinity production rate of 100 mg/L was assumed for this conceptual design. This rate will be checked using limestone contact tests prior to final design. Based on water quality data collected to date, an anticipated 90% or more of the acid and aluminum loading can be reduced with the completion of this project.

Since average iron concentrations average approximately one mg/L, there is a reduced threat of iron coating the limestone, and no compost is necessary or included in the design to lower oxygen levels in the water prior to contacting the limestone.

Limestone in the pond will be installed with a depth of approximately six feet. In-line control structures are included in the design for the primary purpose of flushing aluminum through the voids in the limestone. The in-line structures will be hydraulically connected to the limestone channel by a piping network.

Ponds generally work well for metal precipitation and final polishing (metal removal) using filtration mechanisms. Water will enter the settling pond from the limestone pond. An aeration drop will be provided from the limestone to the settling pond. The water level in the pond will be controlled using in-line control structures. The pond water level can be periodically adjusted in response to buildup of sediment and/or metal accumulation.
Shoup Run Passive Alkalinity Addition Project

The Shoup Run stream corridor is heavily impaired by flooding, streambank erosion, acidity, low pH, and heavy sediment load. The Shoup Run Watershed Association completed a watershed assessment for the Shoup Run watershed that identified a multitude of stream restoration techniques, many of which can be designed to address several concerns simultaneously. Many of the restoration techniques identified in the assessment could be designed to eliminate streambank erosion, prevent flooding, and add alkalinity to the stream and receiving waters downstream of the project site. Alkaline addition could be achieved through streambank stabilization using high calcium limestone rock.

The site chosen for this project is located on the main stem of Shoup Run, northwest of Puttstown, about two miles upstream of the confluence with the Raystown Branch. The impacted reach begins just upstream of the residential property at the old bridge pier and extends downstream to the bridge near the entrance to the GPU nuclear plant. This site has been severely impacted by high flow events. The existing stream channel is significantly entrenched with very high banks, contains significant sediment and debris, and has limited access to the floodplain throughout the reach. Severe bank erosion is occurring on both banks, and is undermining the adjacent residential properties. The channel is actively widening and encroaching on buildings and personal property along the banks. Near the head of the reach, an old bridge pier in the channel has resulted in the formation of a large backwater pool and scour hole.

The stream restoration plan for this section of Shoup Run proposes a combination of BMP’s including channel modification and/or relocation, bank stabilization and grading techniques, and possibly traditional engineering channel stabilization methods. The first step would be to develop the hydraulic geometry for the proposed channel modifications from reference reach information gathered throughout the watershed. This channel modification would include the adjustment of the dimension, pattern, and profile of the existing channel to modify the meander geometry, radius of curvature, and the addition of different stream facets (i.e., riffle, runs, and pools) to enhance the diversity of habitat for aquatic flora and fauna. As part of the channel restoration, implementation of instream structures and grading techniques will provide additional bank stabilization. These instream structures include structures such as rock vanes and cross rock vanes to reduce the stresses along the streambanks and redirect the flows into the center of the channel. Grading techniques include sloping the banks back to develop a bank full bench to reduce the streambank stresses along the streambanks during increased flow events. This will also serve to increase the flood-prone area width and lower the stream entrenchment.

In addition to the bank grading proposed to improve the entrenchment, the existing abandoned bridge pier would be removed to allow for the construction of a bank full bench in this area to improve the flood prone area and reduce the near bank stresses in this reach.
Since this is a streambank reclamation project and no concentrated discharge is associated with the streambanks, the loadings of sediment or acid runoff are difficult to determine; therefore, the effect of implementation on acid loading is unknown. This project will be especially helpful in limiting acid runoff during periods of high rainfall or snowmelt.


Shoup Run is a steep stream corridor with human encroachment. The stream in many locations does not have access to its natural floodway and floodplain. Increased stream velocity causes excessive bank erosion and results in an extremely high volume of bed-load material moving through the corridor during heavy rainfall events.

The Shoup Run Watershed Association received a Growing Greener Grant to complete a watershed assessment to identify these problems on the stream corridor and develop potential solutions for environmental restoration. A combination of FGM and other natural stream restoration techniques were identified in the plan.

The heavy sedimentation load in Shoup Run is caused by the steepness of the stream corridor, increased flow velocity accelerated by the stream’s inability to access its natural floodway, and the fact that the stream flows through areas impacted by past coal mining activity. The sediment load generated by streambank erosion along the stream corridor adds acidity, metals, and lowers the pH of Shoup Run and all downstream receiving waters.

FGM techniques and other more traditional streambank stabilization BMP’s are outlined in the recently completed Shoup Run Watershed Assessment. The Wildcat Rocks area is identified in the Plan as an area needing treatment and is also a high priority concern for the Shoup Run Watershed Association.

The stream restoration plan for Wildcat Rocks should include a combination of BMP’s including channel modification and/or relocation, bank stabilization, and roadbed stabilization improvements. The next step would be to develop hydraulic geometry for the proposed realignment and design the new channel from typical reference reach information gathered throughout the watershed. This would include the adjustment of the dimension, pattern, and profile of the existing channel to include modifications to the meander geometry, radius of curvature, and the addition of different stream facets (i.e., riffle, runs, and pools) to enhance the diversity of habitat for aquatic flora and fauna. In conjunction with the stream channel relocation, bank-grading techniques would be employed in the upper reach to improve the functionality and accessibility of the existing flood-prone area.

This channel relocation design would utilize the existing abandoned historical channel in the left floodplain. As part of the channel restoration, there would be the implementation of instream structure and grading techniques to provide additional bank stabilization. These instream structures include structures such as rock vanes and
cross rock vanes to reduce the stresses along the streambanks and redirect the flows into the center of the channel. Grading techniques include sloping the banks to reduce the streambank stresses along the banks during increased flow events. This will also serve to increase the flood-prone area width and decrease stream entrenchments. The next step in the plan should include removing debris jams. This would include removing debris that is inducing lateral migration and, therefore, streambank erosion and removing excess debris that is reducing the bank full area necessary to transport the bank full discharge, or channel forming flow. This will serve to relieve the stresses on the channel banks, thus promoting the return of the stream section to dynamic equilibrium.

TMDLs and load reduction requirements were not calculated for sediment in Shoup Run; therefore, no load reduction effects of the Shoup Run Alkalinity Project and the Wildcat Run Sediment projects were estimated. These two projects will function as prevention as well as restoration projects that can be used in conjunction with the mine drainage passive treatment and the other alkalinity addition projects.

Implementation Schedule

1. Projects scheduled for 2004:
   The Kenrock reclamation project is the only project scheduled for 2004.

2. Projects scheduled for 2005:
   Proposals for all of the projects on the implementation list were submitted to the DEP Growing Greener program for funding in March 2005. The watershed association hopes that at least 2 or 3 of those projects will be funded and implementation of those would begin in 2005.

3. Projects scheduled for 2006:
   The watershed association plans to submit three project proposals per year until the projects are completed. The Old Never Sweat, Green Garden, and Minersville Road projects will be submitted for funding in 2006 if not funded in 2005. Implementation would take place in 2007.

4. Projects scheduled for 2007:
   The remaining projects will be considered for proposed funding depending on how many projects were completed in the previous years. The Dudley Discharge would come to the top of the list for this year; however, the Dudley project would occupy considerably more time and coordination than the other smaller projects and would very likely be the only project submitted for that year. Also, the timeline for an application for treatment of the Dudley Discharge is dependent on the land restoration work underway in the Trough Creek watershed, new technology, and the success of treatment projects for very high volume discharges elsewhere in Pennsylvania.
5. The other projects on the list will be scheduled after the completion of the earlier scheduled projects. Continuation of the implementation schedule is dependent on the availability of funds. If funding sources receive less money than expected, then some of the proposed projects may not be funded according to schedule. In addition, competition for the limited grant funds increases every year as more watershed associations develop their own restoration plans and submit proposals for implementation projects. In these cases, the project proposals would be submitted again the following year, but the implementation schedule would have to be adjusted to reflect the previous activities.

The watershed association is committed to the successful completion of this restoration plan and will continue to submit proposals for implementations project grants until the planned projects are completed.

Milestones to Determine if Implementation Measures are Being Met

The implementation projects planned for each year will serve as the implementation milestones of the restoration plan. The Shoup Run Watershed Association, the Huntingdon County Conservation District, and the Shoup Run Watershed Advisory Group hold regular monthly meetings. The progress of the planned watershed restoration and grants is discussed at those meetings. Additional meetings between these groups and the DEP Cambria District Office Project Advisors will be scheduled yearly to determine if the implementation schedule milestones are achieved and to chart progress of the projects. If the milestones are not achieved due to lack of funding, weather, or other unforeseen factors that might prevent construction of all of the scheduled projects in a given year, the group will continue to follow progress of the projects and reschedule uncompleted projects for the following year.

When construction of each project is completed, the evaluation process will begin and the conceptual designs of the next project will be reconsidered to determine if changes should be made prior to submittal of a proposal for the next grant.
<table>
<thead>
<tr>
<th>Stream Point</th>
<th>Average Flow</th>
<th>Min/Max Flow</th>
<th>pH</th>
<th>Alkalinity</th>
<th>Hot Acidity</th>
<th>Iron</th>
<th>Aluminum</th>
<th>Manganese</th>
<th>Sulfate</th>
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<tbody>
<tr>
<td>SR-1</td>
<td>7,424</td>
<td>2,100/12,500</td>
<td>4.7</td>
<td>119.9</td>
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<td>36/14,154</td>
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<td>SR-UNT-2</td>
<td>304</td>
<td>7/777</td>
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<td>SR-5</td>
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<td>SR-8A</td>
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<td>104.7</td>
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<td>SR-9</td>
<td>239</td>
<td>9/772</td>
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<td>39.58</td>
<td>68.7</td>
<td>1.517</td>
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<tr>
<td>D2</td>
<td>92</td>
<td>23/396</td>
<td>4.0</td>
<td>0.65</td>
<td>84.6</td>
<td>1.326</td>
<td>24.19</td>
<td>1.718</td>
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<td>D3</td>
<td>27</td>
<td>2/139</td>
<td>7.0</td>
<td>25.65</td>
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<td>0.172</td>
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<td>23</td>
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<td>D4</td>
<td>65</td>
<td>16/270</td>
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<td>0</td>
<td>149</td>
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<td>316</td>
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<td>D5</td>
<td>11.5</td>
<td>0.5/28</td>
<td>5.0</td>
<td>0.43</td>
<td>1.5</td>
<td>0.015</td>
<td>0.116</td>
<td>0.042</td>
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## Shoup Run Watershed Loading Tables
### Discharges (averages in pounds/day)

<table>
<thead>
<tr>
<th>Discharge</th>
<th>Average Flow (gal/min)</th>
<th>Min/Max Flow (gal/min)</th>
<th>pH</th>
<th>Alkalinity</th>
<th>Hot Acidity</th>
<th>Iron</th>
<th>Alumnum</th>
<th>Manganese</th>
<th>Sulfate</th>
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<tbody>
<tr>
<td>MR-UNT 1</td>
<td>68.2</td>
<td>1/252</td>
<td>3.9</td>
<td>0</td>
<td>54.4</td>
<td>0.1</td>
<td>2.4</td>
<td>1.0</td>
<td>83</td>
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<tr>
<td>MR-UNT 2</td>
<td>97.9</td>
<td>10/389</td>
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<td>0</td>
<td>55.9</td>
<td>0.1</td>
<td>2.46</td>
<td>1.64</td>
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<tr>
<td>Dudley Discharge</td>
<td>2,794</td>
<td>300/9,863</td>
<td>3.6</td>
<td>-45.04</td>
<td>2,604.8</td>
<td>10.488</td>
<td>179.447</td>
<td>107.467</td>
<td>8,550</td>
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<td>Green Garden Road (Dudley Public Water Supply)</td>
<td>109.2</td>
<td>1/472</td>
<td>3.8</td>
<td>0</td>
<td>78.4</td>
<td>0.587</td>
<td>6.118</td>
<td>1.455</td>
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<td>Benedictine Mine discharge</td>
<td>23.1</td>
<td>5/50</td>
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<td>0.2</td>
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<td>0.15</td>
<td>0.191</td>
<td>0.178</td>
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<td>Old Never Sweat Mine discharge</td>
<td>25</td>
<td>10/60</td>
<td>3.5</td>
<td>0</td>
<td>33.5</td>
<td>0.142</td>
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<td>Hartman Run discharge</td>
<td>2.2</td>
<td>0.1/9</td>
<td>6.0</td>
<td>1.01</td>
<td>0</td>
<td>0.201</td>
<td>0.011</td>
<td>0.071</td>
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<tr>
<td>Morelli Discharge (D6)</td>
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<td>1/485</td>
<td>5.0</td>
<td>5.84</td>
<td>12.3</td>
<td>1.385</td>
<td>1.209</td>
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### Minersville Passive Treatment System Stream Points

<table>
<thead>
<tr>
<th>Stream Points</th>
<th>pH</th>
<th>Alkalinity</th>
<th>Hot Acidity</th>
<th>Iron</th>
<th>Alumnum</th>
<th>Manganese</th>
<th>Sulfate</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTW</td>
<td>23.3</td>
<td>20/30</td>
<td>6.8</td>
<td>10</td>
<td>2</td>
<td>0.123</td>
<td>0.319</td>
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<tr>
<td>RDT</td>
<td>19.2</td>
<td>16.4/21.7</td>
<td>4.2</td>
<td>0.1</td>
<td>18.3</td>
<td>0.3</td>
<td>2.1</td>
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<td>MTS</td>
<td>19.9</td>
<td>7/45</td>
<td>5.4</td>
<td>1.4</td>
<td>12.9</td>
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<td>1.089</td>
</tr>
<tr>
<td>MSTP</td>
<td>UND</td>
<td>UND</td>
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<td></td>
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</table>

28
Section #4 - Technical and Financial Assistance Needed to Implement the BMP’s Identified in the Shoup Run Watershed Restoration Plan

<table>
<thead>
<tr>
<th>Priority Projects</th>
<th>Design/ Contractual Cost</th>
<th>Construction Cost</th>
<th>Annual Operations &amp; Maintenance Cost*</th>
<th>Potential Sources of Funding</th>
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<tbody>
<tr>
<td>Kenrock AML Reclamation</td>
<td>$10,885</td>
<td>$55,989</td>
<td>$2,239</td>
<td>OSM, Growing Greener, 319 Program, PA Game Commission</td>
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<tr>
<td>Passive Alkalinity Addition Project- Sate Game Lands #67</td>
<td>$1,500</td>
<td>$80,321</td>
<td>$3,212</td>
<td>OSM, Growing Greener, 319 Program, HCCD, PA Game Commission</td>
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<tr>
<td>Old Never Sweat AMD Passive Treatment System</td>
<td>$39,000</td>
<td>$123,844</td>
<td>$4,953</td>
<td>Growing Greener, 319 Program</td>
</tr>
<tr>
<td>Benedictine Mine AMD Passive Treatment System</td>
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<td>$33,050</td>
<td>$1,322</td>
<td>Growing Greener, 319 Program</td>
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<tr>
<td>Green Garden Road AMD Passive Treatment System</td>
<td>$33,500</td>
<td>$153,059</td>
<td>$6,122</td>
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<td>Passive Alkalinity Addition Project- Minersville Road</td>
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<td>$46,703</td>
<td>$1,868</td>
<td>Growing Greener, 319 Program, HCCD, Carbon Twp. Supervisors</td>
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<tr>
<td>Hartman Run AMD Passive Treatment System</td>
<td>$39,500</td>
<td>$223,244</td>
<td>$8,929</td>
<td>Growing Greener Grant, 319 Program Grant</td>
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<td>Dudley Discharge AMD Passive Treatment System</td>
<td>See Plan Narrative</td>
<td>See Plan Narrative</td>
<td>See Plan Narrative</td>
<td>319 Program, Army Corps of Engineers, DEP-BAMR</td>
</tr>
<tr>
<td>Morelli AMD Passive Treatment System</td>
<td>$23,000</td>
<td>$107,650</td>
<td>$4,306</td>
<td>Growing Greener, 319 Program</td>
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<td>$1,120</td>
<td>Growing greener, 319 Program, PennDOT</td>
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<tr>
<td>Wildcat Rocks Bank Stabilization &amp; Sediment Reduction</td>
<td>$13,280</td>
<td>$28,000</td>
<td>$1,120</td>
<td>Growing Greener, 319 Program</td>
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<tr>
<td>Totals</td>
<td>186,445</td>
<td>886,460</td>
<td>35,191</td>
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</table>

* Operation & maintenance costs calculated at 4% of construction.
Section #5  Public Information and Participation

The Shoup Run Watershed Association (SRWA) is a non-governmental, non-profit volunteer organization formed by local citizens to address the problems of acid mine drainage (AMD), streambank erosion, flooding, and stormwater management.

The Shoup Run Watershed Association, in cooperation with the Huntingdon County Conservation District, held two public meetings to discuss the development of the Shoup Run Watershed Restoration Plan. The purpose of these meetings was to identify stakeholders who could assist the Watershed Association with the development of the Restoration Plan and to identify problems in the watershed that should be addressed in the Plan.

A Watershed Advisory Group (WAG) was formed and charged with prioritizing projects, reviewing existing plans and studies, and developing an implementation strategy that would take into account landowner cooperation and funding availability.

Public meeting coverage by two local newspapers informed watershed residents of the planning process and solicited their involvement in plan development and implementation.

The Shoup Run Watershed Association has enlisted the support of an impressive list of stakeholders to assist them in all aspects of project development, funding, design, construction, monitoring, and long-term maintenance. With the assistance of these stakeholders the Watershed Association has the capability of identifying and implementing measures to deal with any project shortfalls that may arise.

The following information is an attempt to document the local services that will be provided for the successful implementation and long-term operation and maintenance of the proposed and existing projects:

--- Shoup Run Watershed Association
   -- Water quality monitoring
   -- Project publicity
   -- Project operations

--- Huntingdon County Conservation District
   -- Grant administration
   -- Project coordination
   -- Bid package or RFP development
   -- Bidding process coordination
   -- Regulatory coordination for permit development
   -- E&S planning assistance
   -- Landowner coordination and land rights for project construction
   -- DEP permit assistance
   -- NPDES permit guidance
-- Applicant liaison with DEP
-- Financial accountability & preparation of accounts for District audit
-- Quarterly reporting to funding agency
-- Long-term project monitoring

-- Southern Alleghenies Resource Conservation and Development Program
  -- Project adoption
  -- Technical assistance for long-term operation and maintenance

-- DEP, Bureau of Abandoned Mine Reclamation
  -- Assistance with water quality monitoring
  -- Technical assistance for operation and maintenance of
  -- AMD passive treatment systems.

A list of stakeholders was developed to identify sources of technical and financial assistance to insure the successful development and implementation of the Plan. A list of stakeholders and their potential contributions is listed below.

Watershed Restoration Stakeholders and Stakeholder Contributions

Shoup Run Watershed Association
-- Project development/prioritization
-- Legislative contacts
-- Public relations/public input
-- Water quality monitoring
-- Project monitoring/maintenance

Huntingdon County Conservation District
-- Technical assistance
-- Grant writing/grant administration
-- Project administration
-- Agency coordination
-- DEP permitting/construction inspection
-- Regulatory liaison
-- Assistance with long-term maintenance

Huntingdon County Planning & Development Department
-- Grant assistance

Southern Alleghenies Conservancy
-- Grant administration
-- Assistance with OSM contracts

Department of Environmental Protection
-- Funding
-- Project development
-- Technical assistance
-- Permit assistance
-- Regulatory guidance

Southern Alleghenies Resource Conservation and Development Program
-- Technical assistance
-- Project development
-- Construction inspection

Natural Resources Conservation Service
-- Technical assistance
-- Project development
-- Construction inspection

Western PA Coalition for Abandoned Mine Reclamation
-- Project and grant support
-- Watershed Association assistance
-- Technical assistance

Western PA Watershed Program
-- Project funding

Pennsylvania Game Commission
-- Land rights
-- Project partnering
-- Long-term maintenance

Pennsylvania Fish and Boat Commission
-- Aquatic resources inventory
-- Technical assistance

Canaan Valley Institute
-- Technical assistance

Environmental Protection Agency
-- Funding

Army Corps of Engineers
-- Project development
-- Project funding

PA Association of Conservation Districts
-- Technical assistance
The Shoup Run Watershed Association has enlisted the support of a very diverse group of stakeholders to contribute to the success of this planning and implementation process. They have developed a close working relationship with local boroughs and townships within the watershed and continually enlist the support of County, State, and Federal legislators. Numerous private engineering firms have donated in-kind support to the watershed group and local landowners have partnered in the successful completion of many projects on private land.

Watershed Problems Identified

As a result of the public meeting process, four main environmental problem areas were identified in the Shoup Run Watershed Association. The Shoup Run Watershed Advisory Group prioritized these problems as follows: acid mine drainage, acidic sediment deposition, sewage, and flooding. Acid mine drainage was identified as the most serious water quality concern in the watershed.

The Watershed Advisory Group developed a list of priority projects for implementation and inclusion in the Shoup Run Restoration Plan. Considerations such as funding availability, land rights, site feasibility, and local concerns were weighed in the decision making process. Projects identified below are listed in order of their importance to the Group.

1. Kenrock Abandoned Mineland Reclamation Project
2. Passive Alkalinity Addition Project - State Game Lands #67
3. Benedict Mine AMD Passive Treatment System
4. Old Never Sweat Mine AMD Passive Treatment System
5. Green Garden Road AMD Passive Treatment System
6. Passive Alkalinity Addition Project - Minersville Road
7. Hartman Run AMD Passive Treatment System
8. Dudley Discharge
9. Morelli AMD Passive Treatment System
10. Shoup Run Passive Alkalinity Addition Project
11. Wildcat Rocks Sediment Reduction Project

Section #7. Water Quality Monitoring and Evaluation

In cooperation with the Pennsylvania Department of Environmental Protection (PA DEP) Bureau for Abandoned Mine Reclamation (BAMR), the Shoup Run Watershed Association (SRWA) has been monitoring water quality and stream flow on a quarterly basis for the past five years. SRWA is actively monitoring at eleven stream sites, six AMD sites and four treatment system sites. Since the construction of the Minersville Passive Treatment System in 2003, three AMD sites have been eliminated
and replaced with four sites at the Minersville treatment system to determine the effectiveness of the system.

Streams or stream segments will be assessed after each implementation project is completed. Some areas of the watershed have aluminum precipitate. The precipitate could slow the recovery of aquatic life, especially macroinvertebrates, in the affected stream segments. The amount of time necessary to scour the remaining metals from the stream substrate is hard to determine. The data collected after implementation is completed will be evaluated and further implementation needs will be established, if necessary, to attempt to achieve further load reductions and restoration of aquatic life.

Treatment systems will continue to be monitored on a regular basis. If performance of individual treatment systems is less than expected, SRWA will make adjustments to the treatment systems, as necessary, to try to improve results. Accumulated metals in the passive treatment systems will be flushed regularly to ensure that metals are not being retained in the system. If additional metals reductions or alkalinity increases are determined to be needed at some systems, an evaluation of the design parameters will be made, and changes such as enlargement of treatment ponds or adding treatment or settling ponds could be made.

Annual evaluations of performance of installed treatment systems, instream load reductions, and restoration of aquatic life will be held through meetings and discussions between the watershed association, DEP Harrisburg and Cambria Offices, consultants, and any other individuals who could provide ideas or assistance in determining how restoration goals may be better achieved.

**Sampling Methods**

A sample for each site consists of three separate grab samples; one Nalgene® 500-ml and two 100-ml polyethylene bottles. Clean sample bottles are labeled using a permanent marker and thoroughly rinsed with the caps on with water from the sample location. The two 100-ml bottles are fixed for metals analysis using hydrochloric (HCl) and nitrous (HNO3) acid. All grab samples are placed in a cooler containing ice and are analyzed within 72 hours from the time of collection. The coolers are transported to PA DEP’s Bureau of Laboratories in Harrisburg, PA where they are analyzed for pH, alkalinity, hot acidity, ferrous iron, total dissolved iron, manganese, total dissolved aluminum, sulfate, total suspended solids, calcium, magnesium and hardness as CaCO$_3$. All results are reported in mg/l.

Flow at the stream sites is measured at the time of grab sample collection using either a Marsh-McBirney® current velocity meter or a Global Water® flow probe. Occasionally, when stream conditions prohibit direct measurement, flow is estimated using a floatable object and stopwatch. Flow is measured in cubic feet per second (cfs) and reported in gallons per minute (gpm). At discharge locations, flow is measured using either a 90° or 1-foot square notch or 2-foot square notch weir devices.
Alternatively, flow at non-weired sites is measured using a 5-gallon bucket and a stopwatch.

Section #8 Operation and Maintenance Plan - Remedial Actions

The Shoup Run Watershed Association has assumed operation and maintenance responsibility for all the projects they have implemented in the watershed. The Association has conducted a volunteer water quality monitoring program in the watershed for several years and has accumulated an impressive water quality database. These data have been very beneficial in the development of new AMD remediation project proposals and the evaluation of how well existing projects are functioning. The Association and its partners are committed to continuing this monitoring for new project development and existing project operation and maintenance.

The Watershed Association has also enlisted the services of numerous partnering agencies to assist with operation and maintenance planning. The Huntingdon County Conservation District and the Association have developed a very close relationship and continue to partner with project development, grant writing, and water quality monitoring activities. The District has committed the resources of the Southern Alleghenies Resource Conservation and Development program to assist the watershed with future technical needs regarding project operation, maintenance, and monitoring.

Conservation District staff is also committed to the long-term operation and maintenance of the projects that they sponsor. The Conservation District's Watershed Specialist will play a key role in project monitoring and maintenance coordination.

Annual evaluations of performance of installed treatment systems, instream load reductions, and restoration of aquatic life will be held through meetings and discussions between the watershed association, DEP Harrisburg and Cambria Offices, consultants, and any other individuals who could provide ideas or assistance in determining how restoration goals may be better achieved.
Appendix A. Shoup Run Watershed Reference Resources


Department of Environmental Protection Bureau of Mining and Reclamation, 2003. Qualitative Watershed Assessment, Shoup Run Watershed.


Penn State Cooperative Wetlands Center, 2001. Economic and Environmental Benefits of Watershed Restoration in Rural Communities.


Appendix B. Summaries of Shoup Run Studies and Investigation

1. Shoup Run Watershed Qualitative Assessment Summary (Water Quality)

The Department’s Cambria Mining Office requested an assessment of Shoup Run to evaluate its current watershed conditions. Impacts from historic mining are found throughout the watershed. Seventeen sampling stations on the main-stem of Shoup Run and six major tributaries were assessed by staff of the Bureau of Mining and Reclamation and the Cambria District Mine Office (DMO), at the end of June and beginning of July 2003. Summary results will support any further watershed planning for Shoup Run. The following is a summary of the results found in the 2003 survey.

Macroinvertebrate populations were impaired at Hartman Run and the headwaters of Shoup Run. Aquatic habitat was considered categorically sub-optimal. Water quality indicated influence from mine drainage.

Before and after the Dudley Deep Mine Discharge around the town of Dudley, to approximately a mile downstream at the confluence of Miller Run, the main-stem is also biologically impaired. Aquatic habitat quality was considered categorically optimal at these sampling sites. Water chemistry results indicated a major influence from mine drainage.

Kennedy Run and the headwaters of Miller Run showed no impairments to macroinvertebrate populations. Aquatic habitat was considered categorically optimal. Water quality indicated influence from mine drainage only in the main-stem of Miller Run.

Approximately a half mile down from where Kennedy Run enters, two mine discharges impact Miller Run. Although possible excess limestone dosing has caused concretion that is limiting macroinvertebrate populations, water quality has been improved. Aquatic habitat was categorically considered optimal.

Macroinvertebrate populations were not impaired at the mouth of Miller Run. Water quality indicated no influence from mine drainage. Aquatic habitat was categorically considered optimal.

Coal Bank Run is biologically impaired. Water quality indicated influence from mine drainage. Aquatic habitat was categorically considered optimal.

Macroinvertebrate populations at Sugarcamp Run and the main-stem of Shoup Run, near the town of Middletown, met an equal amount of stream criteria that indicated a borderline between impairment and no impairment. Continued
degradation or improvement in water quality will determine future designations. No influence from mine drainage was found on Sugarcamp Run, but was found on Shoup Run. Both sites’ habitat was categorically considered sub-optimal.

House Run had impaired aquatic life. Water quality indicated no influence from mine drainage. Aquatic habitat was categorically considered sub-optimal.

The unnamed tributary entering Shoup Run southeast of Puttstown had healthy aquatic populations. Water quality indicated no influence from mine drainage. Aquatic habitat was categorically considered optimal.

The mouth of Shoup Run was biologically impaired. Water quality indicated influence from mine drainage. Aquatic habitat was considered optimal.

2. Upper Great Trough Creek Assessment and Remediation Plan

Great Trough Creek and its tributaries have been severely impacted by pre-Act mining activities. Previous studies have shown that much of the water that should be supporting Great Trough Creek leaks into a vast complex of underground mines and strip pits and ultimately exits as acid mine drainage from the Dudley Discharge, in Dudley Borough, Huntingdon County. This mine discharge, which varies in flow from 300 gpm to 9000 gpm, flows into Shoup Run and eventually empties into Lake Raystown. The Dudley Discharge is a major source of pollution into Shoup Run.

Musser Engineering Inc. was retained by Shoup Run Watershed Association to identify abandoned mining-related problems that are impacting both the Shoup Run and Great Trough Creek watersheds. The Great Trough Creek watershed is losing stream flow due to pre-Act surface mining practices which direct surface water into the underground mine complex through “disappearing streams.” Underground mine subsidence has fractured the Great Trough Creek stream bed, so some stream flow also leaks from the stream into the underground mines and contributes to the Dudley Mine Discharge.

In August and September of 2000, Musser Engineering Inc. conducted field reconnaissance along the eastern drainage of Great Trough Creek, from Robertsdale to Enid Spring. Four “disappearing” tributaries were identified, located, and ranked for environmental impact. The results of this first study concluded in October 2000 with a report titled “Hydrologic Investigation of Disappearing Tributaries to Great Trough Creek.” One conclusion suggested a comprehensive study of the recharge area of Great Trough Creek to identify sites where additional mining or reclamation
activities can further reduce inflow of water to the underground mine complex. The current investigation continues and expands on the previous work to identify surface water loss into the underground mines on the eastern and western slopes of the drainage areas. The investigation also identifies fracturing in the Great Trough Creek stream bed from near the headwaters to Robertsdale. It was felt that the majority of base flow loss occurred through this stream section, since the underground mine complex extends under this area. Base flow is the normal low flow necessary for a stream to maintain perennial flow conditions.

The results of the first phase are incorporated into this second phase report so that all identified areas are ranked according to environmental impact based on two goals. One set of rankings is prioritized to reduce to the greatest extent possible the pollution sources contributing to the Dudley Discharge and degrading Shoup Run watershed. A second set of rankings has been prioritized to restore stream base flow in the upper sections of Great Trough Creek.

Disappearing tributaries in the Great Trough Creek watershed add to the pollution load of the Dudley Discharge that pollutes Shoup Run. This study identifies five stream disappearances in the Upper Great Trough Creek watershed from the headwaters at Enid Spring to Robertsdale. The streams disappear into spoil or mine openings, then become part of the underground mine pool that eventually discharges at Dudley. Two stream diminutions, where some, but not all, flow is lost into the underground mine complex are also identified. These effects are the result of pre-Act surface mining practices.

Great Trough Creek is also losing base flow through subsidence fracturing from the underground mines. Six major fracture zones were identified through VLF and terrain conductivity geophysical surveys. Stream flow losses are verified by instream flow measurements. Additional flow monitoring stations should be established, especially along tributaries to Great Trough Creek, to verify input and output flows along certain stream lengths.

All environmentally impacted areas were ranked based on two goals. The first environmental goal ranks the impacted areas to reduce to the greatest extent possible flow into the underground mines, which contribute to the Dudley Discharge. The stream disappearances received the highest priority rankings to accomplish this task. The second environmental goal ranks each area based on restoring stream base flows in the Upper Great Trough Creek. Sealing the VLF-identified fracture zones in the Great Trough Creek streambed received the highest environmental priority rankings to accomplish this task.

Repairing the stream disappearances and diminutions will require regrading spoil, filling in old pits and highwalls, along with constructing and lining new channels across porous spoil. Some areas that received the highest environmental
priority ranking to decrease flow to the underground mines will also be the most difficult to correct. Some of the other areas such as Matthews Run and Baker Run are relatively easy to correct.

Sealing the rock fractures in the Great Trough Creek stream bed will take a polyurethane grout. These fractures rob Great Trough Creek of needed base flow to sustain it during low flow periods. Sealing these fractures would be costly, but using an EM unit in the field would substantially reduce the time and materials needed for an effective seal. Volunteer labor and materials could also reduce the costs.
3. South Central Pennsylvania Environmental Infrastructure Study

Under the authority of Section 313 of the Water Resources Development Act of 1992, the U. S. Army Corps of Engineers, Baltimore District, conducted an investigation and prepared an interim report identifying water-related environmental infrastructure, and water-related resource development and protection projects which encompass a pilot program for south central Pennsylvania.

Two Corps Districts represent the study area: Baltimore and Pittsburgh. The study area within the Baltimore District consists of a portion of the Chesapeake Bay watershed.

Project information was obtained through site visits, a public participation program, review of existing information, and submission of projects by State agencies and local interests. The study identified approximately 100 water-related environmental infrastructure and water-related resource development and protection projects.

Acid mine drainage is recognized as a significant problem in the Broad Top coal field portion of the study area, with numerous projects identified for environmental restoration consideration.

4. Hydrologic Investigation of Disappearing Tributaries to Great Trough Creek

Musser Engineering Inc. was retained by Shoup Run Watershed Association to identify the specific location of disappearing streams in the Great Trough Creek watershed along the east flank of Rays Mountain upstream from Robertsdale. Streams in the Broad Top area flow down Rays Mountain and into old unreclaimed surface mined areas. These streams then reportedly disappear into the underlying Fulton mine complex. The Fulton mine complex is a vast interconnection of underground mine workings which eventually discharges at the Dudley Mine Discharge in Dudley Borough, Huntingdon County. The discharge flows from the mine mouth and follows a channel a short distance to its confluence with an unnamed tributary to Shoup Run.

Samples collected at the Dudley Discharge by Musser Engineering, Inc. and others indicate the discharge to be very acidic, with elevated metals concentrations. This study also attempts to quantify the hydraulic and pollutional impact on the Dudley Discharge and Shoup Run, as a result of the disappearing streams.
The disappearing streams contribute nearly 900 million gallons per year of acid mine drainage to the Dudley Discharge and ultimately to Shoup Run. Preventing pollution is much more practical than trying to provide treatment. Therefore, if Shoup Run Watershed Association wishes to improve the quality of Shoup Run, every possible effort should be made to correct all the stream disappearances. Doing so should permanently reduce the pollution load currently being placed in Shoup Run.

Finally, the study ranked the identified disappearing streams occurrences based on degree of environmental impact and remediation difficulty.

5. Wastewater Treatment for Dudley Borough, Coalmont Borough, and Carbon Township

Malfunctioning on-lot septic systems have been a serious concern in the Broad Top region for many years. Pollution from these systems has seriously impacted groundwater and stream quality throughout the Shoup Run watershed.

The most critical water quality problems related to malfunctioning septic systems were found in the most heavily populated areas of the watershed, in particular, Broad Top City, Dudley Borough, Coalmont Borough and Carbon Township along State Route 913, Little Valley Road, Black’s Farm Road, and Risbon Hill.

Broad Top City completed the construction of a wastewater treatment facility in 1995. Plans to construct a wastewater treatment facility for the remaining populated areas of Dudley, Coalmont, and Carbon Township have been completed, funding has been secured, and construction is scheduled for Fall, 2003.

The construction and operation of the wastewater treatment system for the Dudley, Coalmont, and Carbon Township areas will address the majority of the water quality concerns related to wastewater management in the Shoup Run watershed.

6. Juniata Watershed Management Plan

The Juniata River Watershed Management Plan was written to help guide conservation efforts in communities throughout the Juniata River watershed. Township Supervisors, Borough Council members, watershed associations, and
community groups can use the plan to improve the quality of life in their particular communities. Projects were identified that will alleviate common water-related concerns in the region.

The planning process was designed to incorporate the ideas and concerns of the local watershed residents. Several methods were used to gather public input including public meetings, written responses, existing studies, and written municipal surveys.

After collecting information through the public meeting process and the municipal survey, watershed-related issues were organized into seven major resource categories: land, water, biological, recreational, cultural/historical, educational, and political/economic. The issues related to each category were prioritized according to their watershed impacts as well as public input.

Acid mine drainage, sedimentation, sewage, and flooding were all categorized as high priority issues in the Juniata River watershed.

7. Hydrologic Investigation of the Dudley Mine Discharge

The Dudley Deep Mine Discharge is located in Dudley Borough, Huntingdon County. The source of the discharge is a portal of the Fulton seam deep mine. The discharge elevation is at approximately 1500 feet MSL. The discharge flows from the mine mouth and follows a channel a short distance to its confluence with an unnamed tributary to Shoup Run.

The Dudley Discharge is a major source of pollution into Shoup Run. Based on samples collected by Musser Engineering, Inc., from 1985 through 1998, the discharge has an average flow of 2700 gallons per minute (gpm). The discharge has a typical pH of 3.5, an iron concentration of 0.21 mg/l, a manganese concentration of 2.95 mg/l, and an acidity of 51.7 mg/l. On average, the Dudley Discharge contributes 6.81 lbs of iron, 95.7 lbs of manganese, and 1678 lbs of acidity per day into Shoup Run.

Site Geology

The Fulton coal seam outcrops on the hillside east of Dudley. The deep mine operator entered the Fulton seam along this outcrop at an elevation of approximately 1500 feet. From there, they advanced eastward, mining to the rise of
the coal so the water would gravity drain out of the mine. The Fulton coal seam rolls slightly through a shallow valley that contains a tributary to Six Mile Run. The coal then continues to rise toward the Broad Top Arch, which is located just east of Wood. The Fulton coal seam then dips sharply into the Trough Creek Syncline, where it folds and rises again toward Rays Hill. The Fulton coal outcrop on the east end of this section occurs at an elevation of approximately 1900 feet. The Fulton coal seam rises 400 feet in elevation from its outcrop at Dudley to its outcrop east of Wood.

Deep mines have been developed in the Fulton seam along the entire extent of the geological cross-section. In addition, mines have also been developed in the Kelly seam on the east and west ends of the section. Numbered boreholes and shafts reportedly connect the Kelly and Fulton Mine complexes.

The Dudley Discharge is recharged by ground water flow moving from points of higher elevation to points of lower elevation. Generally, in the study area, regional ground water moves from northeast to southwest. Rainfall at Wood either runs off into the stream or infiltrates into the groundwater system. Of the portion that infiltrates, some is perched in shallow aquifers. These aquifers discharge to the surface in the form of intermittent streams or leak vertically into lower systems that eventually release ground water into the deep mines. The shallow aquifers are seasonal in nature and have many times dried up during low rainfall conditions.

**Study Conclusion**

All the data available support the conclusion that the Dudley Discharge is fed by ground and surface waters within a recharge area of approximately 6200 acres. The East Broad Top Railroad and Coal Company is the primary landowner of this recharge area. The coal companies have reclaimed numerous old surface mine pits and spoil piles over the years. The reclamation has helped to reduce the amount of water entering the deep mine complex; however, many old pits, mine subsidence depressions, and mine openings remain. In order to reduce the pollutational discharge at the Dudley Mine, a comprehensive study of the recharge area should be undertaken to identify sites where additional mining or reclamation activities can further reduce inflow of water to the Fulton mine complex. Any reduction of water flow into the deep mines will translate into direct reductions of acid mine drainage discharging from the Dudley Discharge into Shoup Run.

**8. Shoup Run Watershed Flood Hazard Mitigation Plan**

The purpose of the Flood Mitigation Plan is to provide the residents and the various municipalities that comprise the Shoup Run watershed, located in Huntingdon and Bedford Counties, Pennsylvania, with factors to consider in a
comprehensive approach to effectively reduce property damage associated with flooding and increase public awareness and safety. As background information, the Plan presents a description of watershed characteristics and describes past flooding problems at four flood-prone areas within the watershed. The Plan outlines specific objectives the watershed municipalities should follow in order to regulate floodplain development. The Plan follows the format specified by PEMA and evaluates and provides cost estimates for several alternatives that include Preventive Measures, Property Protection, Natural Resource Protection, Emergency Service Availability, and Structural Project Potential. Finally, the Plan outlines specific steps the various municipalities must follow to implement the recommendations of the Plan.

9. The Broad Top Soil and Water Conservation Project Report

The purpose of this report was primarily to document the environmental conditions of the Broad Top Region, a 51,000-acre area in south central Pennsylvania, as these conditions relate to the availability of potable water in the area. Watersheds are profiled by creek sub-basin. This information has been very useful, though it is dated. This document details the ecological health, particularly various water quality parameters, of the stream length in the study area, and quantifies both surface and subsurface mining activity, land use and soils information. This report was sponsored jointly by the Conservation Districts and Planning Commissions of both Bedford and Huntingdon Counties.
10. Broad Top Region of Pennsylvania Project

The Broad Top Region of Pennsylvania Plan identifies projects as part of an overall effort to restore and maintain the water resources in the region. Section 304 of the Water Resources Development Act of 1992 directs the Secretary of the Army to develop and carry out a watershed reclamation and protection, and a wetlands creation and restoration project along the Juniata River and its tributaries.

The primary goal of the Broad Top Plan was to develop a demonstration or pilot project that will restore and maintain the physical, chemical, and biological integrity of specific water resources in the Broad Top Region.

The focus of this project was to develop a restoration/reclamation plan that would include innovative reclamation techniques, the removal of public safety hazards, and the development of recreational, cultural, and economic resource opportunities as part of a watershed restoration process.

The site chosen for the project was an abandoned strip mine site approximately 400 acres in size owned by the East Broad Top Railroad and Coal Company known as the “Bikini Site”.

A reclamation project is currently being designed on this site by the PA Department of Environmental Protection, Bureau of Abandoned Mine Reclamation. The design will include traditional reclamation, relocation of disappearing streams, stream grouting, and stormwater management to prevent downstream flooding.

11. Great Trough Creek Hydrologic Study

The Trough Creek Watershed Association, in cooperation with the Huntingdon County Conservation District and the PA Department of Environmental Protection, have submitted a technical assistance application to investigate the effect of restoring flows that currently drain to abandoned mine openings on Great Trough Creek.

Three unnamed tributaries currently draining approximately 774 acres drain into abandoned mine openings near the village of Wood in Huntingdon County. These tributaries are located on abandoned mine lands that contain both surface mining and deep mining. Musser Engineering Inc. has prepared a report investigating the effect of this mining activity on the Trough Creek watershed. The report looks at restoring base flow to Trough Creek and restoring water quality in the basin. It has been determined in the Musser report that these stream disappearances along with fractures in
the streambed of Trough Creek contribute to the flow rate at the Dudley Discharge on Shoup Run and reduce the base flow of Trough Creek. The stream disappearances are located in the very headwaters of Great Trough Creek, and restoring these flows is critical to the base flow in Trough Creek.

One of the primary concerns with restoring drainage to Trough Creek is existing flooding problems downstream, particularly in the village of Todd. As a possible way to alleviate these flooding concerns, the USGS, through a C-SAW grant, had prepared a HEC-RAS model to determine the effect of the removal of an existing dike near the village of Todd. It had been determined in that study that the removal of the dike would not have a significant impact on the flood elevations at Todd. The report cited a downstream bridge as being the limiting factor controlling flood elevations.

This report represents a hydrologic model of the existing and proposed condition of the watershed to the village of Todd to determine the effect of restoring the drainage areas during flood events. TR-20 has been used as the base model for analysis and takes into consideration the existing soils, land use, sub-watershed characteristics, river reach characteristics, and rainfall magnitudes.

It is the conclusion of this report that the restoration of the existing stream disappearances will create additional peak flow to Todd. The two-year rainfall event causes the most significant increase, but the flow is still within the streambanks. In higher order storms, the flow rate increases 1.1% - 1.4% of the pre-developed rate. The increase in flow is fairly insignificant compared with the total flow rate and corresponds to less than an inch of increase in the water surface elevation for the 10-year to 100-year rainfall events. The hydrograph developed for this report indicates that much of the flow contributed by the restoration reaches Todd after most of the runoff has already passed by Todd.

12. Shoup Run Watershed Assessment (Stream Channel Assessment)

The Shoup Run Watershed Assessment was commissioned by the Shoup Run Watershed Association and funded by Growing Greener funds provided by the Pennsylvania Department of Environmental Protection. The assessment is designed to serve as a planning tool and as an aid to future stream restoration activities in the watershed.

The watershed encompasses approximately 21.5 square miles and contains over 26 miles of stream channel. Much of the lower portion of the Shoup Run main stem has been channelized as a result of the historic placement of fill within floodplain areas to accommodate land development and roadway construction. Railway development for mining
activity similarly confined and channelized the stream. All of this artificial confinement has caused significant streambank erosion and sedimentation along the stream corridor.

The Assessment focuses on stream channels rather than upland portions of the watershed. Principal projects of this effort are large-scale maps depicting all stream channels in the watershed; their functional condition and classification according to the U.S. Department of Agriculture’s Stream Visual Assessment Protocol and the Rosgen Stream Type classification, respectively; and those stream reaches prioritized for restoration. A regional hydraulic curve was also developed to aid in the delineation of stream types and to serve as a design tool for future restoration efforts.

A natural channel design approach based on fluvial geomorphic (FGM) principles is advocated for future channel and floodplain restoration work in this watershed. The conceptual prescriptions for repairs outlined in the Assessment represent multi-objective strategies, which emphasize passive flood storage and reduced stream energy. These same strategies will reduce the excessive volume of acidic sediments produced in the watershed, as well as provide for long-term alkalinity addition to the stream corridor.
Maps of Shoup Run Watershed