

Determination of Aquatic Impacts Resulting from Valley Fill Construction

Jim Hedrick and Lara Ras
Research, Environmental, and Industrial Consultants, Inc.
P.O. Box 789, Cool Ridge, West Virginia 25825
jim@reiclabs.com

Abstract

In the fall of 2001, the Army Corps of Engineers introduced an additional requirement for the nationwide permit (NWP) 21. In the permit application, the coal company is required to provide information showing that the impacts on the aquatic environment are both individually and cumulatively minimal. The definition of “minimal” impact has yet to be determined by agencies. Therefore, to determine the aquatic impacts resulting from valley fills, we have compared pre and post valley fill construction data. Water quality collected downstream from constructed valley fills indicated that values for alkalinity, conductivity, total dissolved solids (TDS), chloride, sulfate, and hardness were elevated compared to the pre valley fill construction values. However, water quality constituents usually remained within the ranges recommended for freshwater organisms. Benthic macroinvertebrate data collected downstream from valley fills indicated that there was a shift in the community composition from a predominantly pollution sensitive and facultative community to a community dominated by facultative and tolerant individuals. The West Virginia Stream Condition Index (WV-SCI) decreased slightly, and in many streams went from a “very good” designation to one of “good”. It is very important for coal companies to be aware of procedures that will help decrease the individual and cumulative effects of constructing valley fills, and the data necessary to make a determination of impacts. Pre-existing data from all streams with proposed valley fills, and data from the receiving streams are necessary. Reference data are also imperative from existing valley fills of similar size in the same watershed that were constructed utilizing the same mining methodology.

Introduction

In the fall of 2001, the Army Corps of Engineers introduced an additional requirement for the nationwide permit (NWP) 21. Nationwide Permits (NWP-21) are a type of general permit by the Chief Engineers for activities that result in no more than minimal site-specific and cumulative effects on the aquatic environment. Coal companies typically apply for the NWP-21 permit prior to constructing valley fills. The pre construction notification (PCN) process recognizes that the NWP must address adverse effects on the aquatic environment. The NWP 21 has a requirement in which the District must review and require mitigation to the extent that no more than minimal adverse effects on the aquatic environment will occur for each case verified. To apply for a permit, the company is required to provide information showing that the impacts on the aquatic environment are both individually and cumulatively minimal. If aquatic impacts are not anticipated to be minimal both individually and cumulatively, an individual permit requiring an environmental assessment may be required.

The definition for “minimal” impact has yet to be determined by agencies. Therefore, to determine the aquatic impacts resulting from valley fills, we have compared pre and post valley fill construction data. Results from the determination of individual and cumulative impacts vary depending on the number of valley fills proposed, the methodology used in construction, and the

amount of disturbance created in the stream reach downstream from the valley fill toe. If impacts are not minimal, both individually and cumulatively, the company has the option to mitigate until the impacts are considered minimal.

Methods

Current and historical data were reviewed for the proposed valley fill stream, for the receiving streams, and for other streams in the watershed where valley fills currently exist. Water quality, habitat, benthic macroinvertebrate, and fish community data are useful in identifying changes in the aquatic environment. When data are not sufficient to determine potential aquatic impacts associated with proposed valley fills, additional data are often collected to evaluate the current conditions and provide data from tributaries with existing valley fills.

Water quality is assessed based on the recommended values for freshwater organisms. The recommended values for freshwater organisms were established from literature sources that address the ranges of chemical water quality constituents within West Virginia watersheds (Heinen 1996; Jenkins et al. 1995; Stumm and Morgan 1996; US EPA 1986).

Two important metrics were used to evaluate changes in the benthic macroinvertebrate community, the percentages of pollution sensitive, facultative, and tolerant individuals, and the West Virginia Stream Condition Index (WV-SCI). Benthic macroinvertebrates are classified as pollution sensitive, facultative (intermediate tolerance), and tolerant according to their ability to exist in certain water quality and habitat conditions. Typically, as the concentration of water quality constituents increase, the benthic community becomes less sensitive, and is usually dominated by more facultative and tolerant individuals. The West Virginia Stream Condition Index (WV-SCI) was used as a primary indicator of ecosystem health, and can identify impairment with respect to a reference (or natural) condition (TABLE 1). The WV-SCI includes six metrics that represent elements of the structure and function of the bottom-dwelling macroinvertebrate assemblage. The six metrics included are: EPT (Ephemeroptera, Plecoptera, Trichoptera) Taxa, Total Taxa, % EPT, % Chironomidae, % Top Two Dominant Taxa, and HBI (Hilsenhoff Family Biotic Index). Value comparisons can be made among and between streams according to the following categories (EPA 2000):

West Virginia Stream Condition Index	
Range	Rank
78 to 100	“Very Good”
68 to 78	“Good”
45 to 68	“Fair”
22 to 45	“Poor”
0 to 22	“Very Poor”

TABLE 1. Value range and corresponding rank for the West Virginia Stream Condition Index (WV-SCI).

Results

Water quality collected downstream from constructed valley fills indicated that values for alkalinity, conductivity, TDS, chloride, sulfate, and hardness were elevated when compared to the pre valley fill construction values. However, water quality constituents usually remained within the ranges recommended for freshwater organisms.

Valley fill construction had a physical impact on the stream and the habitat available for benthic macroinvertebrates. There was an elimination of the aquatic community that currently existed in the immediate area where fill material was placed. Benthic macroinvertebrate data collected downstream from valley fills indicated a shift in the benthic macroinvertebrate community composition from a predominantly pollution sensitive and facultative community, to a community dominated by facultative and tolerant individuals. There was also a slight decrease in some metrics including taxa richness, EPT Index, and percent EPT individuals. The WV-SCI decreased slightly, and in some streams went from a rank of “very good” (78-100) to a rank of “good” (68-78).

Discussion

The scientific determination of aquatic impacts has been a new addition to the NWP-21 permitting process. The results we presented were examples of some of the impacts we determined from a small database of pre and post valley fill construction data. The data presented came from valley fills that were constructed using practices designed to minimize effects.

It is very important for coal companies to implement procedures that will help decrease both the individual and cumulative effects resulting from the construction of valley fills. Some of these procedures include: 1) Construct valley fills in the upper most portion of the stream (ephemeral/intermittent) reach; 2) Limit the number of valley fills being constructed on a single receiving stream; 3) Conduct operations with as little disturbance as possible, and maintain the natural stream channel and vegetation downstream from the valley fill toe.

The only way to determine the aquatic impacts associated with valley fills is to have good pre and post construction data. Individual and cumulative aquatic impacts need to be addressed. Individual impacts correspond to a single valley fill, and cumulative impacts correspond to the effects of all valley fills listed on a permit, and all existing valley fills within the same watershed.

It is imperative that coal companies understand that the determination of impacts will be required, and what responsibilities they have to ensure an accurate determination can be made. Pre-existing data from all streams in which they are proposing valley fills, and data from the receiving streams are needed. Biological and chemical data should be collected during both fall and spring sampling periods, as water quality and the aquatic community tends to vary between seasons. Reference data is needed from existing valley fills of similar size, located in the same or adjacent watershed, and from fills constructed utilizing the same mining methodology.

References

- Heinen, J.M. 1996. Water Quality Criteria, "Uptake, Bioaccumulation, and Public Health Considerations for Chemicals of Possible Concern in West Virginia Mine Waters Used for Culture of Rainbow Trout." The Conservation Fund's Freshwater Institute.
- Jenkins, M., Wade, E., Fletcher, J., and Hankins, J. 1995. "Economic Analysis of Non-Traditional Water Resources for Aquaculture in West Virginia." Technical Report funded in part by Appalachian Regional Commission, West Virginia University, Morgantown, WV.
- Stumm, W. and J. Morgan. 1996. Aquatic Chemistry, 3rd Edition, John Wiley and Sons, NY.
- U.S. Army Corps of Engineers. 2001. Guidance for the establishment and maintenance of compensatory mitigation projects under the Corps Regulatory Program Pursuant to Section 404 (a) of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899.
- U.S. Army Corps of Engineers. 2001. Guidance on application of Nationwide Permit 21 to the Martin County Coal Project.
- U.S. Army Corps of Engineers. 2000. Guidance for the pre-construction notification information associated with the implementation of Nationwide Permit 21.
- US EPA. 2000. A stream condition index for West Virginia wadeable streams, Region 3 Environmental Services Division. Prepared by Tetra Tech, Inc. July 21, 2000.
- US EPA. 1986. Quality Criteria for Water 1986. EPA 440/5-86-001.