CONCLUSIONS

A majority of the AMD pollution impacting the West Branch Susquehanna Subbasin is found in six areas: the West Branch Susquehanna River Headwaters; multiple MUs within the Clearfield Creek, Moshannon Creek, and Bennett Branch Sinnemahoning Creek Watersheds; and single MUs in the Kettle Creek and Beech Creek Watersheds. In one possible remediation example, focused effort on the ten MUs contributing the largest pollution loads and yields from each of these areas, along with the other planned restoration projects, are projected to result in a nearly restored West Branch Susquehanna River. Additional sampling of the discharges not meeting analytical criteria (nearly 60 percent of the total discharges) would be needed for more complete restoration projections as these discharges were not used in any calculations.

The West Branch Susquehanna River Headwaters and Major Tributaries examples show alkaline conditions for the length of the mainstem, as well as iron concentrations below water quality standards. Aluminum poses a greater challenge, but the remediation examples show where further efforts are needed to define the problem and propose solutions, particularly for sources generating loads between Clearfield Creek and Bald Eagle Creek. It is also important to note that with the West Branch Susquehanna River being net alkaline after the remediation examples from headwaters to mouth, and consequently containing a circum-neutral pH, aluminum concentrations should be in a precipitated non-toxic state. The dissolved form of aluminum found in acidic waters is very toxic to aquatic organisms even at concentrations below the 0.75 mg/l water quality standard for aluminum.

With respect to treatment costs, this document outlines one possible remediation example with WRAM estimated capital construction costs between $43 and $165 million dollars, depending on the selection of passive or active treatment technologies. An additional WRAM estimated $5 - $8 million, and possibly more with the addition of the Lancashire #15 (Barnes and Tucker) Discharge active treatment plant, would be needed annually for operation and maintenance of those systems. It is important to note that these costs are based on the best available data, particularly those discharges with water quality data meeting analytical criteria, and the examples represented in this document do not provide for complete restoration of the West Branch Susquehanna River Subbasin. In addition, at sites where remining and mine land reclamation are viable options to eliminate or reduce AMD loading, projected restoration costs could be decreased, particularly the annual operation and maintenance costs.

Cost estimates only address the 788 discharges that met the analytical criteria defined for this study. These discharges only comprise 40 percent of the total discharges compiled for this project. Adding in the 60 percent of the discharges that did not meet analytical criteria, total West Branch Susquehanna Subbasin restoration capital construction costs could be in the realm of $400 million, which are comparable to PADEP estimates (West Branch Susquehanna River Task Force, 2005).

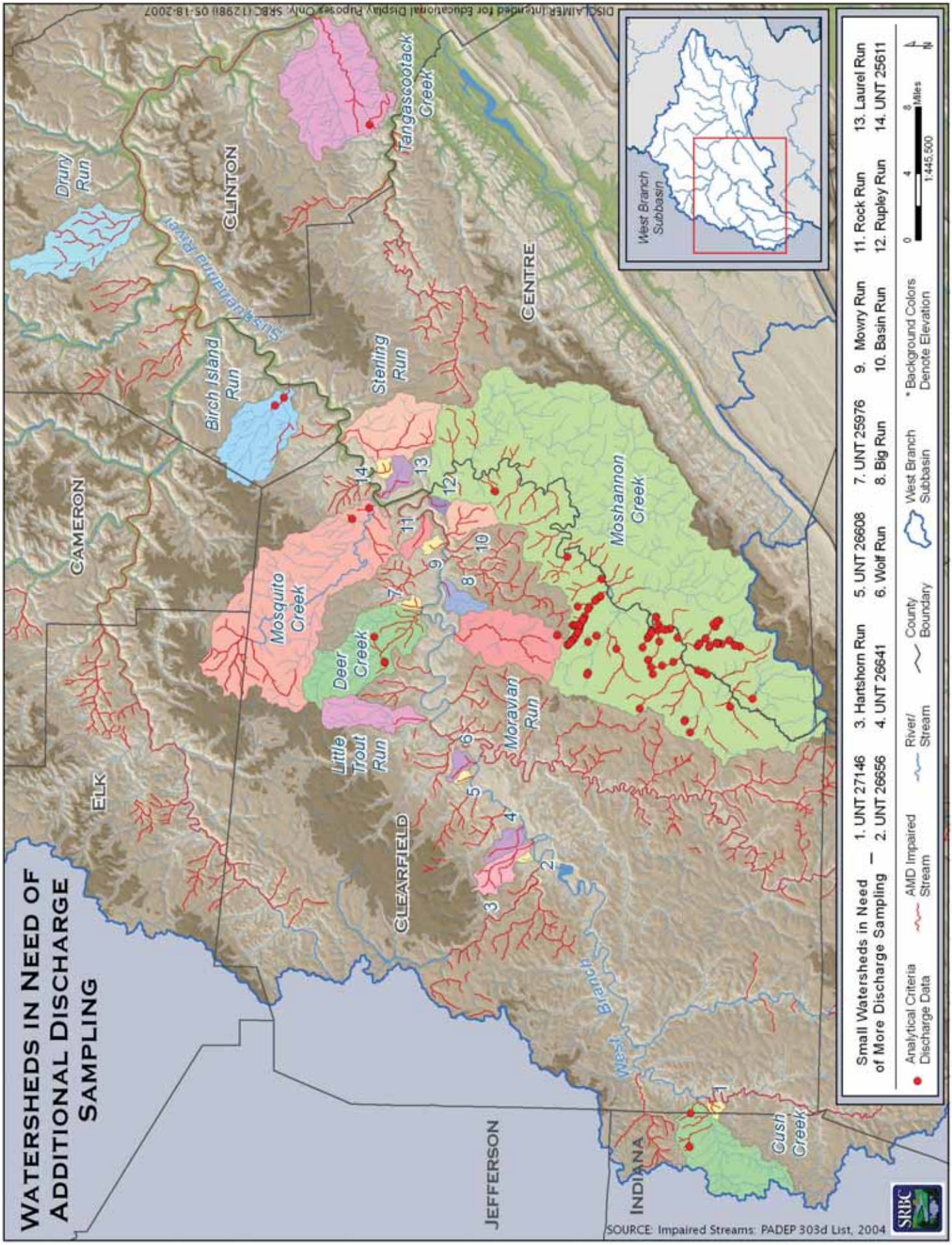
The Task Force recognizes that the areas contributing the largest AMD-pollutant loads represent one part of the problem. Other areas can be just as important for restoring AMD impacts and should be considered within the framework of a stakeholder's restoration goals, which can vary greatly depending on the intended use of the resource and local interest.

In terms of the discharges “adjacent" to Priority I and II sites, there are opportunities to improve conditions within eight MUs through reclamation of these hazard sites. Reclamation of abandoned mine lands often has proven to be an effective method in improving water quality conditions. AML reclamation focused in CLCR4, MOSH1, BENB3, BENB2, and AND1 could directly improve the West Branch Susquehanna River since these MUs contain a majority of the discharge loading that is within one-quarter mile from a Priority I or II site. Additionally, work in CHST1, CHST2, and WBS6 could improve conditions within each of these MUs since a large majority of their analytical criteria discharges are in close proximity to Priority I and II hazard sites. If OSM rules allow, Priority I and II funding could be utilized in these areas to correct a Priority III problem.

Other areas of interest include tributaries containing sections of high quality wild trout fisheries with adjacent sections of stream impaired by AMD or acid deposition. Half of these focus watersheds (24 out of the 48 documented) are found between Anderson Creek and Sinnemahoning Creek along the West Branch Susquehanna River, which is arguably the most impaired section of the river. In addition, 29 out of the 48 focus watersheds are found in the PA Wilds designated area. A significant opportunity exists to bolster existing restoration efforts in these areas with the ultimate goal of population reconnection with the West Branch Susquehanna River.

Continued water quality monitoring is critically important to support the West Branch Susquehanna Subbasin restoration effort. Within areas of the West Branch Susquehanna Subbasin, water quality monitoring data are still needed to properly characterize AMD impacts (Figure 21). In addition, sites need to be monitored as restoration occurs. Instream monitoring sites, such as those used in this strategy, help document improvement and support future restoration planning.

Restoration of the West Branch Susquehanna Subbasin offers a tremendous opportunity to greatly enhance the subbasin’s resources by creating considerable environmental, recreational, and socioeconomic benefits.



J. Zimmerman

Figure 21. *West Branch Susquehanna Subbasin Watersheds in Need of Additional Discharge Sampling.*

West Branch Susquehanna Subbasin AMD Remediation Strategy Recommendations Summary

Encourage restoration activities within the management units contributing to a majority of the AMD-pollutant loads;

Utilize the tools outlined in this document to assist with decision making on restoration planning, including maintaining the water quality database through periodic updates;

Develop restoration plans for areas where none currently exist;

Investigate other factors contributing to aluminum loading issues in the West Branch Susquehanna Subbasin;

Encourage efforts to combine the restoration of Priority I and II Health and Safety Sites with the elimination/treatment/improvement of "adjacent" AMD discharges (Priority III sites);

Investigate opportunities to restore wild trout streams affected by AMD for the ultimate goal of reconnecting populations within the West Branch Susquehanna Subbasin;

Encourage collection of flow measurements when water quality data are collected from streams and discharges;

Complete assessments of areas lacking discharge and instream water quality data; and,

Continue to monitor instream water quality for the 34 management unit endpoint stations so that any improvements can be documented.

Major Highlights of the West Branch Susquehanna Subbasin AMD Remediation Strategy

- ✔ Water quality impairment, mainly from AMD, of the West Branch Susquehanna Subbasin is the only major hindrance to biological expansion since nearly 90 percent of the subbasin has been documented as containing either excellent or supporting habitat (LeFevre, 2003).
- ✔ 1,205 stream miles of the West Branch Susquehanna Subbasin are impaired by AMD, which is 66 percent of the total AMD-impaired mileage in the entire Susquehanna River Basin. However, the subbasin also contains 1,249 of Exceptional Value waters and 5,229 stream miles of High Quality Cold Water Fisheries (West Branch Susquehanna River Task Force, 2005).
- ✔ There are approximately 1,964 AMD discharges in the West Branch Susquehanna Subbasin, however, only 788 (40 percent) contained enough data to meet analytical criteria standards.
- ✔ 11 Management Units (10 tributary MUs and one West Branch Susquehanna River MU), comprising only 10 percent of the West Branch Susquehanna Subbasin area, contain nearly 80 percent of the analytical criteria discharge loading.
- ✔ 8 of the 11 priority Management Units are found within the Clearfield Creek, Moshannon Creek, and Bennett Branch Sinnemahoning Creek Watersheds.
- ✔ The hypothetical examples for West Branch Susquehanna Subbasin remediation would allow for a completely net alkaline West Branch Susquehanna River mainstem with iron concentrations that meet Pennsylvania Department of Environmental Protection water quality standards. Aluminum concentrations, however, may still exceed water quality standards between the entry of Clearfield Creek and Bald Eagle Creek. The capital cost needed for this remediation has been estimated to be between $43 and $165 million.
- ✔ Treatment of Cresson #9 discharge, Gallitzin #10 discharge, Gallitzin Shaft Mine Complex, and Dean Clay Mine in Brubaker Run could lead to a majority (~ 86 percent) of the Clearfield Creek mainstem attaining water quality standards for iron.
- ✔ Out of the 788 analytical criteria discharges, 213 (27 percent) are within one-quarter mile of a Priority I or II Health and Safety Problem Site. Land reclamation of these sites could pay water quality dividends, particularly in the Clearfield Creek, Moshannon Creek, Bennett Branch Sinnemahoning Creek, Anderson Creek, and Chest Creek Watersheds due to possible hydrologic connections.
- ✔ 48 focus watersheds in the West Branch Susquehanna Subbasin contain, at minimum, sections of Pennsylvania Fish and Boat Commission documented wild trout and sections of Pennsylvania Department of Environmental Protection documented AMD and/or atmospheric deposition (acid deposition) impairment. These 48 focus watersheds contain 634 miles of Wild Trout classifications, 99 miles of Class A Wild Trout designations, 55 miles of Wilderness Trout designations, but also 438 miles and 89 miles of AMD and acid deposition impairment, respectively. Only 3.7 percent of the subbasin contains large/strong populations of wild brook trout.
- ✔ Total capital costs of complete West Branch Susquehanna Subbasin remediation from AMD impacts could be as high as $400 million; however, true costs ultimately will not be known until projects are competitively bid.