Environmental Stewardship Projects in the Upper Rock Creek Watershed
Updates and Benefits Summary

January 2007

Environmental Stewardship Concepts - Updated from FEIS

Site ID	Watershed	County	Drainage Area (acres)	Environmental Stewardship Concept	Benefit Derived from ES Project
NB-6	North Branch Rock Creek	Montgomery	235	Stormwater Retrofit – Replace riser and outfall, landscape, adjust NB-6 to work as a forebay for NB-7.	Improve water quality and attenuate more frequent storms to protect downstream channels. Additional attenuation provides the opportunity for more infiltration into groundwater.
NB-7	North Branch Rock Creek	Montgomery	330	Stormwater Retrofit - Add forebays, remove sediment accumulation, create micropools, adjust outflow to address downstream erosion, outfall stabilization.	The existing pond is showing signs of retaining high sediment loads, so creating a forebay from NB-6 and cleaning out NB-7 will help restore sediment retention capacity to the watershed. In addition, repair and modification of the existing riser and outfall will reduce erosion downstream by limiting flows and reduce sediment supply by repairing the outfall
NB-11	North Branch Rock Creek	Montgomery	65	Stormwater Retrofit - Landcape existing wet pond, repair existing outfall, remove existing concrete lined inflow channel (500 lf), adjust riser outflow to address erosion at outfall.	Landscaping the existing pond will improve aesthetics and nutrient removal of the existing pond. Repair of the outfall will reduce downstream sediment supply, and removal and replacement of the existing concrete channel will improve aesthetics, promote infiltration, reduce inflow velocities and resuspension of settled material
NB-16	North Branch Rock Creek	Montgomery	170	Stormwater Retrofits – A- Farm Pond dam upstream of (B) in need of repair, draw down water to create a forested wetland. B- On-line pond, repair outlet pipe, create forebays and enhance existing wetlands by landscaping and minor grading.	A- Benefit will be reduced failure hazard risk (risks include downstream sedimentation from a dam failure) in existing pond, reduced thermal effects of existing wet pond, increased habitat, maintenance of water quality already being provided. B- Because downstream from this pond is in fair to good condition, retrofit will be mostly landscaping and minor grading to improve aesthetics and water quality performance, as well as repair of the outlet pipe.
NB-1	North Branch Rock Creek	Montgomery	640	Reconnect stream with floodplain where necessary, reduce erosion and sedimentation, enhance riparian buffer, remove fish passage barriers, improve habitat.	See below
NB-2C	North Branch Rock Creek	Montgomery	1000	Reconnect stream with floodplain where necessary, reduce erosion and sedimentation, enhance riparian buffer, improve habitat.	See Below

Water Quality Benefits of Stream Restoration Projects

The overall benefits of typical stream restoration projects to the public are largely aesthetic, safety and environmental. Aesthetic and safety improvement aspects are driven by a designer's, reviewer's, or independent observer's personal preferences and common sense. Environmental improvement aspects of stream restoration can be further broken down into habitat, longevity or design life, protection of property, and water quality. Stream restoration projects being performed as Environmental Stewardship for the ICC in Upper Rock Creek SPA will improve the streams in all of the ways mentioned, with particular focus on water quality improvements through restoration of natural processes within the channel and reattached floodplain.

Stream restoration will benefit the aquatic ecosystem by improving water quality within the restored reach, with benefits extending downstream. For example, when stabilizing highly erodible stream banks, a reduction in sediment input can be expected, measured by lower total suspended solids (TSS). Studies have shown that stream bank sediments can contain an average of 4.41 lbs/ton of nitrogen and 1.43 lbs/ton of phosphorus (Merritts and Walter 2006). By reducing these sediment contributions to the stream a reduction in nitrogen and phosphorus contributions to the stream may also be realized. Additionally, the reduction of sediment inputs to the stream can reduce the amount of embeddedness of the riffle substrate material. By reducing riffle embeddedness an increase in the surface area of the riffle substrate material and greater contact with the hyporheic zone would result. Increases in surface area of the substrate and hyporheic zone contact also increases the number of attachment sites for aquatic microbes that can make use of available nitrogen in the stream.

Certain aerobic and anaerobic aquatic microbes (predominantly anaerobic) provide denitrification by converting nitrogen compounds to their gaseous form through the breakdown of organic carbon which can be a limiting factor in denitrification (Korom 1992). Evidence suggests that adding carbon sources to streams and allowing greater floodplain contact during high flow events can help reduce nitrogen levels in the stream (Palmer 2006). The addition of log vanes, root wads, woody debris, and structures that help to collect allocthanus material are all sources of additional carbon to the stream system which is likely to improve the denitrification potential of the stream (Palmer 2006). Large carbon sources within forested floodplains and the increased retention time of flow due to floodplain access, allow flood flows additional contact with soil microbes that provide the same denitrification benefits of aquatic microbes. In addition, studies show that there is a correlation between riparian buffer width and the reduction of nitrogen and phosphorus (Mayer et. al. 2005)

Other methods of providing additional denitrification potential to a stream system include increasing the residence time of the stream. The more sinuous a stream, the longer the flow path which increases the contact time between denitrifying microbes and nutrient rich water. Adding side channels and floodplain wetlands also increases the residence time of the flow and allows for additional nutrient uptake (Palmer 2006).

In some instances, where the stream bed elevation is raised to reconnect the stream to the floodplain, the resultant rise in groundwater elevation will provide additional denitrification qualities. By raising the groundwater elevation, soil microbes within more organic rich layers of soil are now in closer contact with the saturated zone, thereby increasing denitrification. Furthermore, baseflow at a higher elevation in the stream also would have more direct contact with the vegetated root zone along the stream bank, providing access to additional carbon sources for denitrification.

The restoration of a stream reach will also improve the character and diversity of habitat types. The improvement of riffle habitat will potentially increase the amount of dissolved oxygen in the stream, improving fish and macroinvertebrate habitat conditions. Adding or augmenting native vegetation to the banks and within the floodplain will provide shade to the stream, reducing thermal impacts that may occur due to insufficient canopy coverage of the stream. An additional benefit of canopy coverage is that during leaf fall, additional carbon will be provided to the stream for denitrification.

It is unknown how each individual stream will react to restoration in terms of sediment and nutrient level reductions, although it is anticipated that reductions will occur. The only way to be certain that stream restoration has achieved nutrient reduction is to begin monitoring to establish baseline conditions and continue post construction monitoring to determine the level of success with regards to nutrient reduction. Collaborative studies conducted by the Environmental Protection Agency (EPA), United States Geological Survey (USGS) and Baltimore County Department of Environmental Protection and Resource Management (DEPRM) on Minebank Run in Baltimore County Maryland have shown a decrease in nitrate and nitrite levels from 1.5 mg/l to 0.8 mg/l since restoration as well as a nearly two fold increase in the denitrification rate (Mayer et. al. 2005). A similar study on Spring Branch in Baltimore County, Maryland yielded results indicating a 0.02 lb/linear foot decrease in total nitrogen, a 0.0035 lb/linear foot reduction in total phosphorus and a 2.55 lb/linear foot reduction in TSS (Baltimore County 2002). Watershed models show a potential 75% reduction of nitrogen, phosphorus and TSS (Palace et. al. 1998).