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AN EVALUATION OF BMP EFFICIENCIES IN REDUCING TDS LOADS FROM ACTIVE AND ABANDONED MINE LANDS AND ACID MINE DRAINAGE.

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Project Description and Objectives:

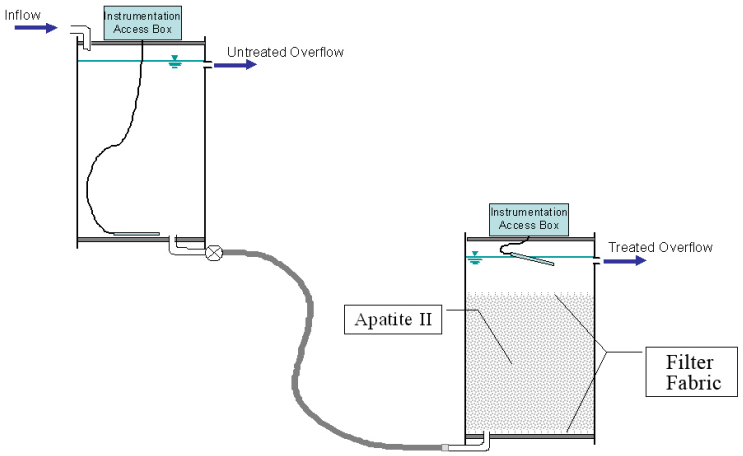
The control of total dissolved solids (TDS) in the Appalachian coalfields is quickly becoming a priority issue for the protection of aquatic life. The primary goal of this study was to evaluate the effectiveness of Best Management Practices (BMPs) in controlling delivery of TDS and its constituent elements to receiving streams. This study will benefit both regulators and industry, in establishing the benefits of proposed BMPs used in mining and reclamation. The project was located in the North Fork Powell River drainage basin in the coalfield region of southwestern Virginia.

Applicability to Mining and Reclamation:

The project found that Apatite II was not effective in reducing TDS in mine drainage. Polymer treatment may have potential in sealing hollow fills which could be used in many areas. The statistical study indicated that reclamation of disturbed areas has an initial negative impact on TDS concentrations, but provides a 67% reduction in the TDS load from those areas over a 2 to 3 year period, as compared to a 36% improvement due solely to completion of mining.

Methodology:

The intention of this study is to assess BMPs and/or others to determine their effectiveness in controlling TDS. Two approaches were pursued to determine the efficiency of BMPs in controlling TDS, direct monitoring of TDS reductions due to specific BMPs and statistical analysis of water quality as impacted by various land uses with differing levels of BMP installation. The treatment of mine water with apatite was identified as potential TDS-controlling BMPs. Apatite is a phosphate mineral group



ABOVE PHOTO: Schematic depiction of Apatite II treatment apparatus.

that can be used to precipitate metals from contaminated waters. Apatite II is made from processed fish bones and based on the literature reduces concentrations of all metals as well as sulfate.

Direct Monitoring Study:

For the field portion of the monitoring study (i.e., assessment of Apatite II, ponds, and wetlands), Virginia Division of Mines Minerals and Energy assisted with identifying local cooperators. Three ponds were identified, each treating different water quality conditions (deep mine discharge, runoff from an active surface mine area that was in cessation, and runoff/drainage from a large valley fill). Together, these three ponds provided a good cross-section of typical water quality conditions produced on mines in the region.

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Methodology (continued):

Statistical Study:

For those BMPs that are not readily monitored or that require time for establishment of the BMP (e.g., establishment of vegetative cover) before water-quality results are expected, a statistical analysis was conducted to relate levels of BMP installation to water quality conditions. Watersheds were identified with monitored water quality data and varying activity in space and time. For each monitored location in a specific time, water quality (i.e., TDS) and contributing features were summarized. These records were used to develop a regression that predicts TDS as a function of watershed characteristics.

Highlights:

In total, three Apatite II treatment monitoring units were deployed.

- Site 1 treated water from a deep-mine discharge.
- Site 2 treated water from the outlet of a pond draining an active surface mine site.
- Site 3 treated water from the outlet of a pond draining a large fill area.

In general, the apatite increased conductivity (27%, 41%, and 3% at Sites 1, 2, and 3, respectively). The amount of increase was most affected by the residence time; a higher residence time resulted in higher conductivity. Overall, it appears that the Apatite II treatment is not effective in reducing TDS levels.

Results/Findings:

The conclusions listed below indicate the relative strength of the BMPs assessed.

1) It appears that the Apatite II treatment is not effective in reducing TDS levels;
1) Detention ponds may slightly increase TDS levels, but more data is needed to verify the results;
2) Constructed wetlands may decrease TDS levels (~7%), but more data is needed to verify the results;
3) The polymer treatment may have potential in sealing hollow fills;
4) The polymer treatment does reduce TDS production where it is applied and allowed to cure (~100%);
5) The peat filter appears to be effective at reducing TDS (~18%);
6) The statistical study indicated that hollow fills have a large potential impact on TDS concentrations, and that BMPs to reduce these impacts should be explored;
7) The statistical study also indicated that reclamation of disturbed areas has an initial negative impact on TDS concentrations, but provides a 67% reduction in the TDS load from those areas over a 2 to 3 year period, as compared to a 36% improvement due solely to completion of mining.

Implications for future research include:

2) Constructed wetlands and traditional reclamation efforts should continue to be assessed to refine the efficiency estimates developed in this study;
3) The use of a peat filter should be further explored to determine efficiencies under varied conditions;
4) BMPs for reducing TDS loads from hollow fills should be explored, including assessment of the polymer treatment at a plot or field scale.

Above Photo: Field installation of Apatite II treatment apparatus.

Website Information:

The final project report can be found at **http://www.techtransfer.osmre.gov/NTTMainSite/appliedscience/2006appscience/CompletedProjects/VAMapTechJFelbinger06FR.pdf**

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