TIDAL CHANNEL GEOMETRY OF BARRIER EMBAYMENT SYSTEMS IN PUGET SOUND

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Barrier embayments provide a network of geographically distributed tidal wetlands which have been identified as being important for rearing of juvenile salmon in Puget Sound (Beamer et al. 2003). However, over 65% of the currently existing barrier embayments have been degraded by reductions in embayment length, wetland area, tidal flow, or sediment supply (Cereghino et al. 2012). The Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) identified and prioritized barrier embayments for restoration and developed guidelines to assist in the conceptual design of barrier embayment restoration projects (PSNERP, 2011).

The design guidelines developed as part of PSNERP for restoration of barrier embayments in Puget Sound were focused on the tidal channel as this is one of the primary hydraulic parameters in forming estuaries and lagoons. However, there is little to no data on the geometry of well-functioning tidal channels which can be used as a guide to efficiently design tidal channels for estuary restoration. Therefore, tidal channel design guidelines were developed by scaling the hydraulic geometry relationships for San Francisco Bay to accommodate the larger tide range in Puget Sound (PSNERP 2011). However, tidal channels in Puget Sound have different geometry than channels in San Francisco Bay due to different sediment composition, larger tide ranges, greater rainfall, salinity distribution and plants (Hood 2007). Several models of tidal channel hydraulic geometry have shown that outlet cross-sectional area, depth, and width are correlated with marsh area and tidal prism (PSNERP 2011). In addition, studies on the geographic variation of tidal channel geometry in Puget Sound have shown that tidal channel geometry might be better predicted by tide range than tidal prism (Hood 2015).

This paper will present the first year of findings from a research project with the objective of producing empirically based models of tidal channel characteristics that can be broadly applied to design estuary restoration projects in Puget Sound. A combination of field data collection methods and desktop analysis are being utilized to calculate tidal prism, channel dimensions, marsh extent, and water surface elevations to parameterize well-functioning barrier embayments in Puget Sound. The tidal channel data will be used to conduct a regression analysis and develop hydraulic geometry scaling relationships. The goal of the study is to develop one set of regression lines for the Puget Sound basin; however, if the data collection reveals important differences between sub-basins, then two or more regressions may be developed. For example, Hood (2015) found wave exposure contributed to differences in tidal channel geometry in the major river deltas within Puget Sound. Differences in wave exposure and tide range among the sub-regions of Puget Sound could create a need for creating more than one set of scaling relationships (e.g. North Sound and South Sound).

In practice, utilizing guidelines to size tidal channels for restoration in Puget Sound which are not based on the regional geomorphology can result in unstable tidal channels requiring a prolonged period of adjustment to reach equilibrium and potentially degrading the ecosystem function. The information provided by this project will improve effectiveness of tidal channel restoration designs and help ensure that investments in restoration are successful and sustainable

Figure 1 – Typical Puget Sound barrier spit tidal channel

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