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MEMORANDUM

To: Kristin Williamson, South Puget Sound Salmon Enhancement Group

Date: October 13, 2010

From: Paul Schlenger and Kathy Ketteridge, Anchor QEA

Re: DRAFT - Chambers Bay Dam Removal Initial Feasibility Assessment Memorandum

The following is a summary of the findings and recommendations resulting from the work performed on the Chambers Bay Dam Removal Initial Feasibility Assessment Project. The feasibility assessment involved three tasks, which are outlined in the project Scope of Work (Anchor QEA, 2010), dated June 16, 2010. A brief discussion of the Project Background follows, along with results of the feasibility assessment for each of the three tasks.

PROJECT BACKGROUND

In support of completing the outlined tasks, a brief research of publicly available information and documentation was done to gain a better understanding of the watershed and the dam. Targeted topics researched included site hydrology, water and sediment quality, dam function and operations, and regulatory issues.

Chambers Creek is part of WRIA 12, the Chambers-Clover Creek Watershed, which covers 144 square miles within Pierce County. Chambers Creek originates at the outlet of Steilacoom Lake and is joined by two creeks – Flett and Leach Creeks – prior to entering a small reservoir behind the Chambers Bay Dam. From the dam, the creek enters a narrow and long estuary that is surrounded by industrial land use with narrow riparian buffers and high-banks before discharging into Puget Sound at Chambers Bay.

A list of findings resulting from the research of publicly available information is summarized below. The documents that support the findings are available upon request.

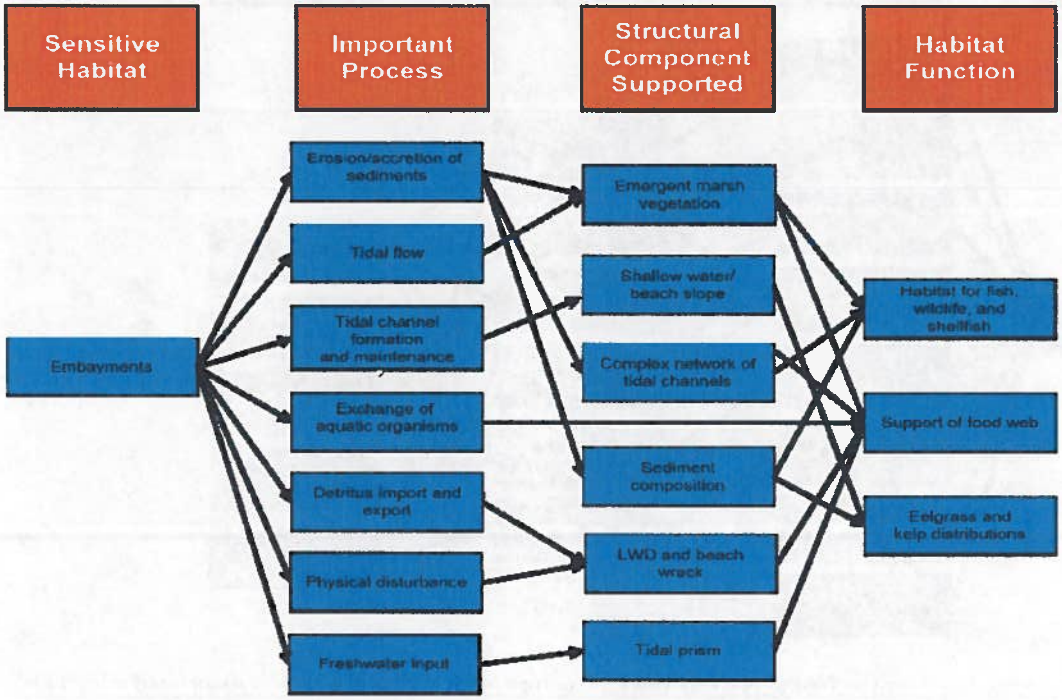

Figure 1. Conceptual Model of the Nearshore Processes, Structure, and Habitat Functions Associated with Coastal Embayments (Source: Schlenger et al. [in review][1])

The tidal wetlands of coastal embayments such as Chambers Bay and large river deltas are those areas of wetland hydrology, vegetation and soils that are subject to tidal influence. Tidal wetlands occur from the uppermost margin of tidal water level fluctuation, through brackish marsh areas with plants of increasing salt tolerance, all the way downstream to the tide flats and mudflats. In undisturbed coastal embayments, these tidal wetlands form along the natural transition from freshwater to saltwater. Tidal wetlands support a broad variety of fish, shellfish, birds, and other wildlife and provide ecologically and economically important ecosystem services such as production of benthic invertebrates, nutrient cycling, flood attenuation, and pollution abatement (Figure 2) (Schlenger et al. [in review]).

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[1] Schlenger, P., A. MacLennan, E. Iverson, K. Fresh, C. Tanner, B. Lyons, S. Todd, R. Carman, D. Myers, S. Campbell, and A. Wick. In Review. Strategic Needs Assessment Report. Prepared in support of the Puget Sound Nearshore Ecosystem Restoration Project.

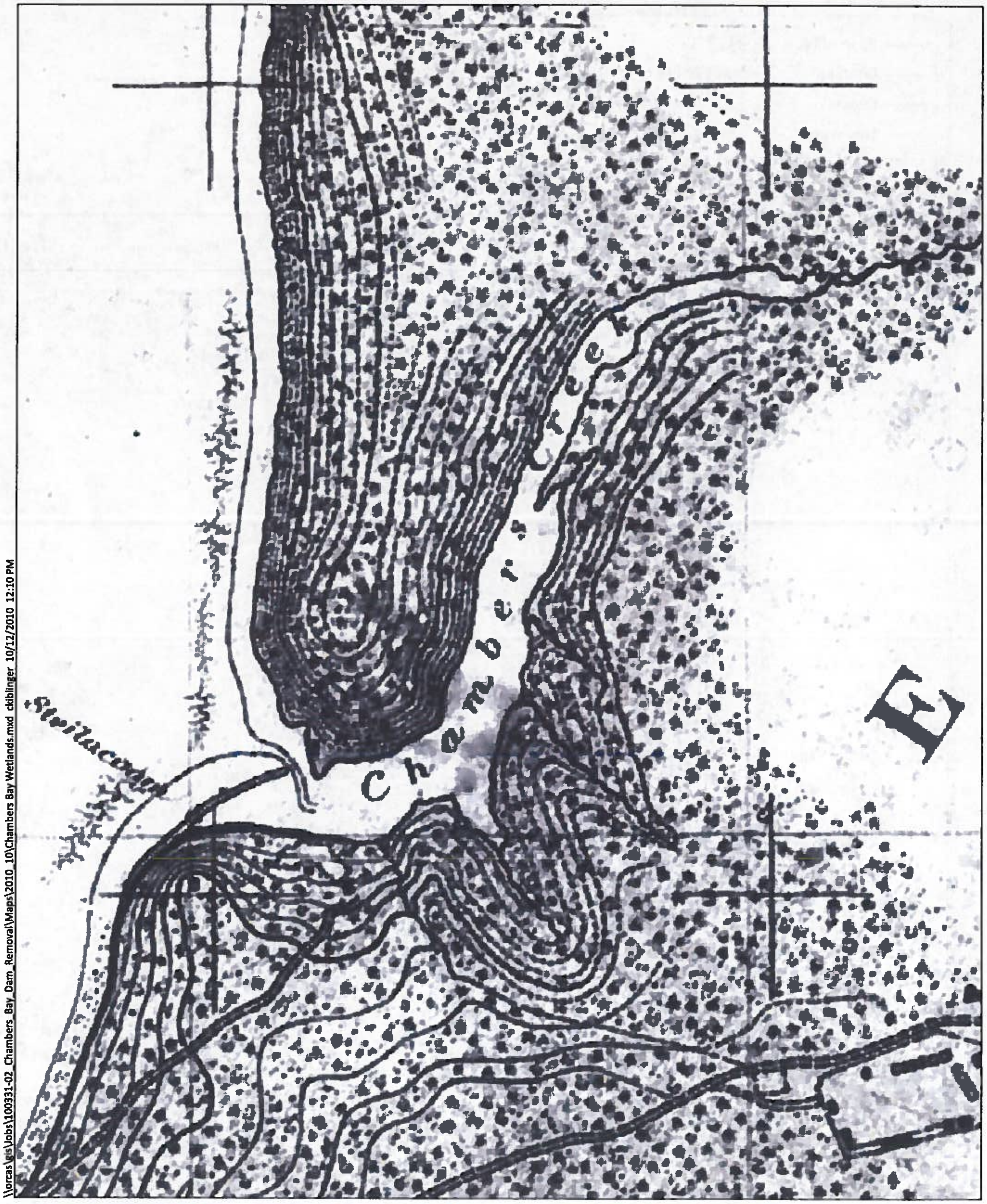

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Figure 3

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Chambers Bay Dam Removal Feasability Assessment

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Figure 5
Historic Tidal Wetlands
Chambers Bay Dam Removal Feasability Assessment

A preliminary estimate of costs for the sampling is $40,000. This estimate includes developing a sampling and analysis plan (SAP) and a health and safety plan (HASP), sampling and testing, reporting findings, and project management and coordination.

Task 3: Recommendations for Sediment Transport Analysis

Background Information

A brief analysis using available LiDAR elevation data (PSLC, 2002) and aerial imagery (NAIP, 2006) indicates that the Chambers Bay dam appears to be approximately 12 feet high and impounds water to include an area of approximately 3.8 acres upstream of the dam, depending upon the time of year and water level in Lake Steilacoom.

A preliminary evaluation of the hydrology of the Chambers/Clover Creek Watershed was done using the USGS StreamStats program, which indicates that the 100-year peak flow may be as high as 3,700 cfs, taken at the dam. This flow estimate is rough and is a great deal higher than the USGS published peak flows of up to 800 cfs measured between 1938 and 2008, at USGS gage 12091500, located downstream of Leach Creek. The drainage area represented below Leach Creek is approximately 70-percent of the total watershed.

A minimum of three structures influence the hydraulics and sediment transport on lower Chambers Creek – the Chambers Bay Dam, the railroad bridge adjacent to Chambers Bay, and the bridge located upstream of the dam on Chambers Creek Road West. The extent that the two bridges affect the hydraulics and sediment transport of the creek is not well understood at this point, although it appears that the bridges are points of constriction in the creek.

Chambers Creek upstream of the dam reservoir is very similar to the creek downstream of the dam – slopes are shallow (0-1 percent slope) and the creek appears to be relatively stable in a gentle meandering alignment (based on a preliminary review of available aerial imagery from 1990 through 2010). A preliminary creek alignment and profile are provided in Figures 6 and 7, respectively.

Sources of Sediment

There are, at minimum, two large sources of impounded sediment upstream of the dam. One source of impounded sediment is immediately behind (upstream of) the dam and the other is located approximately 1,000 feet upstream of the dam.

The extent of sediments impounded behind the dam is unknown. Using the available information discussed earlier, an estimated area of 2.43 acres may represent the depositional extent behind the dam. Two scenarios were developed to estimate the volume of potential sediments behind the dam – an average depositional depth of 3 feet and 6 feet, representing one-quarter to one-half of the height of the dam. Scenario 1 estimates that potentially 12,000 cubic yards are impounded by the dam; Scenario 2 estimates that potentially 23,500 cubic yards are impounded.

The second source of impounded sediments, located approximately 1,000 feet upstream of the dam and approximately 600 feet upstream of the bridge crossing the creek. The source is approximately 325-feet long, spans the channel width (950+ feet), and is approximately 4-feet high above the channel grade at its peak. The aerial imagery suggests that the source is actively aggrading upstream. Narrow channels are present along the banks of the channel, flanking the large deposit. The presence of this large deposit may indicate the effect the dam and the bridge have had on arresting the transport of sediments to Chambers Bay. A preliminary estimate of the volume of the large deposit is approximately 30,000 cubic yards. Figure 8 illustrates the plan and cross-section views of the sediment deposit upstream of the dam. This sediment impoundment is roughly shown in cross-section view in Figure 9, below and is visible in aerial photography.

Tidal Inundation

Tidal inundation of Chambers Creek is documented as reaching the downstream portion of the dam. A separate evaluation using available data (described above, in addition to tidal data from Commencement Bay) indicate that the potential tidal inundation is approximately 10 feet in elevation, NAVD88, which is approximately 5 feet lower than the crest of the dam. Assuming the creek grade upstream of the dam follows the grade downstream of the dam at a 1-percent slope, the extent of tidal inundation may reach as far as 700-feet upstream of the dam, once removed and depending on the dynamics of tidal inundation and creek flow.

Channel Migration and Erosion

In the event that the Chambers Bay Dam is removed, it is expected that the present sediment load in the creek will continue to deposit sediment throughout the lower Chambers Creek reach and into Chambers Bay. Given the shallow slope of the creek in this reach, channel migration is expected to be relatively active as areas of deposition are re-worked by both tidal and creek flow regimes.

Bank protection may be necessary to protect the surrounding infrastructure once the dam is removed. Depending on the type of bank protection, habitat enhancement may be incorporated into the design. Other types of habitat-enhancement hydraulic structures may also be incorporated within the proposed channel to mitigate for the migration of the creek and subsequent erosion of the channel prism. The extent of erosion following the removal of the dam depends on the composition of the existing creek banks and floodplain (where applicable) material, the expected range of flows, and the proposed channel alignment (slope, width, bed composition, etc.).

RECOMMENDATIONS

It is recommended that a hydrodynamic model be developed to evaluate the potential for sediment transport, channel migration, and channel stability. The first step in developing the model is to gather additional and more detailed information to gain a better understanding of the channel geomorphology, watershed hydrology, dam operations, and physical layout and features (hydrographic and land surveys) of the lower Chambers Creek reach. The model employed for analysis should include, at a minimum, a 2-dimensional hydrodynamic model program.