

Mitchell Self-Flushing System Operation and Maintenance Manual

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for the Babb Creek Watershed Association

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System Description

This treatment system consists of two deep mine discharge collection systems, a transfer pipe, a flow splitting box, a concrete limestone tank, a self-flushing dosing siphon in a concrete tank, and a settling pond. Mine water is collected by perforated pipes placed in non-reactive aggregate. The "M1" and "M2" discharges from the Mitchell mines were collected. Both discharges were equipped with emergency overflow pipes. A maximum of 300-500 gpm is collected and transferred to the treatment location via a buried pipe. Cleanouts were placed in the pipe at 400 – 500 foot intervals.

The pipeline enters a flow splitting box. A debris screen in the splitter box (closest to the inlet pipe) is designed to remove any debris that enters the pipeline. The flow limiting screen (closest to the 4" outlet pipes) currently limits the total flow to the limestone tank to about 40 gpm. The rest of the flow discharges from the box to the stream via an overflow pipe. This splitter box is equipped with three additional 4" diameter outlet pipes. These pipes are intended to feed additional limestone cells that could be constructed in the future.

The splitter box discharges to an 8 ft tall, 50 ft diameter concrete tank that contains high-quality AASHTO #1 limestone (95% CaCO₃ limestone from Con-Stone, Centre County, PA). The tank is equipped with a network of plumbing on the bottom that consists of 6 in laterals and an 18 in header pipe. This header pipe leads to an 10 ft tall concrete vault that contains a self-flushing siphon unit (Fluid Dynamics Siphons, Inc., Steamboat Springs, CO). This siphon unit allows the water in the limestone to build up to within 6" of the top of the tank before rapidly discharging all of the water in the tank in a 15-minute period. The high water velocities during the flush are intended to remove solids that are formed in the limestone through its reaction with acidic, Al-contaminated water. The siphon tank is equipped with a float counter, which indicates how many times the siphon has flushed.

The siphon discharges approximately 48,000 gallons of water at about 3,000 gpm of treated water via a buried pipe to a sediment pond. The sediment pond is equipped with an energy dissipater, a submerged internal berm, and an outlet channel to the unnamed tributary to Wilson Run.

Inspections

It is important to inspect the treatment system regularly in order to ensure that it continues to function properly. For the first year, the system should be inspected monthly and after any severe precipitation events.

An inspection form is attached to this plan. This form can be used as-is or adapted for use by the inspection personnel. Record the date, time, and inspector's name. Record the flush counter reading. Measure and record the pH and alkalinity of the water leaving the settling pond. Note whether or not the flow splitter box has an overflow.

Use the "Notes" column to record any other relevant information about the site, such as signs of vandalism, sample numbers if lab samples are taken, or other information.

The following table summarizes the areas that should be inspected and what to look for at each location.

Location	What To Look For
Mine discharges	Are the emergency overflow pipes clear of leaves and debris? Are the dams leaking or sloughing?
Splitter Box	Are the debris screen, orifice plate, and overflow pipe clear of debris? Remove and clear them if necessary. Is the box overflowing or is all the water being treated?
Siphon Tank	Read and record the number of flushes from the flush counter. Has the siphon been flushing regularly?
Settling Pond	What is the condition of the berms, the rock energy dissipater, and the outlet channel?

By reading the flush counter each time, the time between flushes can be calculated. For instance, if two inspections are performed exactly 30 days apart, and the counter reads 50 during the first inspection and 92 at the second inspection, the counter has flushed 42 times in 30 days, or about once every 17 hours.

Sampling

Because this system is based on an innovative design, monitoring its performance is important. If the system provides good, reliable treatment, it is possible that additional self-flushing cells will be built on the site to treat more of the discharge water.

At a minimum, the pH and alkalinity of the water leaving the settling pond should be measured and recorded during each visit. This data should be recorded on the inspection form along with the flush counter reading. This will allow for later analysis of how the system is performing over time.

The collection of water samples for the analysis of AMD parameters will contribute to the evaluation of this innovative technology and assist in decisions regarding the construction of more treatment at the Mitchell site. Water sampling should include the system influent (sampled from the splitter box), the flushed water, and the water discharging from the settling pond. Samples should be analyzed for pH, alkalinity, acidity, Fe, Mn, Al, sulfate, and total suspended solids. In order to better evaluate the performance of the flush system and the settling pond, dissolved and total metal concentrations should be measured. The distinction is made by filtering a raw sample before acidification, in the field or very soon after delivery to the laboratory.

Troubleshooting

The following table describes how to recognize, diagnose, and fix potential problems with the treatment system.

Problem	Potential Cause	Solution
Water is not reaching the splitter box	The pipeline is clogged	Clean the pipe at the installed clean-out locations.
	The mine collection dam has failed	Re-construct the collection dam
The siphon is flushing too frequently (pH and alkalinity are not acceptable)	The flow rate into the limestone is too high.	Partially block the flow limiting screen, or plug that hole and drill a smaller one.
The siphon is not flushing frequently enough	The flow rate into the limestone is too low	Drill the hole in the flow limiting screen larger, or drill a second hole.
The siphon isn't flushing (there is a continuous flow through siphon or into the siphon overflow)	Various problems that are difficult to diagnose	Call Hedin Environmental for assistance, 412-571-2204
System performance (pH, alkalinity) declines over time	Limestone is being dissolved	Add more limestone to replace the limestone that has dissolved
	Limestone is being coated	"Stir" limestone in tank with an excavator or remove and replace with new limestone
	Limestone is becoming plugged	"Stir" limestone in tank with an excavator or remove and replace with new limestone

