ARNOT #2 MINE, DISCHARGE #4

ACID MINE DRAINAGE TREATMENT SYSTEM

OPERATION, MAINTENANCE, AND REPLACEMENT PLAN

BABB CREEK WATERSHED ASSOCIATION, INC.

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Site Background

1. Mine Discharge

The Arnot #2Mine, Discharge #4 is from an abandoned deep coal mine that is located in Bloss Township, Tioga County, Pennsylvania and is located on the Tioga State Forest approximately 1 miles west of the Village of Arnot. The mine was in operation from the late 1870's until the 1940's and approximately 620 acres of the Bloss seam coal was mined from this mine. The mine had five drift entries of which three are discharge points for mine drainage. The other two discharge point flow into the Tioga River Watershed. This discharge comes from a drift that was opened around 1940 to discharge water from the mine so that mining operations could continue. Prior to this drift being dug, the upper reaches of Lick Creek down to Red Run were reportedly not polluted and had native trout in them.

The discharge has an average flow of 160 gallons per minute (gpm). The flows fluctuate greatly with rates as low as 20 gpm during drought conditions to discharges in excess of 300 gpm after high water events and spring thaws. See Appendix Pages 2 thru 3 for data on flows and water chemistry.

2. Receiving Stream

The discharge goes into Lick Creek which is a tributary of Babb Creek. This discharge is located in the headwaters of Lick Creek and there are no AMD discharges above it. Down stream, about 1 ½ miles, are two limestone diversion wells that were constructed in 1990 to treat Lick Creek. The two other AMD discharges on Lick Creek, Davis and Klondike Mines, have treatments systems on them.

A TMDL was developed for the acid mine drainage affected segments of the Babb Creek Watershed in 2003 of which Lick Creek is one of them. See Appendix Page 1 for details and the Lick Creek load allocation.

The Arnot #2, Discharge #4 AMD Treatment System was completed on December 22, 1996. The historic data from monitoring points up to 1 ½ miles south of the point where the discharge enters Lick Creek that were taken between July 1975 and June 1996 show the average pH of Lick Creek in this section to be 4.5. By July 1997 the stream pH had risen to 5.0 and now averages over 6.0 at DEP's Monitoring Point ID #1. See appendix Pages 4 and 5 .

Treatment System

1. Background Information

The AMD treatment system was constructed in 1996 through grants from the U.S Environmental Protection Agency, PA Department of Environmental Protection, Western Pennsylvania Watershed Program, and funds from the Babb Creek Trust Fund of the PA Environmental Defense Foundation. Signor Brothers Contracting of Arnot was awarded the contract to construct the project. Originally, the treatment system consisted of a successive alkalinity producing system (SAPS) pond and anoxic limestone drain (ALD). A Growing Greener Grant, in 2005, was used to re due the SAPS with new stone and compost and to modify the ALD. The ALD portion of the treatment didn't work as anticipated and kept plugging so a Growing Greener II Grant was applied for in 2007 to convert the ALD to a limestone ramp which can be easily cleaned. The conversion of the ALD to a limestone ramp was completed in July 2008. BCWA has a source of funds, as the result of the settlement of a lawsuit against a mining company, to fund monitoring, operations, and ordinary maintenance. Whenever replacement is need, grants will be solicited to supplement BCWA funds.

The coordinates for the site taken with a GPS unit are Latitude 41.668036, Longitude 77.1437658. These coordinates are at the northwest corner of the SAPS pond where the raw water enters. To get to the system from the Village of Arnot, take the Landrus Road (State Forest Road) off of the Arnot Road (SR 2016) at the western edge of the Village. Follow the Landrus Road west for about 1/2 mile and there is a yellow and black gate on the right side of the road. The system is about 1/3 mile behind the gate. Permission must be received from the Tioga State Forest Office in Wellsboro (570-724-2868) to access the site by motorized vehicles and to obtain a key for the gate. The Landrus Road and the access road to the site receive only minimum maintenance in the winter. However, the BCWA does plow the top layer of snow off the roads periodically to allow them access with a 4X4 vehicle. The Landrus Road is also a joint use road with snowmobiles.

2. System Components

The Arnot #2Mine, Discharge #4 AMD System consists of two major components, a SAPS pond and a limestone ramp.

The SAPS pond has a piping system near the bottom that consists of a ten inch PVC pipe trunk line with eleven 4 inch perforated PVC pipe laterals. See Appendix Page 6 for photo of piping arrangement. All the piping is schedule 80. There is three foot layer of AASHTO #3 size high calcium carbonate content limestone on top of the piping. The limestone is covered with a 1 1/2 foot thick layer of spent mushroom compost.

When the water enters the system, the bacteria in the compost remove oxygen from the acid mine drainage. Oxygen is necessary for iron oxide to precipitate, so this removal of oxygen reduces the amount of iron oxide that will coat (armor) the limestone layer. The acidic water then flows through the limestone, dissolving it, and thereby adding alkalinity and increasing pH and heavy metals precipitated out. The treated water then passes through the underlying piping system and into the limestone ramp.

The limestone ramp is approximately 125 feet long and 70 feet wide. In 2008 it contained approximately 3,000 tons of AASHTO #1 limestone. The difference in elevation of the ramp is 2 feet from the in take to the discharge end. The water flows through the limestone bed and as it becomes plugged, the water level rises. When the water level gets up close to the high point on the ramp, most of the limestone is becoming plugged and it must be agitated and cleaned. The water that comes from the SAPS has a pH of around 6 and receives further treatment as it flows through the limestone. It is anticipated the pH will rise to close to 7 and the alkalinity will increase to over 100 mg/l.

3. System Synopsis

There is a valve on the line coming from the mine to the SAPS pond. This vale is used to shut down the flow into the system during maintenance projects. There is an emergency overflow on the SAPS pond which will bypass water, when the system can't handle it, directly to the limestone ramp. This usually only happens when there is a problem with the system such as the compost layer crusting over and needing to be stirred up or during very high water flows after spring thaws or flooding events.

The system was designed to remove acidity and metals from the water, primarily iron, aluminum, and manganese. Compare data in Appendix Pages 3 and 7 for information on changes in pollutant concentrations and loading.

Systems Monitoring, Operations, and Maintenance

1. Responsibilities

The Babb Creek Watershed Association is responsible for all inspections and the operation and maintenance of the system. If a serious problem occurs at the treatment system, outside help should immediately be sought from cooperators and experts in the field.

2. Regular Inspections

Regular inspections are needed in order to assess the performance of the treatment system and to identify any problem that may exist. The system should be inspected at least once a month and after severe storms or high water spring thaw events.

The following must be checked during each inspection:

- Check to ensure inlet flow to SAPS is clear and free of debris and growth.
- Check berms of SAPS and limestone ramp for subsidence, leaks, and pest damage.
- Check exposed pipe, wooden boxes, and flow control box for damages caused by porcupines.
- Check SAPS emergency overflow to ensure that it is free of debris.
- Check outlet from the limestone ramp for debris and plugging.
- Check all valves for leak.
- Note any change in the water level in the SAPS and in the limestone ramp.
- Check for any vandalism including damage to structures, cut locks, illegal vehicle operation, etc.

3. Water Monitoring

There are two water monitoring points for this system. Each is marked with the monitoring point ID # painted on a metal white sign attached to a metal post at the monitoring point location. The monitoring points are:

- Monitoring Point .5, Discharge from the Arnot #2 Mine, Latitude 41.668036, Longitude 77.1437658.
- Monitoring Point .5B2, Treated discharge from the limestone ramp, Latitude 41.660419, Longitude 77.137658.

In conjunction with the monthly visits, field water sample test for pH and alkalinity will be taken at Monitoring Point .5B2 This data that was collected since April 2004, is stored in the POWR Database and is available to the public.

Once during high water flows, in late March or early April, and during a period of low water flows, in late August or early September, samples will be taken at both Monitoring Point .5 and Monitoring Point .5B2 These samples will be sent to a certified laboratory for the standard coal mining discharge analysis. Also flow measurement will measured using a bucket and stop watch if two people are available during the inspection. If only one person is available, the flow measurements will be estimated. These sample results after March 2007, are stored in the POWR Database. Prior data is on file with BCWA and is in a Pa DEP Data Base.

4. Regular Maintenance

The monthly inspections are designed to identify problems before they develop into big problems. Close attention to the following items will allow problems to be corrected before they damage the system or cause decreases in treatment performance.

a. Limestone Ramp Channel

The channel leading from the limestone ramp discharge pipe may become plugged with debris such as sticks, leaves, fallen tees and branches, and other vegetation. Any debris clogging or vegetation growth in these channels should be removed.

b. Pest Damage

Pests such as muskrats and beavers have been known to cause damage to passive treatment systems by digging through berms, blocking pipes and channels, and draining ponds. If muskrat or beaver activity is noted, immediate actions must be taken. The PA Game Commission must be consulted for the appropriate, legal action to take. Porcupines can also cause damage by eating PVC pipes, wooden boxes, and plastic follow control devices. If this type of damage in noted, appropriate protective guards must be installed to prevent the damage. Porcupines are a protected species and cannot be killed. The flow control device on the SAPS is already protected with a metal shield and most of the pipes are completely buried, so this should not be a problem.

c. SAPS Flushing

This treatment system was designed to remove acidity and metals for the water, primarily iron, aluminum, and manganese. These metals can cause clogging and cause the system to premature fail if they accumulate in the compost and/or the limestone. The SAPS must be

flushed a minimum of once every three months to dislodge and remove these metal particles before they plug the system.

The flushing is done by removing the boards from the flow control box. Remove only about ½ of the boards. Removing to many boards can cause to powerful of a flush which can and has in the past caused short circuits to occur through the compost layer. The flushing event should last 15 to 30 minutes. At first, the water maybe very black, orange, or dark brown and smelly. After a period of time the water should start to clear up. When the water clears, the boards should be put back into the flow control box to return the system to it normal operation. The water level in the SAPS should never fall below the top of the compost.

5. Long Term Operation, Maintenance and Replacement Needs

The regular operation and maintenance for the system have been discussed above. There are also long term issues that will eventually have to be addressed.

a. Compost Replacement and Maintenance

The compost layer was replaced in July 2005 so it should not require any attention for at least 5 years. If the water in the SAPS rises and flow going through the system slows down, the problem may be a hard iron crust forming on the surface of the compost that interferes with flow into the underlying compost and limestone. When this happens an excavator or other equipment should be used to stir up the compost layer. In most cases, breaking up the crusty condition usually corrects the situation and the flow through the system returns to normal. As the need for stirring up the compost layer becomes more frequent, more compost may need to be added or the layer replaced. Grants and BCWA funds will be used to complete.

b. Limestone Replacement in SAPS

The system was designed for the limestone to last for 20 years. With the limestone being replaced in 2005, the limestone should last until 2025. If replacement of the limestone appears to be necessary, an autopsy of the entire system should first be done. The water to the system would be turned off and all the boards in the flow control device would be removed to drain the SAPS. Excavation will reveal the condition and the amount of limestone remaining and a repair or replacement plan can be implemented. At this time the compost layer should also be replaced. Grants and BCWA funding will be used to complete the rehab project. **Anytime that the SAPS pond is down for repairs, the untreated mine water must be treated with lime so that degrade of the stream does not occur.**

c. Limestone Ramp Cleaning and Replacement

The limestone in the system will become plugged over time and must be cleaned. Since the conversion to a limestone ramp was just completed when this plan was written, it is not known how often cleaning will be needed. It is anticipated that cleaned will be needed every two or three years because some of the limestone is of poor quality. This can be completed by using an excavator or backhoe to dig up and stir the stone to dislodge particles that are plugging the system. A flushing line is available to aid in cleaning and is located near the south eastern corner of the ramp. Because the limestone in the ramp is low quality and to soft (which is probably why it clogged all the time when it was an ALD), it will probably need to be replace around 2015. When the limestone is replaced , if high calcium carbonate limestone is used, the size of the pit can be made smaller and the amount of limestone used can be as low 2,000. Grants and BCWA funds will be used to finance the rehabilitation work.