Watershed scale reclamation and treatment planning with changing reclamation funding sources

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Extended Abstract

In Ohio, there are several coal mining impaired watersheds that have not had treatment or reclamation projects conducted in them due to the severity and widespread nature of the mining pollution. Rush Creek Watershed in Perry County, Ohio, has been extensively coal mined both prior to and after regulations on mining were in place, with widespread water quality and habitat alteration as a result. There is both underground and surface coal mining impairing the watershed. Multiple subwatersheds (fig. 1, Bowman 2009) near New Lexington, Ohio, would require treatment for improvement to water quality in the watershed. While the watershed is in the Appalachian Region of Ohio, the overall stream gradient at valley bottoms is low, while tributaries have higher gradient draining hillsides.

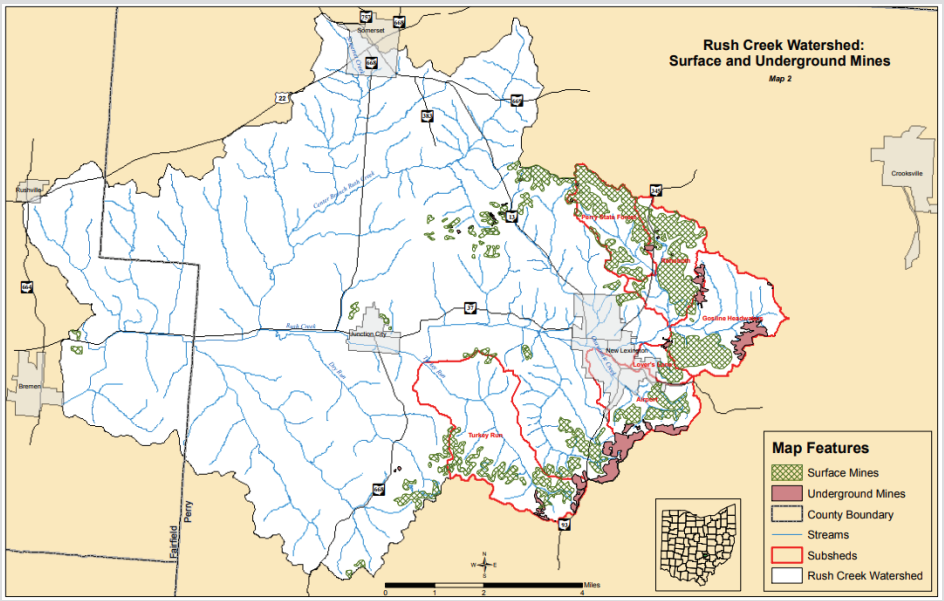

Figure 1 *Rush Creek Watershed with mining areas and characterized subwatersheds noted. Focus has been on Rehobeth, Gosline, and Osawoogie (noted here as Airport) (after Bowman 2009)*

Prior to the passage of the Bipartisan Infrastructure Law (BIL), funding for abandoned mine land treatment and reclamation was dwindling in many mining affected states. During this time, Brownfields funding was an untapped opportunity in southeast Ohio that collaborating partners pursued to address areas with extensive and untreated mining impaired lands. With a focus on the Rush Creek Watershed (fig. 1), planning began. During the course of the planning and design effort, BIL was passed and State of Ohio funding through the H2Ohio program became available; both promise large amounts of money for abandoned mine land projects, allowing focus on areas untreated previously

due to the extent of the issues. These efforts have aligned to create initial plans in several sub-watersheds and future areas of exploration in a difficult to treat watershed.

Together with partners, we characterized the subwatersheds in Rush Creek and developed treatment concepts for several sites in 2009 (Bowman 2009) with an update in 2021 (Voinovich School 2021). Some subwatersheds had extensive enough issues to not be practical for treatment based on the funding levels at that time, specifically Rehobeth and, to a lesser extent tributaries named Gosline and Oxawoosie (sometimes called "Airport" in older reports and in fig. 1). With the new funding opportunities available, the focus has shifted to managing the highest acid and metal loads to support biological recovery in the watershed rather than only addressing issues that were affordable. Chemical sampling was performed across different hydrologic conditions and field reconnaissance supported treatment and reclamation focus areas. With Ohio Department of Natural Resources (ODNR), the Voinovich School of Leadership and Public Service is developing treatment plans that are synergistic and should leverage each partner's expertise and the multiple funding sources for a better outcome.

To target the highest acid sources in the watershed and to partner with willing landowners, the project has focused on two areas named Gosline and Rehoboth. This approach can lead to treatment or reclamation of sites that do not have as large an effect on water quality due to the focus on site access and speed of project development. The recent data collection suggests that the acidity loading is lower now than when first assessed approximately 20 years ago (fig. 2, early data referenced in Bowman 2009), opening the door to new treatment options. Rehobeth is the largest contributor of acid to the watershed, 1671 kg/d (3,685 lb/d) in recent analyses. Approximately 25% of this acid is generated in Perry State Forest from diffuse surface impairments, including exposed spoil and strip pits. The remaining 75% originates from a second tributary which, together with the water from Perry State Forest, becomes a single stream prior to discharge into Rush Creek mainstem. Further upstream, Gosline contributes far less acid per day, approximately 136 kg/d (300 lb/d) to Rush Creek. While Gosline contributes less to Rush Creek, it remains a priority in a watershed-scale planning effort.

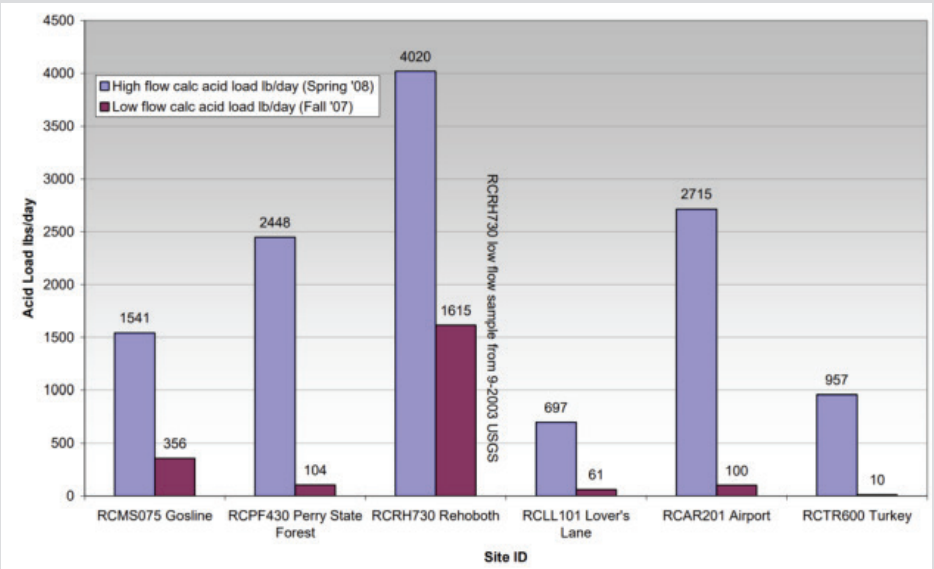

Figure 2 *Acid loading from tributary mouths from 2008-2009 data (after Voinovich School 2021)*

In Rehoboth, ODNR is planning extensive reclamation projects in the headwaters, in Perry State Forest, but will implement projects over several years. Treatment planning, therefore, is focussed on developing multiple treatment scenarios based on different amounts of load reduction from Perry State Forest. In this area, active dosing is being considered, but, due to the low gradient stream bed at this site, mixing will be required. There is access to utilities which could allow for shear mixing, but gravity mixing using the elevation drop from the outlet of an impoundment is also being considered. These projects would be funded by BIL funding and active treatment will be implemented after reclamation is complete.

In Gosline, each side of the valley contributes approximately half of the acid load. A 1970's reclamation project that left exposed spoil on the surface, leading to infiltration into acid generating materials is downgradient from a permitted reclaimed mine site from the same time period is allowing high infiltration rates into acid generating materials and discharging from the so-called "Volcano Seep" (fig. 3). This land will be reclaimed using state funding, however, the project cannot extend into the previously permitted reclaimed land. By leveraging Brownfields funds that do allow access to the permitted site, four borings will be conducted to characterize the acid generating material upgradient from the proposed project site. This project will both allow use of the currently marginal land and will be a project with visible outcomes. The state funding has a short timeline associated with it, so a project that was already in planning that also will have visible results is a priority, while the water quality improvements may be incremental. While not a short-term priority for watershed-scale treatment and biological recovery, the other side of the valley is mostly forested but producing an equivalent amount of acid; there is one primary drainage path that the water flows down. There is sufficient land area and gradient along this flow path to support passive treatment along with a small amount of flat land at the bottom of the valley to build new and enhance existing wetlands.

Further investigation is underway to examine the contribution of Osawoogie further downstream from both Gosline and Rehobeth. If projects are successful in Gosline and Rehobeth, Osawoogie will be the next limitation on biological recovery and will be targeted in future projects.

Figure 3 *The "Volcano Seep" discharges from the toe of a previously reclaimed area that now shows clear evidence of infiltration and erosion. This is a planned site for future reclamation*

With multiple funding sources and collaborators, watershed scale planning can be lengthy, but necessary with the aim of recovering aquatic biology. Increased funding is a boon to the remaining work in abandoned mine lands in the USA, but the speed at which the funds are supposed to be spent generates challenges in planning and prioritizes larger projects or projects with existing planning documents and data that require a shorter path from monitoring to construction, particularly those on public lands.

Keywords: Capitalize infrastructure and law, coal mining, acid mine drainage, active treatment, passive treatment

Acknowledgements

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