UPDATES TO THE 2005 PUGET SOUND CHINOOK RECOVERY PLAN

The Acquisition Strategy of the Stillaguamish Chinook Recovery Plan

Produced by: The Stillaguamish Technical Advisory Group, a subcommittee of the SWC

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Version 1.0

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1.0 Purpose

This strategy is intended to provide guidance to watershed stakeholders as they implement the Stillaguamish Watershed Chinook Recovery Plan. It provides a framework to prioritize parcels along the North and South Fork Stillaguamish, for both the conservation and restoration of floodplain and instream processes.

2.0 Goal

A corridor of protected lands along the Stillaguamish and its major tributaries where riverine processes are allowed to function naturally. The corridor will facilitate accelerated implementation of project types and quantities identified in the Chinook Recovery Plan, while protecting the floodplain from development and securing public recreation access. The corridor will also provide increased flood storage and conveyance, reduce infrastructure in the floodplain, increase human safety, and decrease flood damage claims along the Stillaguamish.

3.0 Background

The Chinook Recovery Plan (SIRC 2005 and subsequent revisions; the Plan) has geographic priority areas for five of the six limiting factors detailed in maps within the document (sediment, riparian, estuary, floodplain, large wood). The 2005 edition of the Plan indicates that more than 7200 acres of acquisition will be needed to reach the 50-year restoration targets, but it does not provide guidance as to where these lands are within the watershed, or how to rank potential acquisitions relative to one another. The SRFB review panel has commented several times on the need for the Stillaguamish Watershed Council to detail their acquisition strategy, and has indicated that RCO funded acquisitions cannot take place without a strategy is in place.

Implementation of restoration projects in the Stillaguamish over the past decade has illustrated that it is difficult to find willing landowners for certain project types- primarily floodplain reconnection, estuary restoration, and engineered log jam installation. The annual monitoring and adaptive management reports (M&AM) document the slow pace of implementation of floodplain/estuary/large wood project types (Purser 2012). These project types typically restore processes that encourage flooding and channel migration, or both, and require a large area along the river or shoreline. Most landowners have

infrastructure and/or land uses that are incompatible with uninhibited estuarine and riverine processes, while state law allows for hydraulic processes to be restricted to protect life and property (bank armoring, dikes). Consequently, watershed stakeholders have been working to acquire large areas of floodplain and former estuarine habitat in order to implement these high priority project types. There is a large amount of restoration work needed to recover Stillaguamish Chinook, illustrated by the depressed nature of the populations. The total Stillaguamish Chinook runsize is less than 5% of the TRT planning target for recovery (PSTRT 2002, Figure 1). Harvest rates have been reduced by almost 70% since the 1980's and hatchery programs instituted to rebuild the runs, but the Stillaguamish Chinook populations still remain at critically low levels. The Stillaguamish is undammed, but freshwater and estuarine habitats remain significantly degraded (when compared to PFC, The Plan).

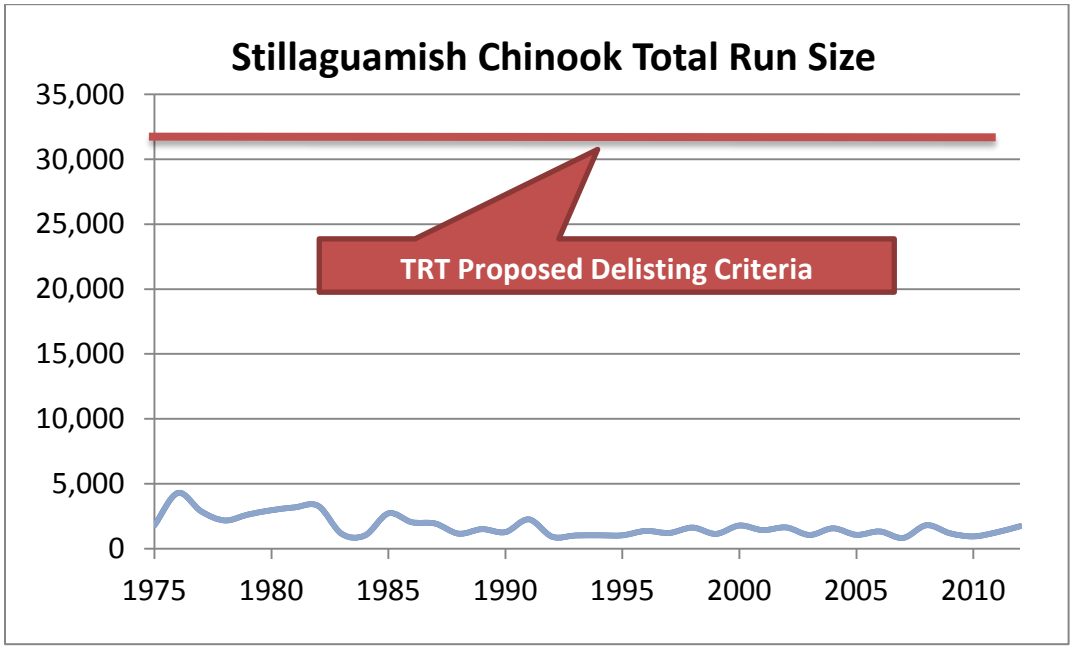

Figure 1. Stillaguamish total Chinook run size from 1975-2012. In recent years it has averaged less than 5% of the TRT recovery target (PSTRT 2002).

The Stillaguamish Technical Advisory Group (TAG) - a subcommittee of the Stillaguamish Watershed Council (SWC) - has talked at length about how to better work towards full implementation of Chinook recovery over the next several decades. From these discussions and a review of recent research (Beechie et al. 2010, Collins and Montgomery 2002, Collins et al. 2012, Roni et al. 2002) the TAG has agreed that a protected "corridor" of lands along the major Chinook producing waters of the Stillaguamish is necessary to

achieve the recovery goals detailed in the Plan. A corridor would allow for restoration of natural riverine processes, without impacts to private lands or public infrastructure. The Plan details the wide range Chinook specific benefits of restoring riverine processes, and already contains the concept of a restored corridor along the river, although it is not explicitly described as such (Figure 2).

Also termed "process based restoration", such an approach is supported by the literature as having the most certainty of restoring the riverine-floodplain ecosystems and the species that depend on them (Beechie et al. 2010). In the absence of work to restore floodplain forests and the ability of the river to migrate, Puget Lowland riverine ecosystems tend to stick in an alternate stable state of reduced biogeomorphic complexity (i.e. reduced salmonid production; Collins et al. 2012). In the absence of sustained and extensive work to restore natural processes, there is little expectation that salmon populations will improve significantly from their severely depressed state.

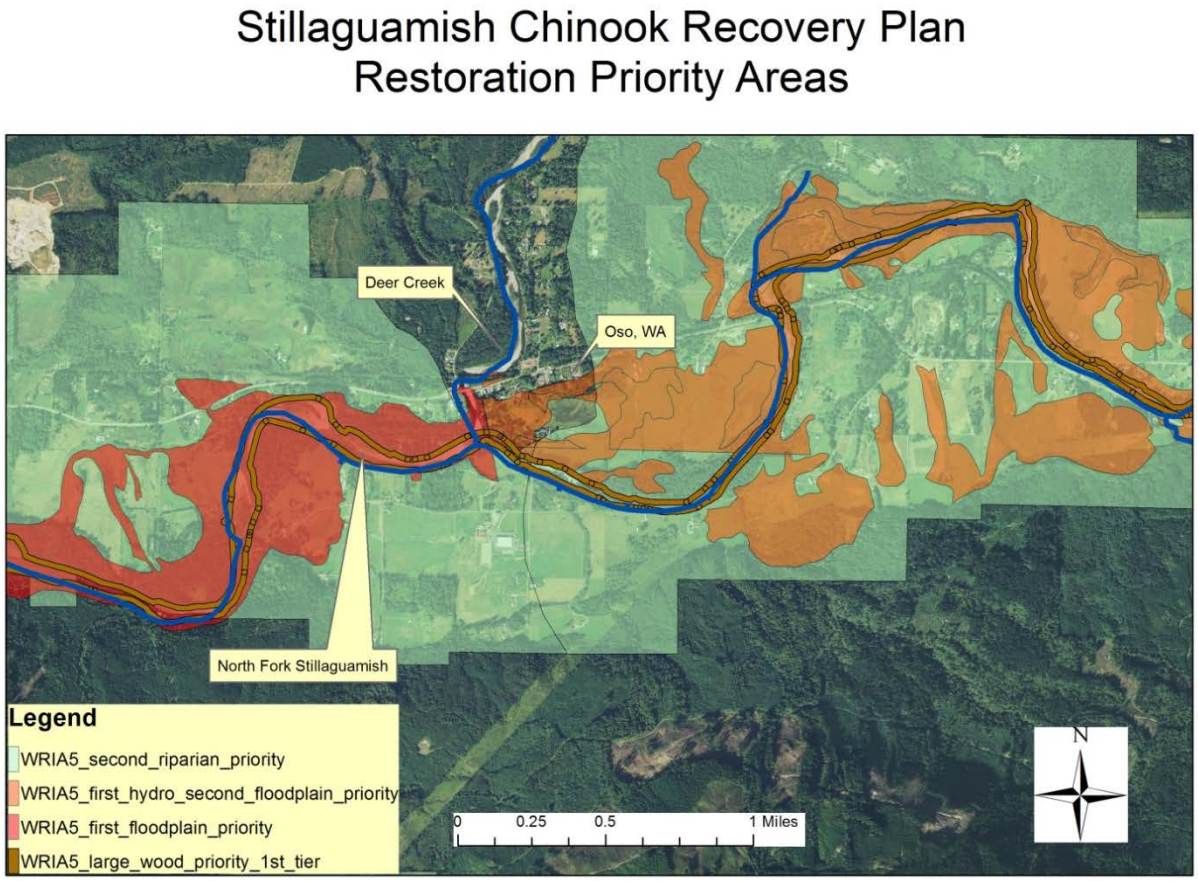

Figure 2. Aerial photo of the North Fork Stillaguamish near Deer Creek with restoration priority polygons from the Plan. A "corridor" is evident along the river where restoration work needs to take place in order to meet the Stillaguamish Chinook recovery goals.

Process based restoration is not fast, however. Even rapid growing tree species require 80-100 years before they reach a functional size for the large channels of the Stillaguamish (Collins and Montgomery 2002, Collins et al. 2012). Therefore, this acquisition strategy is a long term approach to correct ecosystem problems lacking expedient solutions. It will be essential to continue constructing instream wood structures until riparian planting, armoring removal, and dike setback can create and sustain healthy instream habitats. Especially in the case of armoring removal and dike setback, acquisition of the underlying land and adjacent channel migration zone will need to be accomplished as a first step. The latest climate predictions indicate that the rivers draining into the Puget Lowlands can expect to see 26-30% increases in atmospheric river (pineapple expresses) intensity by 2070 (Warner et al. 2014). This will undoubtedly create opportunities to purchase lands along the river as owners seek to move out of the way of more frequent floods.

Ideally a corridor of protected lands would extend from the uppermost Chinook tributaries to tidewater. There is a recent update to the Plan that describes the location and quantity of estuary restoration work that needs to take place to meet recovery goals (Griffith and Fuller 2013). This strategy doesn't cover the parallel work that will be taking place in the estuary over the coming decades, but there remains a gap between the estuary update, the Plan, and this acquisition strategy. Due to the policy/infrastructure concerns surrounding the acquisition and restoration of agricultural lands adjacent to the mainstem Stillaguamish, the inaugural version of the strategy is limited to the forks of the Stillaguamish, the major Chinook tributaries (Pilchuck, Jim, Boulder, Squire), and two potential side channel projects in the mainstem (South Meander and South Slough). Restoration of a corridor along the Mainstem Stillaguamish to tidewater will eventually be needed to meet the final Chinook recovery goals outlined in the Plan, but there is ample work to be done upstream and downstream in the interim.

Lastly, this strategy is not intended as a scoring tool for funding purposes- it is designed to evaluate a suite of properties in a limited funding situation where project proponents are looking to rank available parcels relative to one another. The strategy recognizes that that an efficient process-based approach for the Stillaguamish breaks the floodplain into discrete units that can be acquired and restored incrementally, before the entire corridor is protected.

4.0 Approach for lands along the mainstems of North and South Fork

This strategy draws heavily from the EPA-funded Stillaguamish Peak Flows study, which produced a GIS tool to prioritize floodplain area for conservation or restoration actions (Walter et al. 2014). The tool development involved dividing the active floodplain of the

North and South fork Stillaguamish into “floodplain units”, or FPUs. Floodplain Units are those discrete portions of the floodplain that are expected to be affected as a “unit” if channel migration is allowed to resume unencumbered. FPUs were created based on floodplain elevation (relative to site specific FEMA 100-year flood elevations) and geomorphology (Figure 3). Major transportation corridors in the floodplains (RR grades, state Highways, etc.) constrained the FPUs further than elevation alone would dictate, but this measure of pragmatism is necessary to ensure progress in a reasonable time frame (decades).

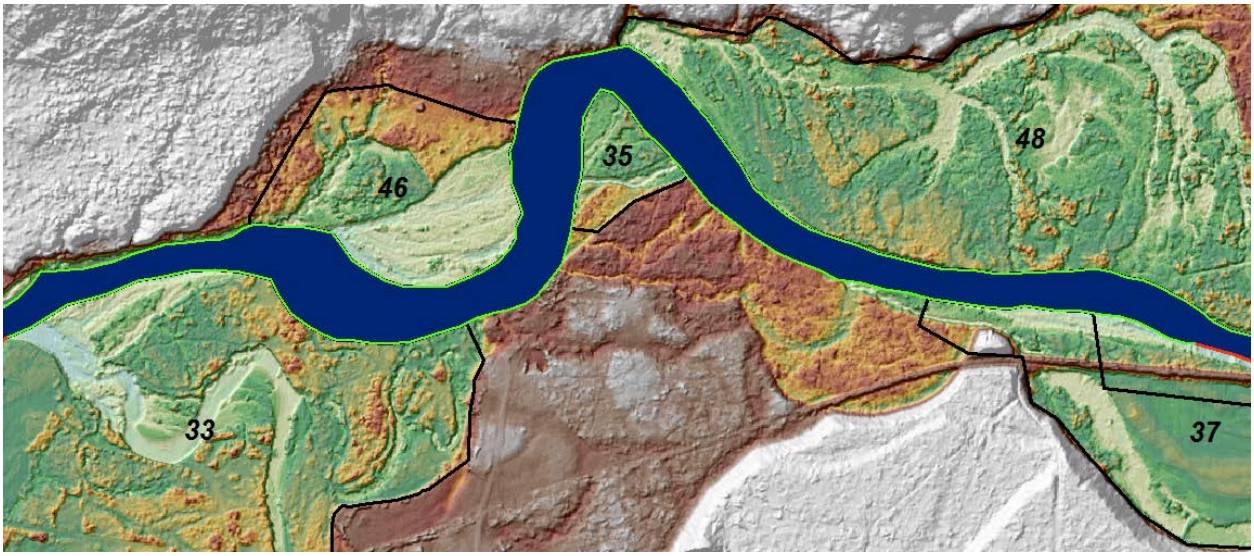

Figure 3. Shaded relief showing FPUs on the North Fork Stillaguamish just upstream of Boulder River. Black lines delineate FPU boundaries, green lines indicate natural banks, red lines indicate bank armoring. Brown or gray areas are outside of the active floodplain.

FPUs along the North and South Fork Stillaguamish were ranked for conservation or restoration themed acquisitions by the scoring the following metrics and weighting them (for more detail, please see Walter et al. 2014):

Channel Constriction
Premise: Floodplain units along more (naturally and artificially) constricted river channels are more desirable targets for restoration. Floodplain units along less (naturally and artificially) constricted river channels are more desirable targets for conservation.

Sinuosity
Premise: Floodplain units along less sinuous river channels are more desirable targets for restoration. Floodplain units along more sinuous river channels are more desirable targets for conservation.

Land Use Types
Premise: Floodplain units having a larger percentage of area in land uses more compatible (i.e. forestry, open space, agricultural, etc.) with restoration/conservation are more desirable targets for restoration/conservation.

Armoring
Premise: Floodplain units with a greater proportion of armoring are more desirable targets for restoration. Floodplain units with a lesser proportion of armoring are more desirable targets for conservation.

Number of Landowners
Premise: Floodplain units held by fewer landowners are more desirable targets for conservation/restoration.

Floodplain Elevation
Premise: Floodplain units having a lower average depth relative to the FEMA 100-year flood elevation are more desirable targets for restoration/conservation.

Scores were normalized to make all factors equal (details in Walter et al. 2014) before they were weighted to calculate the final score.

4.1 Weighting Factors

Not all the factors carry equal weight. The TAG members involved in the GIS tool development used best professional judgement to weight the factors to reflect the significance of each metric relative to all others in the prioritization.

Channel Constriction	1
Sinuosity	1.5
Land Use Types	2
Armoring	2.5
Number of Landowners	2.5
Floodplain Elevation	3

The weighted FPU scores were normalized on a scale of 0-10 for both Conservation and Restoration value and binned in increments of two, making a five stage color ramp that clearly identifies which FPUS are a higher priority for acquisition (Figure 4).

5.0 Approach for Lands Along Major Tributaries:

Chinook use of the major Stillaguamish tributaries (Pilchuck, Jim, Boulder, Squire) is much less than what is observed in the North or South Fork (Washington Department of Fish and Wildlife and Stillaguamish Tribe unpublished data). However, tributary use is important to preserving the diversity and spatial structure of the summer and fall Chinook populations. Diversity and spatial structure are two of the VSP parameters deemed essential for long term salmonid population viability (McElhany et al. 2000). Therefore, a similar FPU analysis was performed to add lands along these major tributaries to the corridors already defined for the North and South Fork. Floodplain units along the four tributaries were prioritized within two groups- Pilchuck with Jim, and Squire with Boulder. This reflects the differences in Chinook use of the tributaries by population- falls are more prevalent in South Fork, mainstem and their tributaries; summers are more common in the NF and its tributaries.

FEMA 100-year elevations are not defined for most of the tributaries of the Stillaguamish, and the FPUs of the tribs were defined differently than along the NF and SF. The tributary rules are summarized as follows:

1. An FPU borders a WDFW Chinook spawning Index.
2. An FPU is not more than 20 feet in elevation above the adjacent stream surface.
3. An FPU's width is greater than 2 times the adjacent stream's expected BFW.
4. An FPU is split at major roads or bridges.
5. An FPU is also split if it encompasses multiple lobes after following rules 1-4.

The metrics used to score the tributary FPUs were modified from those used on the North and South Fork. Since the tributaries are naturally less sinuous and more confined than the mainstems, these metrics were dropped. Comprehensive armoring data has not been collected for the tributaries, and that metric was dropped as well. This left Floodplain Elevation, Land Use Types, Number of Landowners and a new metric, Forest Maturity (Landsat derived), in the scoring matrix. Those FPUs with more mature forests are ranked higher for acquisition. Separate scoring scales were not used to value conservation or restoration potential differently, since the final suite of metrics would be scored similarly no matter which purpose a parcel was acquired for. The same metrics and weighting scheme were used for both groups of tributary FPUs.

5.1 Weighting Factors

Based on professional judgement of the TAG members who developed this strategy, the following weighting scheme was used to generate a final score:

Forest Maturity	1
Land Use Types	2
Number of Landowners	2.5
Floodplain Elevation	3

The FPU scores were normalized on a scale of 0-10 after the weighting factors were applied. For display purposes, the normalized scores were binned in increments of two, making a five stage color ramp that clearly identifies which FPUS rank higher for acquisition (Figure 4).

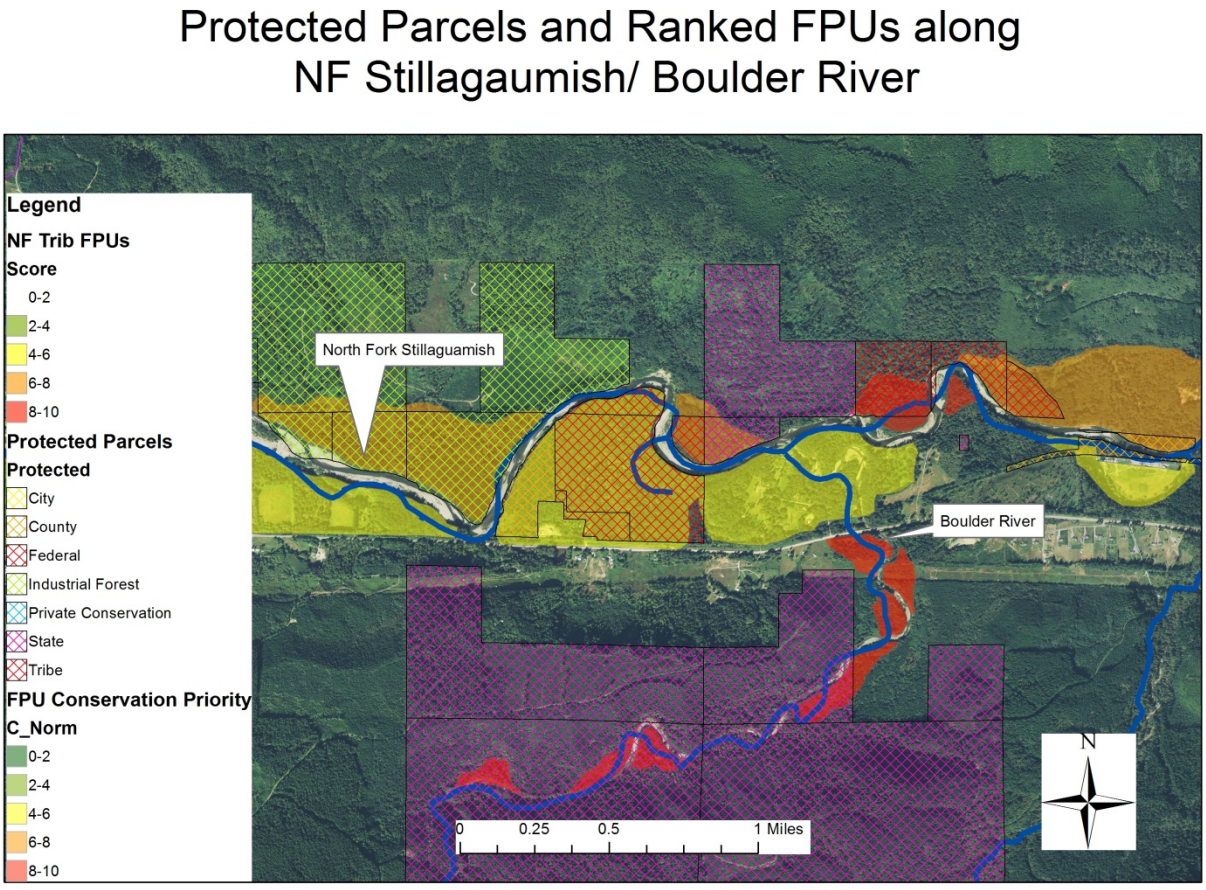

Figure 4. FPU prioritization scores along the North Fork Stillaguamish and Boulder River. Protected parcels are indicated by cross hatching. This is a sample of the layers that will be available to watershed stakeholders to help with their scoping of acquisitions.

6.0 Approach for Lands along South Slough and South Meander

South Slough and South Meander are two conceptual side channel reconnection projects along the mainstem, near Interstate 5. Both projects would restore flow to relic side channels and provide off-channel rearing habitat for juvenile salmonids. Off-channel rearing habitat, especially in the mainstem, has been drastically reduced from what was historically available to juvenile salmon (SIRC 2005). Opportunities to restore unrestricted channel migration are extremely limited along the mainstem Stillaguamish due to intensive agricultural use and an extensive infrastructure network and these engineered side channel projects are the best chance of increasing rearing area in the next 10-20 years. Since neither would restore unrestricted flow to these channels, large acquisitions are not likely to be needed across the length of both channels. However, this strategy acknowledges that some conservation easements or fee simple acquisitions are probably necessary to advance these high priority projects. Since acquisitions in these areas would not restore natural processes in the same way as the corridor lands described in the above FPUs, lands along South Slough and South Meander were not ranked. This does not mean that these side channel projects are not a priority, since they are essential for advancing the targets outlined in the Chinook Recovery Plan. However, it would be difficult to rank them against acquisitions in floodplain units.

7.0 Final Prioritization of Parcels

The FPU scoring is the building block of the strategy, but an additional factor is considered in the prioritization of individual parcels being considered for acquisition. If the parcel under consideration is adjacent to a "protected" parcel, the score is increased by 5 points, if the parcel connects two or more protected parcels the score is increased by 10 points. In this context a protected parcel is defined as one that is: under a conservation easement, managed under State, Federal, or industrial forest rules, or otherwise owned by a governmental entity and managed for natural resources protection. These parcels are either managed under restrictive plans such as the DNR State Lands HCP or the Northwest Forest Plan, or are held for conservation or open space purposes. It does not mean that no land disturbing activity will occur on these parcels, but that the regulations that they are managed under will not impair floodplain processes. In some instances, private lands are included where it is certain that the underlying deeds are encumbered by conservation easements. Protected parcels are indicated by cross-hatching in Figure 4. The layer of protected parcels is maintained by the Stillaguamish Tribe, Natural Resources Department, and is updated annually.

For lands along the North or South Fork Stillaguamish the total score includes both the conservation and restoration subtotal, along with the adjacency score. This acknowledges that acquisitions along the Mainstems all involve some degree of conservation (preventing development, logging, etc.) and restoration (invasive control, planting, armoring removal, etc.) related work. Given the management history of the watershed, there aren't any properly functioning lands in the valley bottoms.

This is the scoring matrix for the lands along the North or South Fork Stillaguamish:

NF/SF	Conservation Score	Restoration Score	Adjacency Score	Total
Score	0-10	0-10	0-10	0-30

And, for lands along the Tributaries:

Tributary	Conservation/ Restoration Score	Adjacency Score	Total
Score	0-10	0-10	0-20

All of the GIS files used in developing the prioritization framework are available from Stillaguamish Natural Resources upon request. As this strategy evolves over time, the GIS files will be updated accordingly.

Lands along South Meander and South Slough were not scored due to the limitations detailed in section six. Best professional judgement will be used to rank South Slough and South Meander acquisitions against parcels located within FPUs, should the situation arise.

8.0 Discussion

This strategy is designed as a tool for watershed stakeholders to help prioritize acquisition of available parcels when funds are limited. Priority should be given to linking protected parcels in the highest ranking FPUs, and stakeholders are encouraged to reach out to the landowners of especially critical parcels. However, it may be that in some years available parcels won't be adjacent to any already protected parcels. This shouldn't prevent acquisition of a parcel if it is within one of the delineated FPUs. Restoration of a corridor along the Stillaguamish will take many decades (Collins et al. 2012), and planting work can take place on stand-alone parcels while the surrounding land is acquired. Most tree

species won't contribute functional and stable wood to the major Chinook bearing waters of the Stillaguamish until they are 80-100 years old, and the sooner planting work takes place, the better.

It is also based on the assumption that the remainder of the floodplain outside of the corridor described in this document will be protected from significant development and will continue to provide flood storage and refugia. The Biological Opinion from NOAA regarding implementation of FEMA's National Flood Insurance Program outlines strict requirements for land disturbing activities in the floodplain, and this acquisition strategy depends on NOAA holding local and state jurisdictions to these standards (NMFS 2008). Additional efforts to restore historic floodplain storage through levee removal or setback may also be necessary to mitigate for past modifications, and to accommodate increasing peak flows. The ability for the floodplain to provide storage during extreme events is an essential ecosystem process to mitigate the effects of high flows.

Lastly, the SWC acquisition strategy should be viewed as a work in progress that is designed to evolve with our understanding of the watershed and the realities of effective natural process-based restoration in a heavily managed and degraded landscape. We anticipate revisions will be needed as watershed stakeholders use the tools and provide feedback. However, this is the first time that the Stillaguamish has adopted a vision for advancing floodplain restoration progress throughout the watershed, and the guidance provided in this document should more effectively sequence conservation and restoration acquisitions.

9.0 References

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