

Water Quality Concern for Kalamazoo River Tributary Streambed Restoration



View of ponds from the top of container based water treatment and clarification system.

On Monday, July 26, 2010, Enbridge Energy Partners LLP reported that a 30-inch pipeline ruptured near Marshall, Michigan. An estimated 819,000 gallons of crude oil entered Talmadge Creek and flowed into the Kalamazoo River, a Lake Michigan tributary. Heavy rains during the three days preceding the

spill resulted in flooding and caused the river to overtop existing dams and carried oil 30 miles downstream on the Kalamazoo River. The tributary was restored in sections by bypassing the flow and excavating and completely replacing the streambed with the same gradation of granular sediment and in the same meander pattern as

the original.

In early 2012, the environmental streambed restoration project had reached a critical point as the threat from flooding from rain and melting snow could compromise water quality. In order to continue efforts, a segment of a Kalamazoo River tributary, directly upstream from the

confluence, needed to be bypassed and the water treated to reduce the turbidity from the restoration efforts. Initial testing conducted by Applied Polymer Systems of Woodstock, GA showed that turbidity levels were around 11,000 NTU. The contractor estimated that approximately 130 million gallons of water were in need of treatment.

The Water Treatment System

A treatment plan was needed that would allow the restoration effort to continue by removing suspended solids from the bypass flow and from the water used to flush clean the new streambed material. Interface H2O was brought in and members, James Smits, Dennis Gebben and Nick

flows from the mix area to the settling area. The settling area slows the water and allows the heavier particles and floc to settle to the bottom of the container where much of it is captured. From the settling area water and unsettled flocculent flows to the large capture area. In the larger capture area vertical jute nets capture the remaining flocculated materials allowing the treated clear water to discharge from the tank system.

Floc Hogs are inline polymer introduction systems. They are inserted on the pressure, or discharge side, of dewatering pumping systems and provide the initial dosage of polymer to start the flocculation process while the water is being pumped. These systems

was required to handle routine pumping as well as flood stage pumping. It was estimated that routine pumping would be approximately 1500 GPM and flood stage pumping could reach 6000 GPM.

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Water Matrix setup next to pond #1 with first bank of Floc Hogs.

Reale met with the project's contractor and formulated a plan that integrated the use of APS Polymers, settling ponds, and Interface H2O's WaterMatrix and Floc Hog systems.

The WaterMatrix is a large container based water treatment and clarification system that includes three distinct modules in the tankage, a mix area, a settling area and a capture area. The mix area is used to provide the turbulence and contact time with the polymers necessary to start the initial flocculation of the suspended solids. Water

contain a specialized internal design which creates maximum turbulence and mixing around the polymer logs. This allows the flocculation process to start while under the pump pressure and utilizes the pressure hoses to "pre-mix" the flocculent into the water stream. When used in conjunction with the WaterMatrix, a higher polymer injection rate is achieved allowing the system to treat a higher rate of flow.

Preparing for Flood Stage

In this project, the treatment design

During routine pumping, (1500 GPM) flocculent capture could be achieved utilizing the designed system. During flood stage pumping, (6000 GPM), the systems would need to be followed by two settlement ponds for flocculent capture and contingency storage capacity prior to discharging the bypass stream water to the Kalamazoo River.

The site contractor provided all pumping and water delivery designs and equipment for the systems. The water was pumped nearly 2200 feet from the Kalamazoo tributary to the treatment area using 18" pumps and pipes. Treated water was discharged to the Kalamazoo River from

the second settlement pond utilizing another 18" pump.

Interface H2O provided a conceptual design plan for two settlement ponds, each 0.8 acres and operating depths of 3 feet (aprox. 750,000 gallons each). Each settlement pond was designed to slow water flow rate to maximize flocculent settling and capture. In the narrow conveyance connecting the two ponds, jute net capture devices were installed to enhance flocculent capture during flood stage pumping.

Next, the Water Matrix was put in

WATER QUALITY

place at the head of the first settlement pond where it directly discharged. The container was supplied by four 4" lines, each containing two Floc Hogs in series. They were separated by 100' of 4" hose and were connected to an inflow manifold which in turn was connected to the 18" inflow pipe supplied by the contractor. This system could effectively treat the routine pumping rate of 1500 GPM.

For flood stage pumping, an additional eight 4" lines were provided from the inflow manifold. Each line had two Floc Hogs in series separated by 100' of 4" hose. These discharged directly into the first settlement pond. A series of valves served to open or close these flood control lines as needed.

Each introduction system contained 40 lbs of APS 703D#3 polymer logs and could handle a maximum flow rate of 500 GPM per line. This provided for 80 lbs of polymer per line with additional polymer added to the mix tank as needed. The estimated upper-end job completion time was 60 days, pumping 24/7. An estimated 1000 APS 703D#3 polymer logs would be used.



Floc Hogs installed with 100' of hose between banks.

Water Quality Achieved

Within 3 days of Interface H2O arriving on-site, water was pumping and being treated. In the following week, rain, snow and the subsequent melting of snow required flood stage pumping to start im-

mediately and continue until project completion. Due to deteriorating weather conditions, the contractor accelerated the stream restoration effort and completed it in 20 days. The project was in compliance throughout.



4 lines opened for flood control.

Initial reduction was dramatic. Suspended solids capture was successful using the container based water treatment and clarification system, the settling ponds, and the jute lined conveyance connecting the ponds. Water discharged from the second

settlement pond to the Kalamazoo River remained in compliance with EPA requirements.

After nearly two years of restoration work in both the Kalamazoo River and tributary, the oil spill cleanup is nearing

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completion and sections of the river are reopening to the public. Monitoring the results of this cleanup is just beginning and will most likely continue for years. **L&W**

by Nick Reale

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