

Hockley Hills Trout Stream Relocation and Natural Channel Design

Road widening in rural areas often involves impacts to streams. A government stimulus project in a rural township in southern Ontario sought to widen an existing road and replace a failing bridge. A high quality stream was located parallel to the road but had poorly developed habitat and channel characteristics due to road maintenance impacts. As part of compensation requirements, the stream was moved away from the road and into a nearby field, located on private property. This provided sufficient room for a “natural” channel design that would align stream flows to the new bridge and provide in-stream habitat to support a native Brook Trout population.

The natural channel design was based on geomorphic characteristics and stream channel dimensions produced from on-site assessments and GIS based analyses. The stream was designed to duplicate existing unaltered headwater streams located nearby (left photo). The design channel included various habitat structures including Engineered Rock Riffles, Log Revetment Angle-Slams, and undercut banks based on modified design structures originally developed by Dave Derrick. The “new” channel created more in-stream habitat than the one it replaced due to the greater amount of meandering, increasing channel length, and in-stream structures. The design channel was constructed in one-week and can be seen below (right photo). Riparian restoration was also completed using native vegetation. The design plan, structure drawings, and additional photos of completed habitat structures are also shown on the next page.



Left photo shows pre-construction condition and existing streams with channel along road (red line); Right photo shows meandering natural stream channel as completed.

PORCUPINE RUN FISH PASSAGE CULVERTS, VENANGO COUNTY, PA

RedHorse Environmental designed, permitted, and installed six oversized aquatic organism passage (AOP) culverts (squash pipes) on tributaries to Porcupine Run near President, PA in 2015. The project was completed with cooperation from PADEP, the Venango County Conservation District, and private timber companies. The project was funded with a PA Growing Greener grant and the culverts were installed by K & M Resources.

The new culverts were designed and installed to facilitate the formation of stable native substrate in the bottom of the pipe to reduce flow velocities and enhance channel roughness. Natural stream channel substrates inside the culvert permits aquatic organism movement through the oversized culvert into upstream reaches. This is extremely important to allow fish, particularly trout, to utilize headwaters for successful spawning and reproduction.

In-stream channel enhancements (grade controls, bank stabilization, flow deflectors) were installed in channel above or below the pipes to provide reduced flow velocities and stabilize bank and channel conditions where warranted. Riparian enhancements and native plantings were also completed.



**Squash Pipe Installed on Knights Run
Supporting Fish Passage**



Typical Blocked Culvert Condition



AOP Culvert Placement in Stream



**Interior of Squash Pipe Showing
Stream Bed Development.**

Trout Run Streambank Stabilization Project, Erie County, PA

RedHorse Environmental designed, permitted, and constructed a longitudinal-peaked-stone-toe-protection (LPSTP) bioengineering structure on Trout Run in Fairview Township, Erie County. The structure addressed a stream bank failure occurring on Trout Run adjacent to the Fairview Area Historical Society on Avonia Road in Fairview.

RedHorse Environmental developed the design of the 130' LPSTP and secured the required permits from PADEP. The project site had very limited access that made the build challenging. Construction and restoration plantings were completed in September 2017 by K & M Resources and RedHorse Environmental.

RedHorse Environmental worked with the Fairview Area Historical Society and K & M Resources to avoid unnecessary impacts to their residential property and restore areas adjacent to the stream following construction. All work was completed without entering the stream channel



Trout Run prior to LPSTP installation
(bank failure to right of stream channel)



Constructed LPSTP
looking upstream

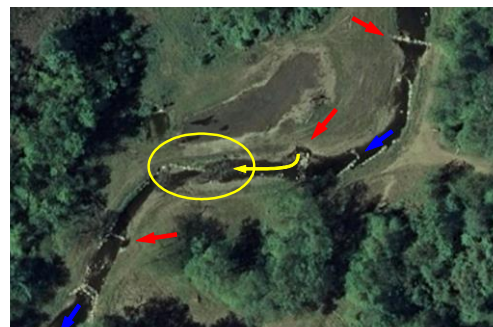


Constructed LPSTP

NINE MILE RUN STREAM RESTORATION

Nine Mile Run (Frick Park, Pittsburgh, PA) has undergone a major transformation following completion of a \$7.5 M restoration in July 2006 that included relocating the channel and the addition of structures to improve aquatic habitat and channel stability. The major features of the natural channel design were two channel realignments with C4 geometry and Rosgen based structures used to create a step-pool configuration throughout much of the length of Nine Mile Run. An audit of in-stream structures was conducted by Dr. Bruce Dickson on August 18, 2007 and revealed that thirty-three (33) of fifty-one (51) in-stream structures were compromised (65%) and no longer functioning as originally designed. Structure failure was primarily caused by flanking, undermining, and bedload deposition and could be observed on satellite imagery (top right). Additionally, of the fifty-one (51) structures assessed, twenty-seven (27) were identified as impassable to fish.

An emergency retrofit plan to stabilize the stream channel and address many of the documented problems was developed with Dave Derrick of USACE and saw the removal, replacement, or reconstruction of critically failing structures and enhancements to structures that were at risk of failure (completed over eight days in September 2007). Many failing structures (right photos) were replaced by Ecorestoration Inc. with engineered rock riffles (bottom left) allowing fish passage and keys were extended and planted with live poles where possible. Nine Mile Run remains in a dynamic state and is far from being geomorphically stable. The stakeholders involved in this project must recognize that they are in the very early stages of a long-term restoration project that will require constant reassessments, maintenance, and adaptive management to be sustainable. Removal of remaining fish barriers and modifications to failing structures not completed in September 2007, additional vegetative plantings, and annual geomorphically-based monitoring will continue until all structures are stable and allow fish passage.



Failures as seen in Google Earth



Dave Derrick at Cross Vane Fish Barrier



Typical Flanked Structure



Root Wads Causing Bank Failure



For additional information contact Dr. Bruce Dickson at 814-806-6073 or bdickson@redhorseenvironmental.com

In-Stream Habitat Enhancement, Stouffville, Ontario

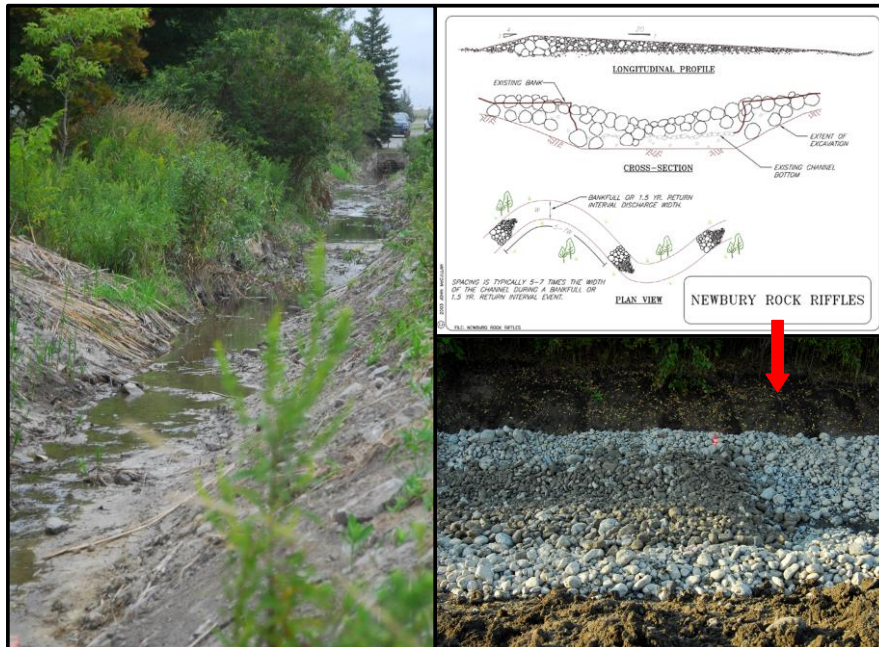
Unauthorized in-stream works conducted on a small stream required a habitat enhancement as part of compensation agreements with the Ontario Ministry of Natural Resources. Because the tributary had been previously realigned and channelized site enhancement opportunities were extremely limited (see photo left below). Habitat enhancement was achieved through the introduction of three riffle-pool pairs placed in the approximately 130 m restoration reach. Following construction of a stable channel base three Newbury-style rock riffle structures (see photos below) were constructed within the channel to create the riffle-pool habitat pairs. Riverstone was used to create the riffles and random boulders were placed in the channel to further supplement habitat. Flow modeling was conducted to ensure that the habitat enhancements would not restrict storm flow through the channel thereby protecting upstream locations from flooding. Bank seeding with native grasses and plantings of containerized native willows along the stream margin were completed to stabilize adjacent banks and provide shade and carbon inputs. Photos at right show the channel with the Newbury structures under construction and the project at completion.



Newbury Rock Riffles Under Construction



Finished Channel



For additional information contact
Dr. Bruce Dickson at 814-806-6073 or
bdickson@redhorseenvironmental.com

ALLEGHENY NATIONAL FOREST FISH PASSAGE CULVERTS, LUDLOW, PA

RedHorse Environmental, in cooperation with the Western Pennsylvania Conservancy, US Forest Service, and National Fuel Gas, managed the installation of eight oversized AOP culverts on tributaries to the East Branch of Tionesta Creek south of Ludlow (PA) in Allegheny National Forest. The new culverts (squash pipes and arch plates) replaced undersized pipes on Forest Service and gas company roads that restricted fish passage from the East Branch of Tionesta Creek into tributaries that sustain reproducing Brook Trout populations.

The new culverts were designed and installed to facilitate the formation of stable native substrate in the bottom of the pipe to reduce flow velocities and enhance channel roughness. Natural stream channel substrates inside the culvert permits aquatic organism movement through the oversized culvert into upstream reaches.

In-stream channel enhancements (grade controls, bank stabilization, flow deflectors) were installed in channel below and above the pipes to provide reduced flow velocities and stabilize bank and channel conditions. Riparian enhancements and native plantings were also completed.



For additional information contact Dr. Bruce Dickson at 814-806-6073 or
bdickson@redhorseenvironmental.com