OPERATIONS, MAINTENANCE, AND REPLACEMENT PLAN

FOR PA DEP
NONPOINT SOURCE SECTION 319 FUNDS
GRANT ME# 4100064394

PROJECT 1311

SIX MILE RUN SX0-D9

AMD REMEDIATION PROJECT

MAY 2017

SITE BACKGROUND

The Six Mile Run watershed is located in Broad Top Township in the northeastern corner of Bedford County. From its headwaters to its confluence with the Raystown Branch of the Juniata River, the watershed is partially forested with several residences along the main-stem in the towns of Coaldale and Defiance. Six Mile Run is classified as a warm water fishery (WWF).

Broad Top Township received PA DEP Section 319 Grant funding for the construction of a passive treatment system at this high priority AMD discharge site. Skelly and Loy, Inc. completed the preliminary engineering design work through a U.S. Army Corps of Engineers project for remediation of multiple AMD sources in the lower portion of Six Mile Run. Broad Top Township selected Skelly and Loy, Inc. to prepare the final engineering design and permitting of the passive treatment system for an estimated 20 to 25-year life. The treatment system engineering design was completed in 2013 and construction was completed in the summer of 2014, following receipt of all the necessary permitting approvals. Based on data from the 2001 AMD Assessment and Remediation Plan and topographic survey information for the site collected by Young's Surveying, Inc. personnel, the project team selected a limestone pond passive treatment system for capture and treatment of the AMD discharge at the site. The SX0-D9 discharge is located above the north bank of Six Mile Run at the west end of the village of Defiance with a large open and relatively flat area adjacent to the discharge site in a westward direction towards Six Mile Run that was used for installing a passive treatment system. Passive treatment of the SX0-D9 discharge utilizing the existing natural iron terrace feature to reduce iron concentrations prior to treatment in the limestone pond followed by a settling pond with an aerobic wetland at the end of the system for final polishing based on the water chemistry. Township personnel & equipment performed the construction. This project included construction of a limestone pond, a settling pond, and an aerobic wetland for treatment while using the existing iron terrace for pre-treatment. The design provides for at least a 90% percent reduction in the iron, aluminum and acidity pollution from this discharge.

TREATMENT SYSTEM

The source of this discharge or seep is an old underground mine on the northern portion of the site, which had a buried entry in the area of the discharge. The system included an iron terrace, a settling pond, a Flushable limestone bed and an aerobic wetland for treatment. An extensive perforated piping network was used below the top of the limestone layer and attached to an automatic inline water level control structure for automatic flushing purposes and a basic perforated piping network located near the bottom of the limestone layer was used and attached to an inline water level control structure for both normal outflow and flushing purposes. The water is then directed out of the FLB and into a settling pond where the metal precipitates are settled and retained. The final component of the passive treatment system is an aerobic wetland, which will help to settle and retain the metal precipitates. An inlet water level control structure was specified in the settling pond to control the water level and provide a means of draining the pond for any necessary maintenance.

An automatic inline water level control structure and perforated piping network was used to set the water level in the FLB and to flush the aluminum and iron precipitates to the settling pond. The automatic inline water level control structure allows the programming of the unit to periodically flush the FLB at specified frequency. The settling pond was constructed following the FLB for the purpose of metal precipitate removal. A baffle was utilized in the settling pond to reduce velocities of the incoming water and to encourage settling of the metal precipitates. An inlet water level control structure was utilized in the settling pond to allow for adjustment of the water elevation for adequate retention in the settling pond. The inlet structure also allows for dewatering of the pond for maintenance purposes (e.g., sludge removal). The outfall from the aerobic wetland serves as the final discharge that eventually leads down to the main-stem of Six Mile Run.

PROJECT RESULTS

The AMD discharge proposed for treatment in this project was historically a significant loading source of acidity, iron, and aluminum to Six Mile Run. This project resulted in the construction of a passive AMD treatment system that is expected to have a 90% percent reduction in the iron, aluminum and acidity pollution from this discharge. Initial testing of the system shows a projected reduction of 79.2 lbs/day, iron 20.4 lbs/day and aluminum 6.2 lbs/day that supports this expectation. The outcome of this project in conjunction with other funded projects along the main-stem of Six Mile Run in a downstream remediation approach should provide for significant restoration in the upstream half of Six Mile Run with regards to AMD degradation.

OPERATIONAL CHECKUPS

In order to ensure the proper operation of the passive treatment system for the SX0-D9 AMD discharges along Sandy Run, water quality samples and flow measurements must be collected and monitored at various locations within the system. The water quality sampling and flow measurement events must be conducted prior to any manual flushing events from the different treatment system components, as flushing events will impact the results. Water quality samples and flow measurements will be collected at the final system outfall at least once every six months to provide periodic snapshots of the operations and effectiveness of the passive treatment system. Other sampling locations shall be sampled based on the results to determine the source of any problems with the system.

Whenever possible, flow rates should be measured at all locations where water (AMD) enters and leaves each component of the passive treatment system. Understanding flow rates into and out of the limestone-containing pond may help to identify problems associated with hydraulic conductivity or permeability of the treatment material layers in the ponds. All flow measurement locations for the passive treatment system will be measured using the bucket and stopwatch approach, installation of weirs, or through visual estimation as a last resort. The flow measurements and water quality sampling will be conducted every six months at a minimum at the final system outfall and the other following locations on an as-needed basis.

Chemical samples may be collected at any of the discharges into the FLB out of the distribution pipe.

Flow and Water Chemistry Sampling Points:
1 -Inflow into the FLB (Flow must be estimated)
2 -Outlet of inline Water Level Control Structure
3 -Outlet of Inlet Water Level Control Structure
4 -Outlet of Settling Pond (Final System Discharge)

Water chemistry sampling shall include both field water quality measurements and water samples collected and sent for analysis to an off-site independent laboratory. Water samples collected and sent to an off-site independent laboratory for analysis shall be performed at least once per year or when field measurements warrant at the final system discharge and the other locations as needed. Laboratory analysis shall include the following parameters.

1. Total Iron
2. Total Aluminum
3. Total Manganese
4. Total Alkalinity
5. Hot Acidity
6. pH

Normally, the primary sampling location final system discharge should be tested for the above parameters, but additional parameters are recommended should laboratory results from a sampling event indicate problems with the treatment system.

In order to investigate the problem, dissolved metals analysis for both iron and aluminum may also be necessary at certain sampling locations. Sampling at different outfalls will aid in determining the source of the problem. For the dissolved iron and aluminum analyses, the water sample can be either filtered in the field and placed directly into a nitric acid preserved bottle (after filtering) or put on ice and sent to the laboratory unpreserved (no nitric acid) for filtering by the lab. If the FLB is not working properly, dissolved metals will persist through the system. This important information cannot be concluded from a total metals analysis.

In addition to the standard analyses performed at least twice a year at the final system discharge, other field analyses should be performed more frequently to closely track the system operation to serve as indicators for maintenance. Field kits and meters can be used to easily measure parameters at sampling locations for such things as acidity, alkalinity, total iron, and pH.

Since certain components of the treatment system may require somewhat frequent maintenance, as often as once every month for flushing the FLB, it would be advantageous to measure some of the parameters easily measured in the field such as pH at the system final discharge during each visit. However, it is important to note that water quality measurements should not be collected for an outfall of a pond during a flushing event of an upstream system component. Locations recommended for field-testing of water quality (at a minimum pH, acidity, and alkalinity) during more frequent maintenance activities, but at a minimum on a quarterly basis at the treatment system, should include the following.

Water Quality and Flow Sampling Points:
1 -Inflow into the FLB (Raw AMD Chemistry)
2 -Outlet of lnline Water Level Control Structure
3 -Outlet of Inlet Water Level Control Structure
4 -Outlet of Settling Pond Final System Discharge)

MAINTENANCE ACTIVITIES

Periodic maintenance must be performed to maintain the functionality and longevity of the passive treatment system for the SX0-D9 AMD discharge at the site. While certain components of the treatment system may require more frequent monitoring and maintenance, a basic outline is set forth in this document to provide guidelines for maintenance of the system components. Measured flow rates and water quality data collected from the site at the locations indicated will ultimately provide the best information necessary for performing maintenance activities on the treatment system. Each component of the passive treatment system is discussed below relative to potential maintenance activities and the estimated frequency associated with each activity. Following the component specific maintenance activities, general maintenance items associated with the treatment system are discussed.

Flushable Limestone Bed

The raw SX0-D9 AMD is collected in a piping system after flow over an iron terrace and flows directly into the FLB. The raw AMD is discharged into the southern end of the FLB from a PVC pipe that will require periodic cleanouts of built-up iron deposits. Cleanouts were installed in the pipeline. The water level in the FLB is controlled by an automatic inline water level control structure, which also serves as the normal outfall structure, and performs periodic flushes of the limestone bed based on a programmed schedule. Manually flushing the FLB is recommended every three months at a minimum. Removing all of the stop logs from lnline Water Level Control Structure for at least ten minutes can perform manual flushing of the FLB. Flushing the other perforated pipe system for an additional five minutes right after the ten-minute flush through the inline structure is also recommended. Prior to manually flushing the FLB, the water level in Settling Pond should be lowered by removing one stop log from Inlet Water Level Control Structure located at the end of the Aerobic Wetland. This will allow Settling Pond and the aerobic wetland to drain. When the water level reaches the level of the remaining stop logs, the stop log that was removed can be replaced to provide storage and retention of the flushed water from the FLB for settling the metal precipitates. It is imperative to rely on monitoring of the outfall water quality and visual observations of accumulated material on the limestone layer in the FLB to determine when the limestone layer needs to be stirred. Finally, if after manually flushing the FLB the AMD is not being treated adequately (minimum outfall pH between 5.0 and 6.0) or if visual observations of the top surface of limestone indicate short-circuiting of water across the top due to accumulated ferric iron precipitates or due to debris on the surface, then arrangements should be made to remove any accumulated material and stir up the limestone layer to maximize permeability. The limestone should be stirred with a piece of heavy equipment such as a backhoe, making sure to not damage the perforated piping networks near the bottom of the limestone layer. The water level in the FLB may need to be lowered to perform the maintenance to keep the water level at or just below the portion to be stirred.

Settling Pond receives the outfall from inline Water Level Control Structures that continuously discharges water from the FLB. Water from Settling Pond flows into the aerobic wetland. Each time a site visit is conducted for maintenance, which is every three months at a minimum for other components of the treatment system, inline Water Level Control Structure should be inspected for ease of operation, ensuring that it has not stopped operating. It is important to have storage volume available in the Settling Pond prior to a manual flush event from the FLB to allow the settling and retention of the flushed precipitates. Removing at least one stop log from Inlet Water Level Control Structure, located at the discharge end of the aerobic wetland, will lower the water level in the settling pond to provide the necessary storage. The stop log should be replaced when the flow is approximately equivalent to the normal inflow to allow adequate storage for flushing from the FLB.

Sludge accumulation within the Settling Pond is dependent on the treatment efficiency of the FLB and the flow rates entering the pond. However, the sludge levels in the bottom of the pond should be measured and assessed every two years at a minimum. Once the sludge levels accumulate to more than one foot at any location within the pond, a sludge clean-out event should be performed. Depending on the method used for sludge cleanout, dewatering most or all of the water from the pond may be accomplished by either removing most of the stop logs from the Inlet Structure or pumping water from the pond. The inflow from the FLB should also be temporarily routed around the pond. Methods of sludge removal include the use of a vacuum truck, pumping and dewatering the sludge material in a geomembrane textile bag, or completely dewatering the pond and using heavy equipment with a bucket to remove the material and place it in a pile on the site for drying before hauling off-site. Upon removal of the sludge material, the inflow from the FLB may be directed back into the pond.

Aerobic Wetland

The discharge from the Settling Pond enters the aerobic wetland at the southeastern end of the wetland. The water level in the aerobic wetland is controlled by the Inlet Structure, which also serves as the normal outfall structure. Lowering the water level of the aerobic wetland can be accomplished by removing all of the stop logs from Inlet Water Level Control Structure if maintenance is necessary. It is imperative to rely on monitoring of outfall water quality and visual observations to determine the overall function of the upstream portion of the system. Finally, if the AMD is not being treated adequately at this stage of the treatment system (minimum outfall pH between 5.0 and 6.0), a total assessment of the system is warranted.

GENERAL SITE MAINTENANCE RECOMMENDATIONS

In addition to the maintenance needs for each unit within the passive AMO treatment system, other components do require some basic inspection and infrequent maintenance work. These items, including the rock-lined spillways and the rip-rap outlet protections at each pipe outfall, should be inspected every six months at a minimum and after major rainfall events. Pipe openings should be cleaned as needed to ensure that they are kept unobstructed and allow water to flow freely. All constructed berms/embankments involved with the treatment ponds should be inspected at least twice a year to monitor for potential failure caused by excessive flows, surface erosion, or animal activities. Any areas experiencing significant erosion should be immediately re-graded and stabilized with seed and mulch. Embankments should be kept free of woody vegetation.

REPLACEMENT OF TREATMENT COMPONENTS/MATERIALS

The treatment cells containing limestone are designed to provide adequate treatment for 20 to 25 years. After 20 to 25 years of operation, the limestone contents of the treatment cells must be replenished. However, care must be taken to avoid damaging the piping networks in the bottom of the limestone beds. Once the contents of the treatment cells have been replenished to original volumes, they should provide adequate treatment for another 20 to 25 years. Limestone replacement will consist of approximately 2,600 tons of limestone (greater than 80% CaC03) placed in a 4-foot-thick bed. Additionally, any system components (water level control structures, stop logs, pipes, etc.) that wear out or fail should be replaced immediately. The annual O&M cost utilizing Township personnel & equipment are estimated to be approximately $2,000 for routine maintenance. This cost can increase significantly for non-routine issues i.e. stirring, sludge removal & limestone replacement.