

Estuary Restoration Target Update to the Stillaguamish Chinook Recovery Plan

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Background

The 2005 Stillaguamish Chinook recovery plan (the plan, SIRC 2005) included targets for estuarine habitat restoration. These targets were mostly based on Collins (1997) which was, at that time, the most up to date summary of historic and current estuarine habitats in the Stillaguamish. However, since the plan was finalized, additional work has been done in the Stillaguamish estuary by Collins (unpublished data), the Stillaguamish tribe (Griffith 2005) and The Nature Conservancy (unpublished data). Additional work in the Skagit delta by Hood (2004, 2007, 2012) and in the Columbia River estuary by Lott (2004) has provided additional data relevant to the Stillaguamish. A review of the information described above by the authors indicated that an update to the 2005 targets was warranted, and this DRAFT document was prepared for submittal to the Stillaguamish Technical Advisory Group (TAG), a subcommittee of the Stillaguamish Watershed Council (SWC).

Review of Estuary Targets in 2005 Chinook Recovery Plan

The targets in the plan were based on the concept of properly functioning conditions (PFC, NMFS 1996), and the idea that restoring 80% of historic estuarine habitat (as described in Collins 1997) would achieve PFC (SIRC 2005). Using this approach, a need for 2,020 acres of estuarine restoration was identified in the plan (IBID). The 10 year goal is 195 acres restored and 120 acres created while the 11-50 year goals are 1055 acres restored and 650 acres created. While the exact type of estuarine restoration is not specified in Tables 10 or 12 in the plan (other than “acres created” and “acres restored”), there are “SIRC approved” projects that talk of restoring or creating “salt marsh”. The “created” category of estuary restoration is based on the concept of placing engineered log structures on the sand/mudflats to collect sediment and “create” new marsh areas that were previously sand or mudflat. No mention is made of restoring other estuarine habitat types such as shrub scrub or tidal forested wetlands, although these habitat types were historically common in estuaries throughout the Puget Sound, including the Stillaguamish (Collins et al. 2003).

Proposal for Updated Estuary Targets

Recent work studying Chinook salmon in estuaries has documented the importance of shrub-scrub and forested wetlands in large river deltas to rearing juveniles (Lott 2004, Hood 2012). Collins’ (unpublished data) updated historic river and estuary condition layer (Figure 1.) documents the former extent of these habitat types in the Stillaguamish delta, ca. 1870. However, recent habitat mapping work indicates that both shrub scrub and riverine tidal habitat types have mostly disappeared from the Stillaguamish delta in the last 130+ years (Griffith 2005), similar to what has been reported from the Skagit (Hood 2007) and other Salish Sea River deltas (Collins et al. 2003). Due to the paucity of sampling sites, fish use studies in the Stillaguamish estuary (Stillaguamish Tribe 2009) did not sample shrub scrub or tidal forested habitats.

As the goal of the Stillaguamish Chinook Recovery Plan is to restore PFC in the estuary, it is appropriate to expand the restoration targets to include the full suite of habitats that were historically available to juvenile Chinook salmon. We propose that the Stillaguamish estuary restoration targets be amended to include targets for emergent marsh, shrub-scrub, and tidal forested wetland habitat types. All of these habitat types were present historically, and would have been extensively utilized by Chinook juveniles (Lott 2004, Hood 2012).

We recommend that the topic of “creation” of new marsh be revisited through a technical workshop this year to examine the feasibility of the approach. Work done by the Stillaguamish Tribe and The Nature Conservancy (both unpublished) indicates that the placement of wood structures in the estuary is highly unlikely to create the 650 acres of new marsh that the recovery plan calls for in the 50 year work plan. Monitoring suggests that it is possible to create some new marsh using wood, however due to the tidal and wind dynamics in the estuary, the likely cost of creating marsh may be far higher than anticipated and the likely stability of the new marsh may be considerably lower. It appears unreasonable to expect more than tens of acres of new marsh from creation. In addition to the challenges of implementation, there are other issues which should be considered. First, marsh creation with engineered log jams converts an existing habitat type (unvegetated tide flat) to another (tidal marsh) for the benefit of Chinook. Many species of fish, invertebrates and birds are supported by tide flats and prefer them to marsh, so large scale habitat conversion is not necessarily an ecosystem approach to Chinook recovery. Secondly, emerging science on climate change impacts suggests that both tide flats and the outer areas of tidal marsh are increasingly vulnerable to loss. This is as a result of accelerating changes in both sea level rise and freshwater flow regime. Summer low flows are projected to decrease substantially in coming decades which will increase estuary salinities during the growing season. As a result of the many issues raised by recent work, we recommend a technical workshop to re-assess the feasibility of marsh creation and to identify new, more realistic creation targets.

Approach

In order to create DRAFT estuary restoration targets, we clipped the Collins historic habitat layer (Figure 1.) to the WRIA 5 boundaries and the estimated upstream extent of tidal influence (similar to the estuary priority area detailed in Figure 18 in the plan). The Collins layer was created with a GIS using archival materials, including maps and field notes from the Public Land Survey (PLS) cadastral survey from 1856 - 1891, U.S. Coast & Geodetic Survey (USC&GS) topographic sheets (1874 - 1902), and aerial photographs from 1931 - 1940, in combination with a DEM (digital elevation model) from LIDAR and other materials. Due to sometimes vague source materials, and alteration of the landscape by early European settlers, there are a few unknown polygons totaling a little over one thousand acres, comprised of undifferentiated forested floodplain habitat types (Table 1). Given the location in the watershed, and the elevations of the underlying land, these polygons were likely a fairly even mix of shrub-scrub wetland, tidal forested wetland, and non-wetland/riparian forested habitats. For purposes of this update, the unknown areas were split evenly between the aforementioned three categories.

Collins also mapped channel polygons and divided them into several categories. However, we did not include the channel acreages when calculating habitat areas in the target update, as the recent mapping work (Griffith 2005) excluded channel area, and Hood (2004) has documented that channel area is controlled by both tidal prism and river morphology in a prograding delta like the Stillaguamish. We assume that if the targeted acreage is restored, the associated channel changes (size, shape, and abundance) will result in an estuarine landscape that achieves PFC.

Once we had an estimate of the type and extent of the historic habitat types, we then compared it to the extent of recent mapped habitats (Griffith 2005, Figure 2.). Subtracting the historic and current habitat types, and multiplying by 0.80 produced the DRAFT 50 yr. updated estuary targets in Table 2. The ten year targets were generated by dividing the 50 yr. target by five. These draft targets do not take into account sea level rise and, given recent projections, should be considered conservative. In addition, there is indication that some of the marsh area mapped in 2005 has disappeared in the intervening years (TNC unpublished data), a further indication that the marsh target may be conservative.

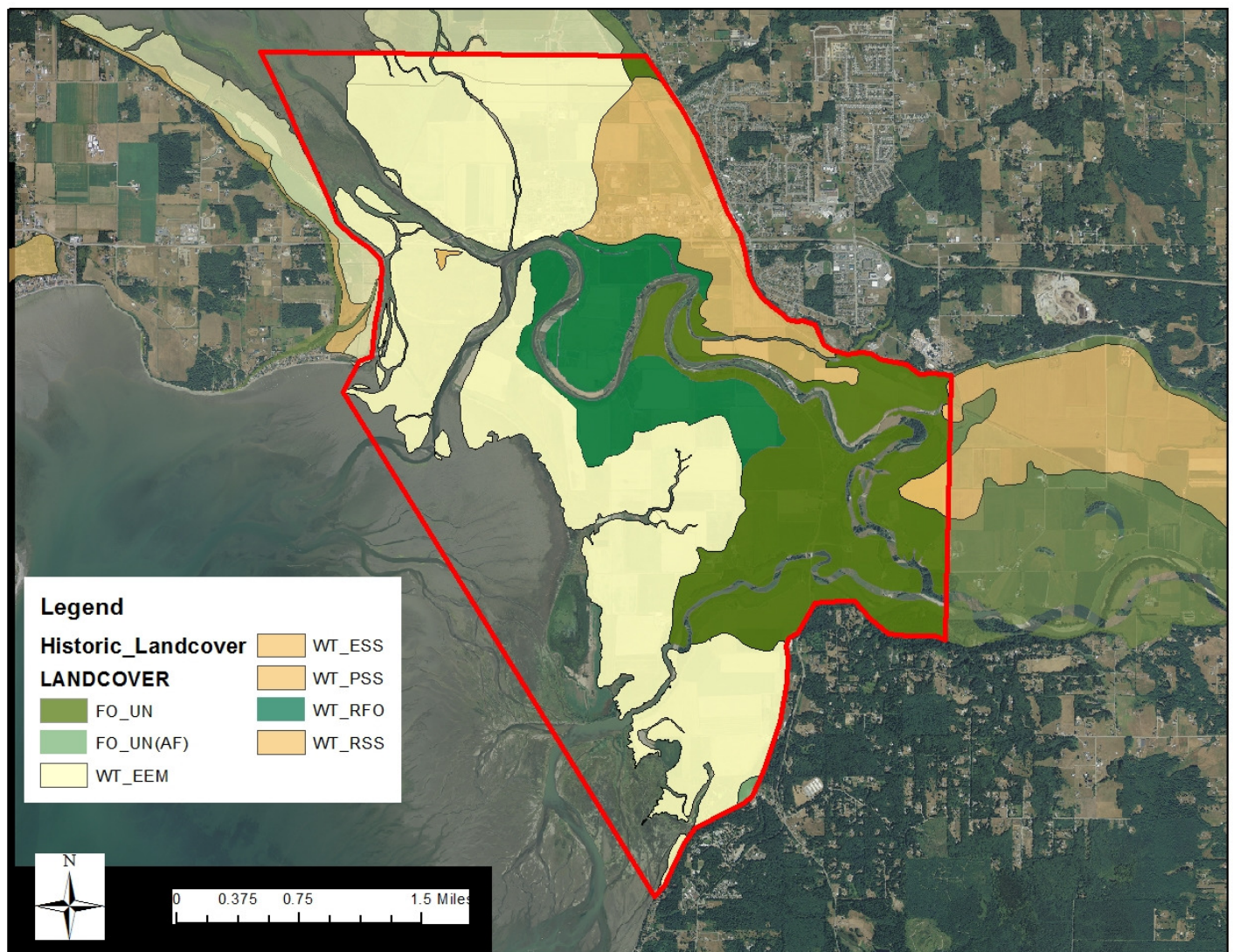


Figure 1. Collins Historic Estuary Habitat Layer, clipped to a modified Stillaguamish estuary priority restoration area (red polygon). “WT” stands for Wetland Type, though a portion of the FO_UN likely included tidal habitats.

Table 1. Detailed for the polygons depicted in Figure 1.

LANDCOVER	Description	AreaAcres	Category
WT_EEM	Estuarine emergent wetland	2,877.7	Estuarine Wetlands
WT_ESS	Estuarine scrub-shrub wetland	5.5	Estuarine Wetlands
FO_UN	Forest, undifferentiated type	1,280.9	Forested Floodplain
FO_UN(AF)	Forest, undifferentiated type (Alluvial Fan)	8.9	Forested Floodplain
WT_PSS	Palustrine scrub-shrub wetland	41.4	Palustrine Wetlands
WT_RFO	Riverine Tidal Forested Wetlands	627.6	Riverine Wetlands
WT_RSS	Riverine-tidal scrub-shrub wetland	650.7	Riverine Wetlands

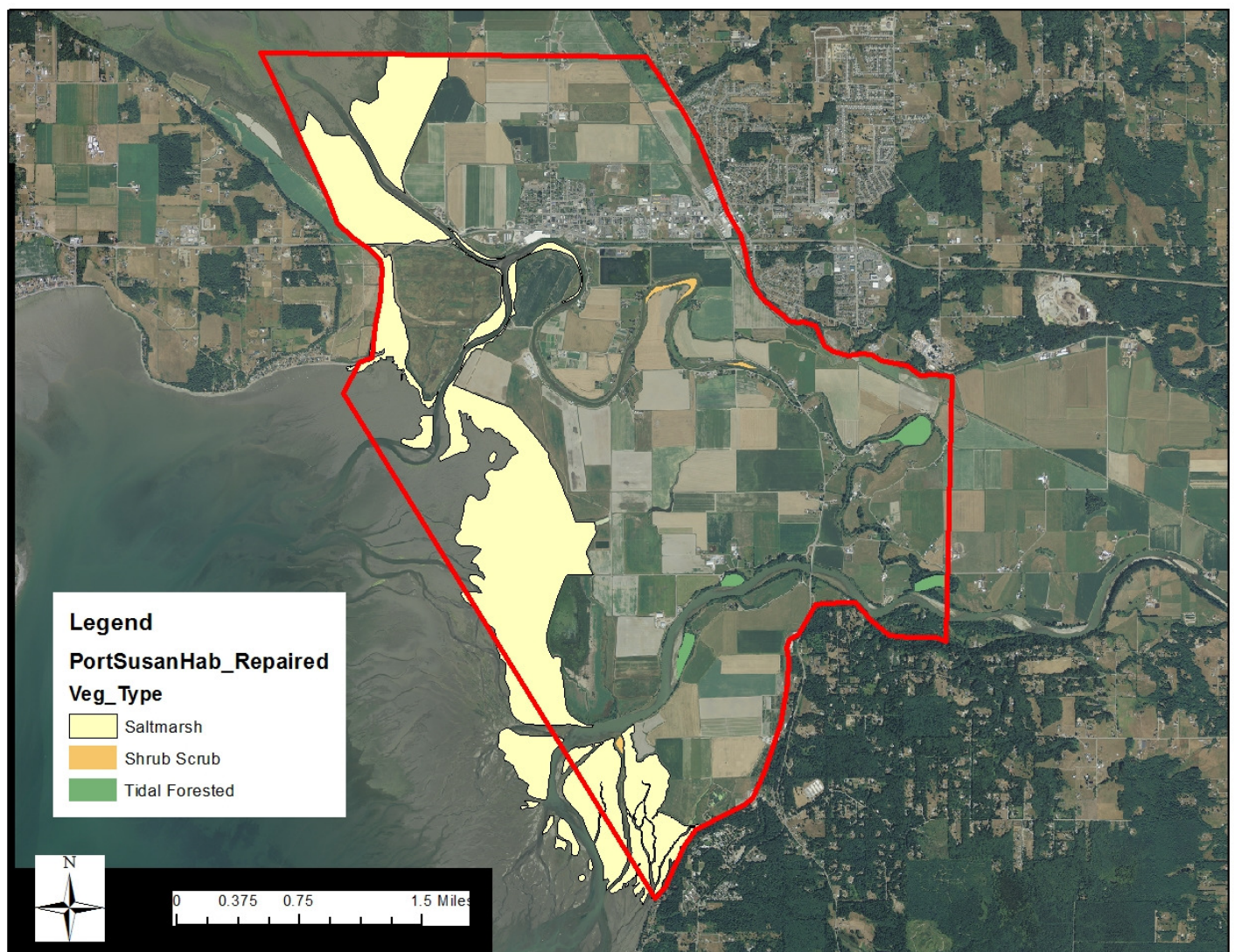


Figure 2. Current estuarine habitat including emergent marsh, shrub scrub, and forested tidal.

Table 2. Current (Griffith 2005) vs. Historic (Collins unpublished) estuarine habitat in the Stillaguamish delta along with DRAFT targets.

Habitat type	Est. Current Ac. (2005)	Est. Historic Ac. (~1870)	Est. % Reduction from Hist.	DRAFT 50 Yr. Target (Ac.)	DRAFT 10 Yr. Target (Ac.)
Emergent Marsh	1,426	2,878	50%	1,161	232
Shrub Scrub	9	1,120	99%	889	178
Tidal Forested	41	1,050	96%	808	162
Totals	1,476	5,048		2,858	572

Conclusion

While the exact acreages of each habitat type needed for PFC in the estuary are not precisely known, it is probable that there were extensive areas of shrub-scrub and riverine tidal forest accessible to Stillaguamish salmonids historically. These habitats are not specifically identified in the 2005 restoration targets. However, it is known that tidal forested and shrub scrub habitats are used extensively by juvenile Chinook salmon, and that these habitats have been virtually removed from the landscape (>95% loss, Table 2). We feel that the proposed update better captures the magnitude of restoration that is needed in the Stillaguamish estuary to restore PFC, and meet the goals of Chinook salmon recovery.

References

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