Why Natural Channel Design Projects are Incompatible With Natural Resource Protection and the Preservation of Native Biodiversity

Alexandria Federation of Civic Associations (AFCA)

October 28, 2020

Rod Simmons

Upper Watts Branch Forest Preserve, City of Rockville, Maryland. Photo by City of Rockville.

"**Wrong Approach for Stream Restoration**“ [Letter to Editor]

The biggest problem with the so-called natural channel design approach to stream "restoration" for us in the greater Washington, D.C. region is that it is planned and implemented in completely the wrong places: small order, interior forested, upper headwater streams and wetlands. Natural channel design (Rosgen method) is mainly applicable to large order streams and rivers, especially the kinds one finds in the American west. Applying it to small order, upper headwater stream channels of the deeply dissected Fall Zone of our area is a misuse of the methodology, a misunderstanding of eastern Fall Zone hydrology and stream geomorphology, a sure recipe for failure, a mismanagement of public funds by inappropriately targeting sediment-control projects in places with low levels of the very nutrients for which funding is based, and an unacceptable loss of irreplaceable native forest, wildlife, and landscape memory…

Rod Simmons, Environmental Scientist and Ecological Restoration Specialist
John Field, PhD, Stream Restoration Specialist and Fluvial Geomorphologist
Tony Fleming, Hydrogeologist
Barbara Southworth, Environmental Science and Policy Specialist
Greg Zell, Natural Resource Specialist
Edd Barrows, PhD, Georgetown University Biology Professor
Andrew Macdonald, PhD, Geologist and Environmental Council of Alexandria Chair
Laura Anderko, PhD, Georgetown University Professor, Health Studies and Climate Change
Jim Long, PhD, Physicist and past president of the Mattawoman Watershed Society
Ken Bawer, Watts Branch Watershed Alliance, Vice President

Serious concerns with the stream restoration industry

'I helped lead the effort in developing the *Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects* with Tom Schueler of the Chesapeake Stormwater Network… I can no longer hide from the turmoil that I helped to create in the stream restoration industry… This action unleashed an unprecedented flurry of stream restoration projects identified in Watershed Implementation Plans and MS4 implementation plans across the Bay watershed which are now being implemented by a thriving billion-dollar stream restoration industry comprised of engineers, hydro-geomorphologists and a few biologists. I forgot to mention big-time financiers. Also, take notice of what I said about "few biologists"…

A severe training need exists among local and state governments, NGOs and practitioners in understanding their application and the appropriate siting of projects. Also, the Expert Panel felt strongly that as a qualifying condition to receive credit, projects have to be part of a comprehensive watershed plan that also addresses the root causes of stream bank erosion: impervious cover. Further, stream restoration projects are supposed to demonstrate "functional lift" or improvement to the ecosystem. Generally, this is not happening at least not to the extent that it should. Few biologists or ecologists are asked to participate in the design of stream restoration projects. As a result, municipalities are spending enormous amounts of money on projects that generate the necessary water quality credit but have no real impact on stream function… I am not sure what it will take to make these projects part of an integrated watershed plan to provide functional lift beyond the sediment and nutrient credits. Perhaps this will come after we spend billions of dollars on these projects and the taxpayers ask "why can't I catch fish in this stream?" '

- Bill Stack, Professional Engineer and Center for Watershed Protection Deputy Director of Programs

The main trail along the south bank of Taylor Run at Chinquapin Park through stands of old-age trees and along non-alluvial forested wetlands in “Chinquapin Hollow” is a designated Alexandria Heritage Trail.

The denuded, post-construction footprint of a recently completed natural channel design (NCD) stream construction project along the north braid of the west branch of Turkeycock Run at Mason District Park in Fairfax County, Virginia. NCD projects are highly destructive to forest communities and wetlands because they require extensive clearing of canopy trees and forest along the stream banks as staging areas and to create artificial floodplains and stream channels.

Tree removal negatively impacts water quality

•Groundwater sampling studies of 5 Maryland streams (Campus Creek, Minebank Run, Paint Branch, Scotts Level Branch, and Stony Run) showed that concentrations of nitrogen (N) and other nutrients were elevated in ground water in sites where trees were removed.

•Concentrations of nutrients in groundwater decrease downslope in riparian zones with trees, but increase downslope in riparian zones where trees were removed.

Other studies have shown increased nutrient concentrations after tree removal in watersheds:

•Löfgrenet al. (2009)
  –Increased concentrations of Na, K, N, Cl, etc.
•Martin and Pierce (1980)
  –Increased concentrations of Ca and N.
•Rusanenet. al. (2004)
  –Increased concentrations of N.
•Likens et al. (1970)
  –Increased concentrations of N, Ca, K, Na, Mg, etc.
•Hewlett et al. (1984)
  –Increased concentrations of N, K, Na, Ca, Mg, etc.
•Feller and Kimmins(1984)
  –Increased concentrations of N, K, Mg, Ca, etc.

Source: Sujay S. Kaushal et al. 2018. Tree Trade-offs in Stream Restoration Projects: Impact on Riparian Groundwater Quality.

Unintended consequences of the Clean Water Act

"While the Clean Water Act has accomplished many great things and benefited society, of late it has driven some unintended negative consequences by inducing inappropriate stream restoration projects. The driving force behind most geomorphic stream restoration projects in the Chesapeake Bay Watershed in recent years is local jurisdictions seeking to find ways to meet Clean Water Act requirements focused on reducing nutrient and sediment loads - principally Chesapeake Bay and individual river/stream Total Maximum Daily Load (TMDL) requirements, but also Municipal Separate Storm Sewer Systems (MS4) permits. TMDLs for sediment are set based upon what is necessary to reduce phosphorus loading because phosphorus is transported to the Bay in large quantities adsorbed to sediments.

Managing excess phosphorus (P) delivery is probably the greatest concern. The most important measures to curb excess phosphorus sediments are by improved agricultural practices, sanitary sewer rehabilitation, and better urban stormwater runoff management. So-called stream restoration projects, however, do not actually target phosphorus-rich deposits.

The stream bank and channel sediments that geomorphic projects prevent from eroding can be rich in phosphorus if they consist of recent erosion of topsoil (i.e., through inadequate silt fencing around soil disturbance of cropland), erosion of floodplain overbank deposits, and the like. Conversely, eroding geologic materials in upper headwater streams typically have minimal phosphorus in them compared to mid and lower stream reaches that contain floodplain sediments. Yet, headwater streams are often targets for geomorphic restoration work because substantial erosion can occur there."[1]

[1]Simmons, R.H. 2020. A Review of Little Hunting Creek Watershed, Paul Spring Segments 1 & 2 (Brickelmaier Park and Goodman Park), Hollin Hills Stream Restoration 100% Plans.

Most so-called stream restoration projects do not target phosphorus-rich deposits

Mehlich-3 P test	ppm (parts per million)
Very Low	0-15
Low	16-20
Optimum	21-25
High	26-30
Very High	31+

Source: "Interpreting results of the Mehlich-3 ICP Soil Phosphorus Test", Iowa State University of Science and Technology.

Four equidistant, pre-construction soil samples were taken from mineral soil of exposed stream banks along perennial Taylor Run (TR) at Chinquapin Park and First Baptist Church in the City of Alexandria, Virginia. Six equidistant samples were similarly taken along the Goodman Park (GP) intermittent stream and Brickelmaier Park (BP) low-discharge perennial stream at Hollin Hills in Fairfax County, Virginia. These were analyzed for phosphorus (P) using the Mehlich-3 method by Brookside Laboratories, Inc.

As expected, phosphorus levels were very low in all of the samples: TR-1 = 7 ppm P, TR-2 = 8 ppm P, TR-3 = 3 ppm P, and TR-4 = 11 ppm P. GP-1 = 18 ppm P, GP-2 = 8 ppm P, and GP-3 = 10 ppm P. BP-1 = 5 ppm P, BP-2 = 10 ppm P, and BP-3 = 10 ppm P.

Source: Simmons, R.H. 2020. 'Why Natural Channel Design Projects are Incompatible With Natural Resource Protection and the Preservation of Native Biodiversity' [PowerPoint presentation to Maryland Sierra Club Natural Places Committee, August 15, 2020].

Globally and state rare Coastal Plain / Outer Piedmont Acidic Seepage Swamp (USNVC: CEGL006238) along the south bank of Taylor Run at Chinquapin Park in the City of Alexandria, Virginia. Despite some protection from encroachment, natural channel design will destroy this groundwater-controlled, *non-alluvial* wetland by creating an artificial floodplain where none naturally exists and using the non-alluvial wetland as an *alluvial* habitat to be washed out by overland flooding regimes. This violates the explicit terms and conditions of the Nationwide Permit 27 (NWP) because the "NWP does not authorize the conversion of a stream or natural wetlands to another aquatic habitat type."

A series of non-alluvial acidic seepage wetlands occur along the south branch of Lucky Run at Stonegate Scenic Easement. At least 8 Alexandria “critically imperiled; A1” and “imperiled; A2” plants, as well as the wetlands themselves, are threatened by the planned stream construction project for Lucky Run at this site. (See previous slide.)

At least 80 native trees are to be removed along Strawberry Run at Fort Williams Park for the proposed natural channel design project. Many of these are old-age canopy Sweetgum, White Oak, Southern Red Oak, Tulip Tree, Black Gum, and Sycamore trees.

Numerous old-age canopy trees occur along the south bank of Taylor Run at Chinquapin Park and First Baptist Church property directly in the footprint of the proposed natural channel design stream construction project.

Shaded streams are cooler, allowing the water to hold more oxygen

When streams dry up (as the channels are widened and summertime flows are reduced in "natural channel design" restorations), the water temperature in the streams rises, which in turn cooks off the oxygen in the water. Dead fish result.

Ecologists have pointed out that though restoration of hydrogeomorphology is a critical consideration in restoring many streams, it is typically not sufficient for degraded channels, and it can even lead to worsening the ecological condition of the stream; i.e., it may be viewed as a disturbance itself (Louhi et al. 2011, Tullos et al. 2009). For example, in restoring floodplain overflow potential, if riparian trees are removed from a previously closed-canopy stream, the underlying energy regime may change from allochthonous resources to one driven by primary production, which may shift the stream further away from the desired ecological state and often toward algae-dominated streambeds and higher temperatures (Sudduth et al. 2011). https://palmerlab.umd.edu/publications/Palmerpublications/Palmer2014a.pdf

Changes in vegetation near streams can have major impacts on stream temperature (Brown and Krygier 1970; Beschta and Taylor 1988; Johnson and Jones 2000)... The response of stream temperature to changes in near-stream vegetation has been shown to vary, with water temperature in some small streams dramatically increasing following disturbance and removal of riparian vegetation (Brown and Krygier 1970; Johnson and Jones 2000).
http://forestry.oregonstate.edu/cof/fe/watershd/fe538/StreamTemperature/johnson_factors_effecting_stream_temp_CJOF04.pdf

Maintain or enhance vegetation alongside streams, to shade the water and filter pollutants from the run-off. Never remove the natural riparian vegetation that protects these waterbodies.
https://fortress.wa.gov/ecy/publications/documents/0210001.pdf

Courtesy Suzanne Sundburg, professional science researcher and writer.

The stream banks along many sections of Taylor Run at Chinquapin Park and First Baptist Church are naturally vegetated with a diversity of native plants characteristic of stream banks and are not significantly eroded or incised. Moreover, hundreds of feet of stream bank were successfully armored with boulders decades ago, negating the need for natural channel design construction.

Best practice recommendations to help ensure the preservation and future sustainability of forested stream valleys

Hold central the overarching concept of Do No Harm and for keeping sites natural and causing as little disturbance as possible.

All jurisdictions share a public trust responsibility and commitment to properly steward and preserve their natural resources for present and future generations and the good of the environment. It is critical to thoroughly assess and present all irreplaceable natural resources potentially affected by a stream restoration or wetlands project as necessary environmental review prior to construction. The pros and cons of a project need to be properly quantified and weighed if a quality outcome is to be expected.

Adopt the policy that disallows the construction of highly destructive, misapplied stream construction and stormwater management projects in small order, interior forested, upper headwater stream valleys.

The careful and *selective* armoring of stream banks and channels with wood or boulders and/or log jams and wood snags that mimic natural processes are proven best practice recommendations for stabilizing and helping to restore eroded stream channels. Sometimes the No Build Option is the best alternative.

Be vigilant in controlling non-native invasive plants along waterways. It is also critical to acquire some funding for large-scale projects to accomplish work out of reach of staff and volunteers.

Continually help educate others as to the essential value and effective means of preserving natural resources, stream valleys and wetlands, and our irreplaceable native biodiversity. This is largely outside the scope of most planners/designers, builders, engineers, property managers, and homeowners.

QUESTIONS?
Photo by R.H. Simmons