



The Blackstone River flows through what was the heart of the American industrial revolution. Its banks were lined with impoundments, canals and water-powered mills. The Fisherville Canal Restorer is located downstream of long active mill site with a complicated but telling history.

The Fisherville Mill site had been in operation since the 1830s and its history tells the story of manufacturing in America. The mill, producing first cotton textiles, later tool and die, and finally

lawn furniture and foam rubber, closed its doors in 1986. In 1999 a huge fire burned it to the ground and left behind toxic rubble on top of an already degraded environment. The site underwent a five-year clean-up effort where much of these materials, including two 20,000 gallon underground oil storage tanks, were removed.



Oil sheen on water's surface



View down the Fisherville canal

What could not be removed was a heavily degraded canal choked with legacy contaminants and canal banks containing high levels of Bunker C. Crude oil, which leaches into the canal with each rain storm. In 2006 an extensive interagency and inter-discipline coalition contacted John Todd Ecological Design to see if a version of our restorer technology could be a solution. The restorer is an in-situ remediation approach developed over many years and has been used to bring back to health canals heavily loaded by sewage and ponds choked by excess nutrients. While JTED has experience treating many tricky contaminants, high-strength wastes, pesticides like DDT and pharmaceuticals, the tar-like bunker C oil was a new challenge.

A pilot study beginning in 2006 added to our ecological treatment train cells of mycelium known for their capacity to break down petroleum hydro-carbons. After a year of data collection where we saw a reduction of 60-to-90 percent in total petroleum hydrocarbon concentrations, we knew enough to begin our scale design.

The Fisherville Canal Restorer is a hybrid of in-stream and side-stream technologies. Taken together they create a powerful circulating loop of healthy ecology, a stream within the stream in which water is purified and the canal is re-seeded with healthy ecology. The system consists of four powerful stages of treatment.

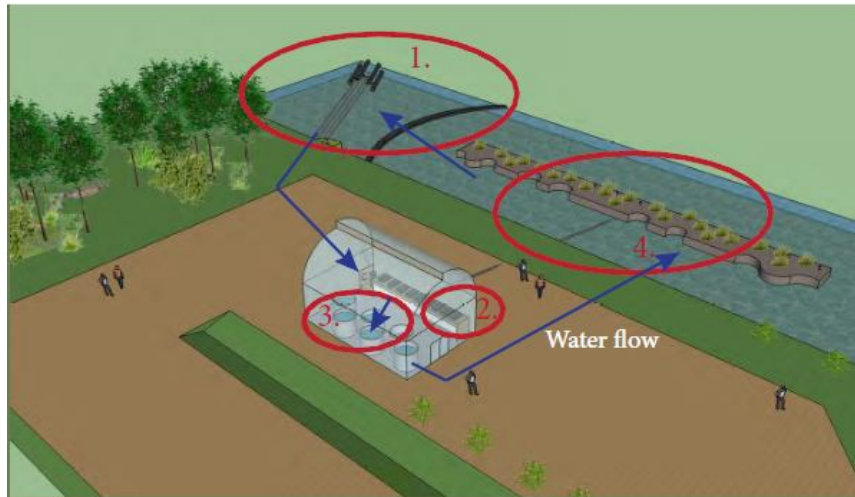


Diagram of flow through the system

Stage One - Sediment Digesters: micro-biologically colonized gravel filters sit beneath a blanket of sediment and draw contaminated water up into the greenhouse. In these filters the oil is heavily concentrated and its biological brake-down begins.

Stage Two - Myco-Reactors: Sediment digested water is trickled through a wood chip media housing mycelium, the web-like tissue of mushroom forming fungi. The myco-reactors contain fungal species known to secrete enzymes capable of breaking down petroleum hydrocarbons and effective at removing other contaminants as well. Enzymes collect in the water passing through the system and are then pumped into the next stage of treatment.



Aquatic cells and Myco-Reactors inside of greenhouse

Stage three - Aquatic Cells: A series of six vertical tanks housing a diversity of algae, bacteria, protozoa, zoo plankton, snails, and fishes. Shrubs and emergent plants grown from racks floating within these tanks. Water passing through this system comes into prolonged contact with these living communities and is purified, aerated, and seeded with living organisms before it is discharged to the final stage.

Stage Four - Floating Restorer: A thick planted floating raft. Water from the greenhouse is discharged here through a series of sprinkler nozzles and flows through fruiting mushrooms and root zones before re-entering the canal. The floating restorer creates a pocket of clean oxygen and life rich water and attracts a high concentration of insect life, minnows, carp, snapping turtles, painted turtles, and frogs.



Lush growth on Canal Restorer

The overall purpose of the Eco-machine is to provide large numbers of beneficial organisms to the canal on a year round basis. It functions as an ecological incubator providing a sufficient density of life forms from the various kingdoms of life to digest the oils and transform the ecology of the canal to a healthier state. Water from the Grafton Eco-Machine™ flows back to the Restorer zone in the canal. The concept of an ecological incubator is new and quite radical, but its potential for water quality improvement is very real.

During the system's first year of operation a reduction of petroleum hydrocarbons in excess of 95 percent was seen through-out the system.

Today we are eager to build on this success and expand the project to begin restoring impoundments and degraded water along the entire length of the Blackstone River and its adjoining canals. We are seeking partners and support to help in this mission and have begun joining with local universities to create an educational consortium capable of sustaining and learning from this important work.