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Natural Floodplain, Stream, and Riparian Wetland Restoration Best Management Practice

Definition and Nutrient and Sediment Reduction Efficiencies For use in Phase 5.0 of the Chesapeake Bay Program Watershed Model

Recommendations for Formal Approval by the Nutrient Subcommittee's Watershed Technical Workgroup, the Modeling Subcommittee and the Nutrient Subcommittee's Sediment Workgroup

This document summarizes the recommended definition and nutrient and sediment reduction efficiencies for the Natural Floodplain, Stream, and Riparian Wetland Restoration Best Management Practice. The Tributary Strategy Workgroup, the Modeling Subcommittee, and the Sediment Workgroup were asked to consider and review the proposed practice at their meetings on March 5, 2007, April 3, 2007, and April 26, 2007, respectively. Attached to these recommendations is a full accounting of the Chesapeake Bay Program's discussions on this practice and how these recommendations were developed, including data, literature, data analysis results, and discussions of how various issues were addressed.

Recommended Natural Floodplain, Stream and Riparian Wetland Restoration Best Management Practice Definition

The Natural Floodplain, Stream, and Riparian Wetland Restoration Best Management Practice (NFSRWR-BMP) is an ecological restoration and management strategy that is founded in the Principles for the Ecological Restoration of Aquatic Resources (USEPA, 2000). The NFSRWR-BMP's goal is to rehabilitate a site and its ecosystems to their natural potential. Restoration and management actions are proposed to re-establish the natural condition and function of floodplains, streams, riparian wetlands and other natural aquatic resources impaired by legacy sediment storage and erosion. The natural condition is represented by aquatic resources that formed as a result of long term physical, chemical, biological, climatic, geologic and other natural processes. The BMP's goal is to rehabilitate a site and its ecosystems to their natural potential based on an understanding of the natural condition. Implementing the practice will target legacy

sediment that has been identified as a significant non-point source of pollutants in some Chesapeake Bay watersheds (Walter et al, 2007; Walter and Merritts, 2008). Rehabilitating natural aquatic resources and the ecosystem functions they provide will provide ecosystem services that are self sustaining. The NFSRWR-BMP primarily is a land-based strategy that results in significant restoration of natural aquatic resources. Implementing NFSRWR-BMP projects have the potential to achieve significant reductions in sediment, nitrogen, and phosphorous and result in significant restoration of natural aquatic ecosystems.

Legacy sediment is defined as a non-point source of pollution that was eroded from upland hill slopes after the arrival of early Colonial-American settlers and during centuries of intensive land uses; that was deposited in valley bottoms along stream corridors, burying natural floodplains, natural streams, natural wetlands, and other natural aquatic resources; and that altered and continues to impair the hydrologic, biologic, aquatic, riparian, and water quality functions of natural environments (PA DEP, 2007; Walter, et al, 2007). The practice will focus on eliminating the ongoing environmental stresses resulting from storage and erosion of legacy sediment in Chesapeake Bay watersheds.

Eroded sediment is a leading cause of impairment in rivers and streams (USEPA, 2002). Legacy sediment erosion is recognized as a ubiquitous non-point source of fine sediment that represents significant potential impairment to aquatic resources in many Chesapeake Bay watersheds (Walter et al., 2007; Walter and Merritts, 2008). Additional non-point source pollutants associated with legacy sediment erosion in Chesapeake Bay watersheds include phosphorous and nitrogen. Where legacy sediment erosion and resulting fine sediment transport are impairing aquatic resources in Chesapeake Bay Watersheds, aquatic resource restoration and management priorities will focus on rehabilitating natural aquatic ecosystems through implementation of the NFSRWR-BMP. Restored natural ecosystems will provide opportunities to capture and store sediment and its associated nutrients.

Nitrogen has been identified as a significant excess nutrient in the environment, and impaired natural aquatic ecosystems often fail to sequester nitrogen leading to eutrophication problems (Galloway, et. al. 2003; Driscoll, et. al. 2003; Mayer, et. al. 2005). The NFSRWR-BMP targets excess nitrogen in the environment by rehabilitating natural floodplains, streams, riparian wetlands, and other aquatic resources that are buried under legacy sediment. Exposing surface and subsurface hydrology to significant amounts of carbon, like that contained in natural ecosystems buried beneath legacy sediment, recently has been advocated as a way of reducing nitrogen loads (Craig, et. al.

2008). The practice provides significant potential to restore natural nitrogen removal processes, particularly those processes that are impaired and typical in channels deeply incised through legacy sediment (Groffman et. al. 2002; Craig, et. al. 2008). Additional benefits are realized by restoring natural riparian plant community interactions with subsurface hydrologic flow paths, increasing biogeochemical interactions and available carbon (Craig, et al. 2008).

Habitat modifications are a leading cause of impairment in rivers and streams (USEPA, 2002). The practice has the potential to rehabilitate naturally formed aquatic ecosystems and their natural aquatic ecosystem services. The practice will restore the ecological integrity and the natural structure and function of aquatic ecosystems and will be based upon an understanding of site specific and watershed natural potentials. The appropriate goals for ecosystem restoration will be defined by natural aquatic ecosystems that are buried under legacy sediment and that formed as a result of natural processes. The widespread storage of legacy sediment has a significant adverse impact on natural floodplain, stream, wetland, and other aquatic resources and the natural ecosystem services they provide.

Recommended Nutrient and Sediment Reduction Efficiencies

Monitoring and analysis at implemented pilot project sites is necessary and recommended to establish efficiencies for the NFSRWR-BMP defined above (Palmer, et. al., 2005). Until one or more pilot projects are sufficiently monitored, and the data is analyzed, it is difficult to anticipate a specific approach for establishing efficiencies. At this time, no NFSRWR-BMP projects exist that fit the definition and that document before and after conditions sufficiently to establish BMP efficiencies. Pennsylvania is supporting the monitoring of nutrient and sediment reductions at specific implementation sites, prior to recommending BMP nutrient and sediment reduction efficiencies. Other planned habitat monitoring and ecological assessments will complement the nutrient and sediment reduction monitoring.

Significant monitoring at a targeted implementation site in the Big Spring Run Basin of the Mill Creek Watershed in Lancaster County, Pennsylvania where significant baseline and pre-implementation monitoring data has been compiled and evaluated (Galeone, D.G, et al., 2006; Walter et al., 2007) is intended to provide the basic elements for establishing the NFSRWR-BMP efficiencies. Additional baseline and pre-restoration and post-restoration monitoring and data analysis are underway at this site targeted for BMP implementation. Pennsylvania also plans to encourage and support additional monitoring and data analysis at other implementation sites in the Chesapeake Bay Watershed and throughout the Commonwealth. Implementing the NFSRWR-BMP also will restore wetlands and riparian buffer. Established efficiencies for additional existing BMP's that could result following implementation of this BMP, like Wetland Restoration for Agricultural landuse, will conform to those already established by the Chesapeake Bay Program until further monitoring and data analysis is complete.

Tracking the Floodplain and Riparian Wetland Restoration BMP

Tracking information for the NFSRWR-BMP will include: site location, length of stream restored, area of rehabilitated floodplain, riparian wetlands and other aquatic ecosystems, volume of legacy sediment removed, any pre- and post monitoring completed for verification of BMP efficiencies, and any additional management practices, such as riparian buffers and wetlands, that were installed. Tracking of additional existing BMP's will be reported consistent with their specific requirements.

Issues to Resolve in the Future

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Appendix A

Supporting Technical Information and Historic Record for Developing the BMP

Definition and Nutrient and Sediment Reduction Efficiencies

Definitions

"Natural." Ecological conditions of aquatic resources that formed naturally, as a result of long term physical, chemical, biological, climatic, geologic, and other natural processes.

"Aquatic resources." Floodplains, floodways, streams, watercourses, wetlands, and other bodies of water.

"Legacy Sediment." Sediment that meets all of the following conditions:

(1) Eroded from upland areas after the arrival of early Pennsylvania settlers and during centuries of intensive land use.
(2) Deposited in valley bottoms along stream corridors, frequently behind mill dams or other dams, burying natural streams, floodplains, wetlands, valley bottoms and other aquatic resources.
(3) Altered and continues to impair the hydrologic, biologic, aquatic, and riparian and water quality functions of natural aquatic resources and existing aquatic resources.

"Restoration" - Return of an ecosystem to a close approximation of its condition prior to disturbance; the term restoration means the reestablishment of pre-disturbance aquatic functions and related physical, chemical and biological characteristics; the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former or degraded wetland; rehabilitation.