Baseflow Stream Channel Design: An approach to restoration that optimizes resource values and ecosystem services

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Stream restoration is a large market in the restoration field with millions of dollars expended annually. The prevailing approach for stream restoration is the natural channel design technique popularized by Rosgen which focuses on designing channels capable of dynamic equilibrium through the use of a bankfull channel designed to be competent with respect to sediment transport (i.e., sediment in, sediment out). The sediment competence requirement of the bankfull channel design approach limits the opportunity for material processing. In a another line of research, the consideration of pre-colonial land clearing practices and the resulting historic changes to stream morphology and sediment supply (i.e., legacy sediments) presents an opportunity to refine our understanding of what constitutes a 'natural' stream. Starting just a few hundred years ago colonial land clearing practices resulted in the delivery of huge volumes of sediment, burying the historic stream systems and resulting in our current familiar stream and floodplain morphology While our watersheds have changed dramatically since pre-colonial times, it appears a channel form more representative of the pre-colonial period is an excellent model for stream restoration.

A baseflow channel that is well connected with its riparian or floodplain habitat resembles the streams of the pre-colonial period and can deliver many ecosystem services (e.g., restore floodplain functions, reduce channel erosion and sediment transport, increase sediment trapping, etc.). Another analog from the past for the baseflow channel approach is the historically widespread repeating sequence of beaver ponds and dams. If successfully implemented, the baseflow stream channel conveys the 'normal' flow in a channel with a high surface area to volume ratio. With increased discharge associated with runoff, the increased water surface elevation spills out of the baseflow channel and into the adjacent riparian zone reconnecting the floodplain and delivering associated benefits. Society capitalizes on natural floodplain functions critical to ecosystem and societal health, including sediment trapping, material processing, reduction in flood water surface elevation, increase in concentration time of floodwaters, reduction in volumes through infiltration, evaporative looses, and depressional storage. Furthermore, this contributes to groundwater recharge and stream baseflow maintenance during periods of summer low flow, support for wetland and vernal pool hydrology and ecology, suppression of non-native invasive plant species, increased micro-habitat diversity, etc.

The utility of this approach to stream restoration in urban and suburban watersheds cannot be overestimated. The reconnection of the floodplain and the restoration of floodplain function for every significant precipitation event mitigates the single largest problem associated with urbanization—hydro modification. The increased channel work resulting from increased volume of runoff results in channel erosion (i.e., widening and incision), loss of aquatic habitat and biota,

degradation in water quality, loss of groundwater, aggravated summer low flow conditions, degradation of riparian resources, floodplain wetland loss, etc. This approach to stream restoration can reverse much of the degradation resulting from decades of uncontrolled or poorly controlled storm water runoff.

Examples of this restoration approach will be presented, including pre- during, and post-construction photos. In addition, water quality and sediment monitoring results will be summarized. Finally, construction costs and financial value of the resulting natural capital will be discussed.

Joe Berg is an ecosystems ecologist with more than 25 years experience in the assessment and analysis of natural resources; development, preparation, and implementation of restoration plans; and the range of studies, documentation and permitting required. The focus of his efforts have been the restoration of stream, wetland and floodplain functions as a means to deliver ecosystem services to society, increase natural capital, and integrate local community needs with an appreciation of natural resource values.

Kevin Nunnery, PhD. has over 13 years of experience in wetland ecology research and wetland and stream mitigation projects. In addition, he has negotiated environmental permits for many wetland and stream projects, contributed to several watershed assessments in the Piedmont and Coastal Plain ecoregions, delineated hundreds of acres of wetlands, contributed to the design of several stormwater BMP's, completed Rosgen natural channel design training, and contributed to over 10,000 feet of stream restoration design.