KLONDIKE ACID MINE DRAINAGE TREATMENT SYSTEM

OPERATION, MAINTENANCE, AND REPLACEMENT PLAN

BABB CREEK WATERSHED ASSOCIATION, INC.

JULY 2007

KLONDIKE AMD SYSTEM OPERATION, MAINTENANCE, AND REPLACEMENT PLAN

Site Background

1. Mine discharge

The Klondike Mine is and abandoned deep coal mine that is located in Bloss Township, Tioga County, Pennsylvania and is located on the Tioga State Forest approximately 2.5 miles west of the Village of Arnot. The mine was in operation from the late 1800's until the early 1930's. It is known locally as the Klondike Mine but the official recorded name is the Maple Hill Mine. Approximately 270 acres of the Bloss seam coal was mined from this mine.

The discharge is on the main entry of the Klondike Mine and has an average flow of 200 gallons per minute (gpm). The flows fluctuate great with rates as low as 20 gpm during drought conditions to discharges in excess of 500 gpm after high water events. See Appendix Pages 5 thru 8 for data on flows and water chemistry.

2. Receiving stream

The discharge goes into Lick Creek which is a tributary of Babb Creek. Upstream approximately 1/4 mile from this point, Red Run empties into Lick Creek. Red Run has been affected by AMD by the discharge from the Davis Drift, another entry into the Klondike Mine. The discharge from the Davis Drift is being treated by a limestone diversion well and there is another limestone diversion well treating Red Run. These wells were constructed in 1995. Upstream about ½ mile there are two limestone diversion wells, that were constructed in 1990, that treat Lick Creek. Upstream about 1 ½ miles near the headwaters of Lick Creek a discharge from the Arnot # 2 Mine enters the stream. This discharge has been treated since 1996 with a SAPS and ALD treatment system. See Appendix Page 1 for details and the TMDL for Lick Creek.

When the Klondike AMD Treatment System was installed in 1998, all the AMD discharge above it were being treated and the stream was starting to recover. At the mouth of Lick Creek below where the discharge enters, the average stream pH was still 4.5. After this system went on line, the stream pH went up to and average close to 6. See Appendix Page 2 and 3 for MP ID # 17 which is on Lick Creek below this point. Do not have any data on the stream immediately above

that was taken after 1994 which is before many of the AMD systems on Red Run and Lick Creek were put into operation.

Treatment System

1. Background information

The system except for the settling pond was constructed in 1998 through grants, donated manpower and equipment and funds from the Babb Creek Watershed Association (BCWA). Grants were received fro the Western Pennsylvania Watershed Program and the Orvis Corporation. DER Bureau of Abandoned Mine Reclamation provided two dozers and operators and constructed most of the SAPS pond. The DCNR Bureau of Forestry provided equipment and labor to dig the line and set the pipe from the mine opening to the pond and the high water bypass. BCWA supplied the rest of the funding to purchase materials and hire Signor Brothers Contracting to finish the project. The settling pond was constructed with a Growing Greener Grant in 2005 and the compost layer was replaced with funds from a Growing Greener Grant in 2007. BCWA has a source of funds, as the result of the settlement of a lawsuit against a mining company, to fund monitoring, operations, and 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 41.6604192, Longitude 77.1724376. These coordinates are at the southwest corner of the SAPS pond. 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 1one mile and there is a wooden routed sign on the right side of the road which has an arrow pointing to the “Klondike Project”. There is a gate on this road in several hundred yards off the Landrus Road. Permission must be received from the Tioga State Forest Office in Wellsboro (570-724-7564) to access the site and obtain a key for the gate. The Klondike AMD System is about 1.4 miles past the gate. The Landrus Road and the access road to the site are not maintained 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 Klondike AMD System consist of two major components, a SAPS pond and a settling pond.

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

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. The treated water then passes through the underlying piping system and out to the settling pond.

The water coming from the SAPS goes through an open ditch so the water can be aerated before entering the settling pond. As the water passes through the settling pond, the metals precipitate out before finally going into the stream.

3. System synopsis

There is a valve on the line coming from the mine to the SAPS pond which is partially closed and when water flows are greater than 300 gallons per minute (gpm), the excess flow is diverted through the high water bypass line. There is an emergency overflow on the SAPS pond which will bypass water when the system can't handle it. 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 the valve set to bypass excessive flows is not set properly and to much water is entering the system.

The system was designed to remove acidity and metals from the water, primarily iron, aluminum, and manganese. See Appendix Pages 5 thru 8 for information in changes in pollutant concentrations and loading.

SYSTEMS MONITORING, OPERSTION, 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 flow control box to ensure that it is clear and free of debris and growth.
- Check berms of SAPS and settling pond for subsidence, leaks, and pest damage.
- Check exposed pipe, wooden boxes, and flow control box for damages caued by porcupines.
- Check SAPS emergency overflow to ensure that it is free of debris.
- Check outlet aeration channel from SAPS to settling pond for debris and plugging.
- Check outlet channel from settling pond for debris and plugging.
- Check all valves for leak.
- Note any change in the water level in the SAPS.
- 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 11, Discharge from the Klondike Mine, Latitude 41.661030, Longitude 77.172267.

- Monitoring Point 11.0, Treated discharge from the SAPS pond, Latitude 41.660419, Longitude 77.172438.

In conjunction with the monthly visits, field water sample test for pH and alkalinity will be taken at Monitoring Point 11.0. This data that was collected since April 2004, will be stored in the POWR Database.

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 11 and Monitoring Point 11.0. 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, will be stored in the POWR Database. Prior data is on a disc and is available from BCWA.

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. SAPS and Settling Pond Channels

The channels leading from the SAPS exit and the settling pond exit channels 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 appropriate legal actions must be taken. The PA Game Commission should be consulted for 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 already is 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.

Before beginning the flushing event, the settling pond must be drawn down. This is done by opening the valve located on the lower slope of the berm near the southwest corner of the pond.

The flushing is done by removing the boards from the flow control box. Remove as many boards as possible to provide for the most powerful flushing action. The 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 2007 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 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.

b. Limestone Replacement

The system was designed for the limestone to last for 20 years. With the system being constructed in 1998, the limestone should last until 2018. 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.

c. Settling Pond Cleaning

The settling pond will over time fill up with sludge. With this pond being constructed in 2005, it is not anticipated that the pond will need to be cleaned for at least 15 more years. When the performance of the pond declines and the sludge needs to be removed, the proper permits, landowner permission etc. must be obtained to determine the best method of disposing of it.