

Sand/Iron Filter - 'Minnesota Filter' Game Farm Road in Minnetrista



Summary

Reducing phosphorus loads in our water resources is among the top goals of water quality professionals nationwide. For the past few decades, phosphorus has primarily been combated with stormwater ponds, which allow phosphorus particles to settle to the bottom of a pond before the water enters a lake or stream.



But particulate phosphorus is only part of the picture. There is also the phosphorus that has already dissolved, which can make up as much as 90 percent of a water body's phosphorus loads and which stormwater ponds are ineffective at treating. Over the years, stormwater professionals — led by the University of Minnesota's St. Anthony Falls Lab — have discovered that iron filings embedded in a sand filter can react with dissolved phosphorus and remove it from the water.

The Minnehaha Creek Watershed District is taking the idea a step further and is now constructing an innovative offline sand/iron filter adjacent to a stream channel that drains into Minnetrista's Dutch Lake, which has high nutrient loads.



Outcomes:

The modeling for the District's project in Minnetrista shows that it should remove an estimated 25 to 30 lbs/ year of phosphorus and reduce the load to Dutch Lake, which is listed as impaired for its nutrient load.

MCWD staff has conducted three years of pre-construction sampling and will be continuing this monitoring for an additional three years to find the effectiveness of the project. Anyone interested in the results can contact us for more information.

Project Design and Location

The filter will be operational by Spring 2012 and sits just north of Game Farm Road in Minnetrista. The filter is comprised of two separate 20 foot wide rectangular basins: one 80 feet long and the other 160 feet long. It will be placed parallel to a stream that connects two large wetland complexes. During high flows, the inlet will take on the high water at the north end and connect it to the two large filtration cells, then return the water back to the stream channel via a pipe outlet.

The filters are a mix of sand and iron, with about 7 percent iron for this project. The basins will have a six inch clay base and an additional six inches of clay for the ground profile to contain the media. Riparian buffers will also be established to reduce erosion within the project area.



Performance and Maintenance

As the iron rusts, dissolved phosphorus binds to the oxides by surface absorption. For this to be effective, the system cannot be permanently inundated. The system is gravity fed and is designed to drain in between storm events. Tests on sand/iron filters show that they can remove between 30 and 90 percent of dissolved phosphorus, and is typically greater than 50 percent. Maintenance requirements for this type of system vary, but this particular project is designed to allow for simple access to filter media for easy replacement, in addition to the construction of a permanent easement road creating a convenient entry point to access the system.

Sources:

Erickson, A.J.; Gulliver, J.S. and Weiss, P.T. "Removing Dissolved Phosphorus from Stormwater." 12th International Conference on Urban Drainage, Porto Alegre/Brazil. Pages 10-15, September 2011.

Erickson, Andrew J. and Gulliver, John S. "Performance Assessment of an Iron-Enhanced Sand Filtration Trench for Capturing Dissolved Phosphorus." St. Anthony Falls Laboratory, University of Minnesota: Engineering, Environmental and Geophysical Fluid Dynamics. Project Report No. 549, November 2011.