Appendix D: FCRPS Biological Opinion Tributary Habitat Projects: From Inception to Implementation

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This narrative describes the inception, evaluation and implementation of tributary habitat improvement projects for salmon and steelhead under the Biological Opinion (BiOp) for the Federal Columbia River Power System. It explains how projects emerge, how expert panels with local knowledge assess the benefits of projects before and after implementation and how the Action Agencies ensure that the projects are implemented effectively to meet the expectations of the expert panels.

The expert panel process is employed to evaluate changes in habitat quality improvement associated with completion of habitat improvement field projects that address key limiting factors for most of the Snake River and upper Columbia River Chinook and steelhead populations identified in the 2008/2010 FCRPS BiOp RPA Action 35, Table 5. Results from the Expert Panel process measure the accomplishment obtained by the Action Agencies and regional partners in reaching the Table 5 habitat quality improvements (HQIs). This description elaborates on the process described in Appendix C of the Comprehensive Analysis for the 2008 BiOp and describes how the process has been implemented during the initial years of the BiOp.

Background: A scientific foundation

The Expert Panel concept of local biologists assessing conditions for fish within individual watersheds and identifying the factors limiting fish populations, as called for by the BiOp, is not new. It has its roots in the 1990s, when Congress and the Northwest Power and Conservation Council (then called the Northwest Power Planning Council and referred to hereafter as the Council) took steps to strengthen the scientific basis and objectivity of the Council's Fish and Wildlife Program, designed to guide funding by the Bonneville Power Administration of mitigation for the effects of federal dams. This is important because the steps have carried through to today. Most habitat improvement projects at the time took place under the auspices of the Fish and Wildlife Program. Projects were often opportunistic, taking advantage of available funds and willing landowners, but not necessarily systematic in terms of applying resources where science showed they would do the most good for fish. The steps by Congress and the Council responded to a series of recommendations and directives from science organizations. As early as 1996, for instance, the National Research Council, an arm of the National Academy of Sciences, published a report on Northwest salmon (National Research Council 1996) calling for:

- Protecting the genetic diversity within salmon species.
- Recognizing and working with local breeding populations and their habitats.
- Working to protect salmonids at the watershed scale.
- Recognizing that different approaches are necessary in different watersheds, even if the goals are the same.
- Assessments of each major watershed or basin to identify causes of mortality (in other words, limiting factors) and the best means of addressing them.

That same year Congress followed with an amendment to the Northwest Power Act that for the first time required independent science review of BPA fish and wildlife projects before they are considered for funding. Shortly thereafter, the Council's Independent Science Group (ISG), created by the Council in 1992 to provide scientific advice, issued the first independent scientific review of the Fish and Wildlife Program. It reflected many of the same conclusions as the National Research Council and recommended an "integrated approach" to salmon protection and recovery and "rigorous program of evaluation, monitoring, research and adaptive management" (ISG 2000). The review was published in 2000 as "Return to the River: Restoration of Salmonid Fishes in the Columbia River System."

The Council responded with an overhaul of the Fish and Wildlife Program that adopted an ecosystem management focus and directed that implementation be guided by locally developed subbasin plans that address the unique conditions and challenges in each of about 60 subbasins within the Columbia River system. The plans identified limiting factors in each subbasin and included management plans with steps to address them. The Independent Scientific Review Panel (ISRP), a group of experienced scientists recommended by the National Research Council and appointed by the Council, reviewed each subbasin plan to assure that it was scientifically sound. Following ISAB approval the plans were adopted by the Council as amendments to the Fish and Wildlife Program, which, now accompanied by the BiOp, continues to guide BPA funding for mitigation projects. The purpose of the subbasin plans was to identify limiting factors affecting fish in each subbasin for the purpose of developing projects to implement the Fish and Wildlife Program. The ISRP also continues to review the science behind each mitigation project proposed for BPA funding, including habitat projects proposed under the BiOp.

Subbasin plans were followed in many parts of the Columbia River Basin by the development of recovery plans, science based blueprints for the recovery of salmon and steelhead listed under the Endangered Species Act. The first listings began in the 1990s and required the development of recovery plans. The recovery plans developed with NOAA guidance built upon the subbasin plans and went further by identifying specific actions, costs, and time frames and then using models to examine and refine the actions based on how effectively they would contribute to salmon recovery. Both the subbasin plans and, where they exist, recovery plans, proved to be important sources of information and knowledge for the expert panels regarding local conditions and potential projects.

How habitat projects emerge

The significance of subbasin and recovery planning is that habitat improvement projects proposed under the BiOp are based on a foundation of local knowledge developed over more than a decade. Although subbasin and recovery plans are not directly connected to the BiOp, they are complementary. While developed primarily as local blueprints for the Fish and Wildlife Program, the subbasin plans were also expected to help fulfill requirements of the BiOp (an earlier version in place at the time) and recovery plans. Many of the principles behind the subbasin and recovery plans, the types of habitat projects they outlined and the local knowledge gained through their application have carried over to habitat improvement plans under the BiOp. For instance, much of the work that went into identifying limiting factors and effective mitigation projects for the subbasin and recovery plans has continued to inform the development of projects and work of the expert panels under the current BiOp.

Such knowledge and expertise is typically maintained by local watershed groups that may include model watersheds, recovery boards and technical teams as well as other local biologists and experts affiliated with states, tribes and local agencies. These are the same organizations that assist with establishing and supporting the expert panels. In some cases the groups were established after development of the subbasin plans to provide local direction for subsequent salmon and steelhead recovery plans developed with the guidance of NOAA Fisheries. The overlapping purposes of the groups – for instance, supporting the BiOp, Fish and Wildlife Program and recovery plans – is intended and beneficial, so that work under the different initiatives can be coordinated to make the most of available resources.

Just as the subbasin and recovery plans are tailored to local conditions, many of the locally based groups have developed their own systematic approaches to identifying, evaluating and prioritizing projects to go forward under the BiOp and other habitat improvement programs. These individual strategies typically account for unique local conditions and concerns in ways that a single universal

approach to project selection would not. They also provide a science-based structure that helps guide potential project sponsors in developing and refining projects before they reach the expert panels.

For example, local biologists in the Upper Columbia region formed the Upper Columbia Regional Technical Team (RTT) to discuss and address habitat and other issues affecting salmon and steelhead in the region. The Upper Columbia Salmon Recovery Board (UCSRB), established to develop and coordinate the recovery plan for the Upper Columbia, then took advantage of the RTT to provide technical support for habitat restoration. The RTT includes nearly 15 scientists and other authorities on habitat conditions, who together drafted, "A Biological Strategy to Protect and Restore Salmonid Habitat in the Upper Columbia Region," a 200-plus-page document that is regularly reassessed and updated – most recently in 2013. (*See Appendix D, Attachment 1 for a synopsis of this document.*) It includes a scientific foundation for restoration activities in the Upper Columbia and outlines priority areas for habitat protection and restoration as well as individual biological objectives by subbasin and watershed. In addition, it includes scoring criteria to evaluate and prioritize projects for available funding, giving heavier weight to whether projects address primary ecological concerns and improve freshwater survival of the target species.

The strategy also provides guidance for using habitat assessments such as tributary and reach assessments completed or in process by interdisciplinary teams of experts from the Bureau of Reclamation. The reach assessments evaluate the conditions of specific tributaries or reaches, identifying those where habitat improvements could be expected to provide the greatest benefits. About 20 of the assessments have been completed or are in process, with the intent of filling gaps in technical knowledge and providing insight and advice that might not be available locally.

Following completion of Reclamation's reach assessment for the Lower Entiat River, for instance, the RTT met with Reclamation's core team to translate the results into detailed guidance for potential project sponsors. The guidance focused on the development of projects that are suited for the geomorphology of the river and are biologically appropriate to meet the goals and objectives outlined for the Lower Entiat in the local biological strategy described above. The guidance included a spreadsheet outlining potential actions that could be developed to address certain limiting factors for salmon within the Lower Entiat assessment area and a recommended list of specific actions to address limiting factors at specific locations within the reach. For instance, recommended actions included placement of engineered log jams at the apex of islands at approximately river mile 6.3 and four other specific points down stream and removal of levees at several specific points to provide the river with renewed access to the floodplain. An accompanying map displayed sites of the recommended habitat improvement projects as well as related river conditions.

Another important advance in informing both the planning and evaluation of habitat projects was the development by the U.S. Bureau of Reclamation of so-called "limiting factor pie maps" that visually depict limiting factors and habitat conditions in individual assessment units. These provide the panels an immediate picture "at a glance" of the current state of limiting factors and, in turn, the condition of habitat in each assessment unit, along with indications of the how far the units are from "fully functioning condition." Assessment units are derived from the subbasin and recovery planning processes and represent smaller units of a watershed with common limiting factors that would be expected to respond to a certain habitat treatment in a similar way. The pie maps help project planners and expert panels quickly compare and assess conditions across watersheds to focus on those areas where habitat improvement projects would provide the greatest value.

The UCSRB and RTT also provide for adaptive management at the local scale. The RTT hosted a five-year analysis and synthesis workshop in January 2010, where biologists discussed fish and habitat

status and trends, action effectiveness of habitat actions and research needs. A report of the workshop was adopted by the RTT in October 2010 as Ward et al. (2010).

This provides one example of how habitat information is gathered, how prospective habitat improvement projects are identified and how they are evaluated through locally developed strategies that account for the conditions of individual watersheds. Other regions, such as the Lower Snake and Upper Salmon (*Appendix D, Attachment 2*), have developed similar processes to advance salmon recovery in ways that account for local conditions. Representatives of the Action Agencies also observe and track the evolution of habitat improvement projects through this process so that they have a picture of what upcoming opportunities are available. Where the Action Agencies have identified a need for additional habitat actions to benefit certain populations or ESUs, they may encourage sponsors to pursue projects in the appropriate areas. The project sponsors, often working with local landowners, develop the projects and then take the projects to the RTT for initial evaluation and scoring. This information, along with much additional information to be described below, then informs the expert panels convened under the BiOp. Since many expert panel members were involved in developing the earlier plans and information, many come to the panels with advance knowledge of habitat conditions and prospective improvement projects.

Forming the expert panels

Members of the expert panels are authorities on local habitat conditions and fish populations, although there are not specific selection criteria for panel members. The required expertise and knowledge of local habitat conditions can be developed in various ways and may not necessarily be reflected in certain academic degrees or years of experience. Typically, but not always, expert panel members are biologists or other scientists with local, state, tribal and federal natural resources or wildlife agencies. The number of local scientists with the background knowledge expected of expert panel members is typically limited. Most if not all are well known to each other, to local organizations involved in habitat rehabilitation and to the Action Agencies by virtue of their involvement in earlier habitat improvement initiatives including development of the subbasin plans and recovery plans. The result is that those most qualified to serve on the expert panels were usually widely recognized from the start and the Action Agencies engaged them in the process. The expert panels meet in three-year cycles to evaluate habitat improvement projects, convening most recently in 2012.

For example the 2012 Expert Panel for the Upper Columbia included a core regional team of experts from the Colville Tribes and Yakama Nation, Washington Department of Fish and Wildlife, public utility districts with their own habitat programs, U.S. Forest Service, U.S. Fish and Wildlife Service, NOAA Fisheries, Natural Resources Conservation Service and consulting biologists with experience in the area. Additional teams of experts on individual subbasins supplement the core panel when evaluating projects in those subbasins. For instance, the Entiat subbasin team includes experts from the Yakama Nation, Cascadia Conservation District, U.S. Forest Service and U.S. Bureau of Reclamation (the Reclamation expert participated in the Entiat reach assessment described above). Members of the expert panels submitted written descriptions of their qualifications as documentation of their expertise. Members representing organizations that also propose and sponsor projects are asked to recuse themselves from evaluating projects proposed by their organization.

The expert panels themselves do not design, develop or propose habitat improvement projects. Their one role is to examine projects and assess the degree to which the projects will address the limiting factors for salmon and steelhead. Since there is overlap between members of the RTT and expert panels, it is common for members of the panels to have encountered and examined the projects before and thus to be generally familiar with their design and objectives.

Expert panels are provided with numerous sources of information to supplement their professional knowledge and experience. Among the most important sources of background information on habitat conditions and limiting factors are recovery plans, where they are available, and the subbasin plans where they are not. Other information provided to the expert panels include details of the BiOp (both the original 2008 BiOp and 2010 Supplemental BiOp and AMIP) and the Habitat Collaboration Workgroup approach outlined by the BiOp. They are also provided with standardized definitions of limiting factors released by NOAA Fisheries in 2011, which the expert panels will use to evaluate actions completed from 2013 on. (The original set of limiting factors was used through 2012). They are also provided a wide array of background material on relevant issues including climate change and invasive species as well as the results of habitat monitoring programs and action effectiveness monitoring.

Background materials for the expert panels are provided in advance at a dedicated Bureau of Reclamation website, *http://www.usbr.gov/pn/fcrps/habitat/panels/index.html.*

How the expert panels work

Although expert panels represent an important core step in translating the effects of habitat improvement projects into benefits for fish, they meet only every three years. This allows for interim periods of planning, implementation, and research. During these regular workshops, the panels evaluate habitat improvement projects that have been completed during the previous three years. They compare the metrics of completed projects with those originally expected from the projects to determine whether the projects were implemented as expected. If not, the panels may adjust their findings as described below. The expert panels also "look forward" to examine planned and potential habitat improvement projects, along with the anticipated metrics of the projects.

The Action Agencies, with help from local watershed groups, assembled seven expert panels across the Columbia River Basin. The expert panels focus primarily on watersheds occupied by listed populations identified as priorities under the BiOp. Six of the panels address salmon and steelhead populations in the upper Columbia River, lower Snake River, Wallowa and Imnaha rivers, upper Grande Ronde River, lower Salmon River, and upper Salmon River. A seventh panel addresses Clearwater River steelhead. The panels all use the same process to evaluate projects, following guidance specified in the BiOp, based on how the projects address limiting factors. The primary steps include:

Identify key limiting factors. Expert panels use available information such as subbasin plans, monitoring and recovery plans, research results and the panel members' own knowledge of local conditions to identify environmental characteristics that constrain adult holding and passage, spawning, redds (nests of fish eggs), emergence, summer and winter growth and rearing, and smolting of salmon and steelhead populations in tributaries to the main stem of the Columbia and Snake rivers. Access to quality spawning and rearing habitat, mechanical injury, lack of sufficient streamflow, and lack of in-stream channel complexity are examples of key limiting factors. Different limiting factors may affect fish survival in different parts of each tributary. As noted above, parts of tributaries with a common set of limiting factors are called assessment units, many of which were first identified through subbasin and recovery plans. Assessment unit boundaries and associated key limiting factors can be different for each salmon and steelhead population, even when they occupy the same tributaries. The benefit of using assessment units is that they divide watersheds into sections that each have common characteristics, providing a more detailed picture of which limiting factors apply to which parts of the watershed. Expert panels began using a standardized set of limiting factors

and definitions developed by NOAA for projects completed from 2013 onward (Hamm 2012). The panels can also reconsider and update the limiting factors as conditions change.

Identify limiting factor status. When evaluating projects, expert panels assign three numeric values between zero and one to each limiting factor. The numeric values are related to Properly Functioning Condition (NMFS 1996), which reflects habitat quality and which NOAA has described as the habitat component of a species' biological requirements (NMFS 1999). A low value indicates that the status of the limiting factor is poor and is constraining fish populations. A higher value indicates that the status of the limiting factor is relatively better and is not limiting fish populations as severely. The Expert Panel first assigns a value to represent the current status of the limiting factor, prior to any habitat actions. This is called the "low bookend." Two other values represent the near and longer-term potential for improvement in each limiting factor through implementation of all reasonably feasible habitat improvement actions.

The first of these represent the relative improvement in the limiting factor expected from those habitat actions by 2018, the end of the 2008/2010 FCRPS BiOp. The second represents the improvement in the limiting factor expected by 2033, 25 years after the end of the 2008/2010 FCRPS BiOp. These are called the "2018 and 2033 high bookends," respectively. For example, the riparian condition may be assessed a low bookend of 40 percent, a 2018 high bookend of 50 percent and a 2033 high bookend of 80 percent. This recognizes a relatively small potential for riparian vegetation to grow and provide improvements by 2018. But as the vegetation matures, the full value of the action accrues between 2018 and 2033. In another example, the limiting factor of access by fish to rearing habitat may be assessed a low bookend of 40 percent, with 2018 and 2033 high bookends both assessed at 80 percent. This indicates that all the expected improvements from projects addressing this limiting factor will accrue by 2018, with no additional future improvement beyond 2018.

For projects completed during the previous three years, the expert panels assess whether they were completed as planned by comparing the actual metrics (such as miles of stream improved or barriers removed) to the expected metrics. If the projects were completed as planned, the Expert Panel accepts the change in limiting factor assigned previously unless newly documented scientific evidence warrants a different value. If the project changed to include more or fewer habitat improvements than originally planned, the panels debate and decide whether the changes in limiting factors they assigned earlier should be increased or decreased accordingly. For projects scored earlier by the expert panels but never completed, any associated change in limiting factor is discarded. The process is repeated for each limiting factor, assessment unit and steelhead and Chinook population.

Identify limiting factor weights. Certain limiting factors may have a greater relative effect on salmon and steelhead in some areas than others. Expert panels may assign weights between zero and one to different limiting factors to recognize the relative importance of each limiting factor in the appropriate area. For example, a given assessment unit or population may be limited by three primary factors: high levels of fine sediments, lack of woody debris, and a lack of off-channel habitat. In this case, biologists weight each habitat variable by its relative importance to fish survival. For instance, they may weight fine sediment highest, because it has a relatively larger effect on fish survival than the other two factors. The resulting weights may be 0.75 for fine sediment, 0.15 for off-channel habitat, and 0.10 for woody debris. The sums must equal 1.00. Expert panels are not required to weight limiting factors differently, but can if they feel it is warranted. The purpose of assigning weights is to make sure those factors or habitat variables with a relatively greater effect on fish survival or productivity are accurately reflected in representations of overall local habitat condition.

Identify assessment unit weights. The landscape and geomorphology in some assessment units provide greater spawning and rearing habitat potential than others. In the development of recovery plans, NOAA's Northwest Fish Science Center (NWFSC) developed a method for calculating this

potential based on local habitat characteristics. The result is a numerical indication of "intrinsic potential" that reflects the relative potential for the habitat to support salmon and steelhead. For instance, an assessment unit dominated by high gradient streams that are relatively inhospitable to fish may have low intrinsic potential regardless of habitat improvements, while one with lower gradient streams and numerous pools may have higher intrinsic potential that makes it a better candidate for improvement. The relative weights help discern those assessment units where habitat improvement projects could be expected to best capitalize on local conditions to produce benefits for fish. Improvement projects would ideally be concentrated in assessment units with poor habitat conditions (as represented by low limiting factor values) but high intrinsic potential. Such units would be expected to have significant potential to support fish, if habitat conditions can be improved. Expert panels may adjust intrinsic potential values based on new information or justifications that supplement the scientific data used in the NOAA NWFSC intrinsic potential analysis.

Finally, the Action Agencies compile the findings of the expert panels into an online database accessible to panel members, who then perform a final review. Once panel members have reviewed the results for accuracy, the Action Agencies use a mathematical procedure described in the BiOp to convert the changes in limiting factors as estimated by the expert panels into the expected percentage in habitat quality improvement that is the BiOp's yardstick for measuring improvements in habitat (Appendix C). HQIs represent survival improvements under the BiOp. The calculations by the Action Agencies take into account the weighting assigned by the expert panels to different limiting factors and different assessment units.

Ensuring project completion

In recent years BPA has invested in the development of Pisces and Taurus. Taurus facilitates tracking of funds and project completion, and ensures that funded projects address the specific limiting factors identified by the expert panels. This allows BPA to measure success not by the dollars spent but by the actual results delivered. The system provides additional accountability and transparency in the use of funds, which in turn yields increased confidence that the work funded by BPA is tied directly to actions that will improve the condition of those limiting factors. Most of the information described below is publicly accessible through the website *www.cbfish.org*, which is the public portal for the Taurus system. This includes roughly 80 percent of the information associated with habitat projects. The specific projections of the expert panels are in a secure section of the website to avoid alteration of the input outside of the expert panel process. A description of how Taurus relates to BPA business practices and links to expert panel products is presented in Attachment 4 .

Each habitat project may encompass one or more specific actions, which are represented in the Taurus system as individual work elements and associated metrics. Work elements may include, for example, installing fish passage structures. The metrics associated with each work element are categorized according to the specific limiting factor, as designated by the expert panels, that the work is designed to address. An anticipated value (miles of increased stream access or complexity, for example) is attached to each metric and BPA COTRs are responsible for ensuring the values are accurately represented in each contact. Each year BPA COTRs and sponsors review contracts to be sure the work elements and associated metrics still appropriately reflect the work that is being delivered under the contract. This provides BPA, project sponsors, expert panels and others with a clear picture of how each work element and associated metrics are expected to benefit fish, and how this relates to the work of the expert panels. It also serves as a systematic and structured way of assessing the results. The metrics can then be evaluated following completion of the project to

determine whether the project was completed as planned or if it underwent changes that warrant reassessment by the expert panels.

The system provides BPA and other stakeholders with more detail on the specific elements and progress of each habitat improvement project, which serves as an important tool to help BPA plan and track the millions of dollars dedicated annually to habitat projects. Direct annual fish and wildlife spending by BPA has increased by about $100 million since 2008, much of it to support habitat improvement projects under the BiOp. Spending over the life of the BiOp provides a measure of assurance that habitat improvement projects will continue to be implemented over time, avoiding any shortfalls at the very end of the BiOp. The Taurus system, which allows regular updates of project progress and spending, provides for tracking of projects in increased detail, which in turn provides more current and complete information on actual spending. This additional detail helps BPA monitor spending more closely so the agency can make the most of its available budget and use the full amount of funds available without overspending.

The Taurus system also provides for more effective "roll-up" of all habitat improvement metrics, improving BPA's ability to track total BiOp accomplishments.

In sum, the development, implementation, and evaluation of habitat improvement projects involves a lengthy and highly detailed process founded in scientific recommendations and direction identified in early reviews of the Fish and Wildlife Program. It provides for the local design and development of habitat projects according to local conditions as well as systematic evaluation of projects by expert panels under the framework outlined in the BiOp and according to established biological criteria. BPA then tracks progress to assess whether the Action Agencies are successfully addressing limiting factors, providing the anticipated biological benefits for fish.

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Attachment 1: Summary: A Biological Strategy to Protect and Restore Salmonid Habitat in the Upper Columbia Region

The biological strategy for the Upper Columbia Region (UCR) (2013) identifies the *key biological considerations in protecting and restoring habitat for salmonids*. The strategy is *intended* for use by project sponsors *to identify* the *locations and types of projects* with a high likelihood of improving abundance, productivity, spatial structure, and diversity for ESA-listed salmonids.

The 2013 strategy updates the strategy developed by the Regional Technical Team (RTT) of the Upper Columbia Salmon Recovery Board (UCSRB). The RTT was formed in 2000 to provide technical support to guide UCSRB restoration efforts. The strategy documents the technical foundation for setting priorities for developing habitat actions. Based on *available information* and *professional judgment* of natural resource professionals in the region the RTT expects:

1) To better define priority habitat actions.
2) To provide updated information regarding restoration strategies and priorities.
3) To provide technical scoring criteria for habitat restoration, protection, assessment, and design projects submitted for funding through various sources.
4) To continue to update information-needs.

The UCSRB is a partnership among Chelan, Douglas, and Okanogan counties, the Yakama Nation, and Colville Confederated Tribes and local, state, and federal partners. The mission of the UCSRB is to restore viable and sustainable populations of salmon, steelhead, and other species of concern (e.g., Westslope cutthroat trout and Pacific lamprey) through the collaborative, economically sensitive efforts, combined resources, and wise resource management of the UCR.

The RTT supports efforts of the UCSRB to: 1) recommend approaches to protect and restore salmonid habitat; 2) guide development and evaluation of salmonid recovery projects within the UCR; 3) review and coordinate monitoring and evaluation activities; and 4) develop and guide salmonid recovery monitoring plans. The RTT uses a scientific foundation to identify projects that will best contribute to the recovery of salmonids and other species. The RTT approach supports implementation of the Upper Columbia Spring Chinook and Steelhead Recovery Plan.

1.0 Development of Restoration Activities in the Upper Columbia Region

Development of habitat improvement actions in the UCR is informed by a number of factors or processes. Among these are Viable Salmonid Population (VSP) criteria, process-based restoration, and tributary and reach assessments. The adaption of these for use by the RTT is described below.

VSP Criteria--The RTT worked with stakeholders in the UCR and other regions to generate criteria and recommendations for developing habitat restoration projects and criteria for habitat protection. Originally, the RTT biological strategy (RTT 2000) adapted the work of MacDonald et al. (1996) who identified HUC-6 watersheds for spring and summer Chinook, sockeye, summer steelhead, bull trout, and Westslope cutthroat trout. That framework was generally consistent with VSP criteria for listed species (McElhany et al. 2000) with exception that it does not link criteria to attributes required for recovery. In 2007, the UCSRB adopted the VSP construct and the biological principles for developing

recommendations so criteria for recommending habitat projects could be linked to recovery[14] among other objectives.

Process-based restoration -- Process-based restoration refers to projects that will affect long-term changes to watershed and fluvial processes. Process-based restoration addresses causes not symptoms and includes projects like riparian plantings, flow restoration, and floodplain reconnection all that contribute to restoring natural processes. Process-based restoration is scalar insofar as it considers the geographic, watershed, and habitat/reach scales (Naiman et al. 1992; Montgomery and Buffington 1998). At the geographic scale, factors such as geology, soils, vegetation, and climate serve as ultimate "top down" spatial controls (Leopold et al. 1992; Montgomery and Bolton 2003). Factors at the watershed scale refer to landform, and biotic processes that operate over smaller spatial areas and shorter timeframes. Watershed factors include stream flow, temperature, sediment, and channel migration. Habitat/ reach-scale factors include pool-riffle ratios, channel size, riparian vegetation, substrate, large woody debris, and bank stability. This is the scale which fish species exploit resources and reproduce. This is also the scale which most restoration occurs (Fausch et al. 2002).

Assessments -- Assessments are used to characterize processes that affect habitat quality and actions that can be taken to reverse, improve, or enhance the processes that affect habitat quality. The Bureau of Reclamation develops tributary and reach assessments that depending on the scale can be used to identify project types and locations for achieving specific outcomes. Assessments can be used to develop a list of potential actions/opportunities, which then can be considered for prioritization based on funding or other feasibility criteria.

Each subbasin in the UCR is unique in the VSP parameters, process-based restoration opportunities, and assessments that will determine feasibility of project selection and development. The following narratives include objectives for habitat improvement of limiting factors in subbasins of the UCR.

2.0 UCR Subbasins and Priorities for Habitat Improvement

Each subbasin in the UCR is unique in the VSP parameters, process-based restoration opportunities, and assessments that will determine feasibility of project selection and development. The following narratives include objectives for habitat improvement of limiting factors in subbasins of the UCR.

2.1. The Wenatchee Subbasin

The Wenatchee River supports the greatest abundance and diversity of spring Chinook salmon and steelhead, summer Chinook, sockeye salmon, bull trout, Pacific lamprey, and Westslope cutthroat trout. These species persist although the system has been degraded by past land management activities. Primary among the factors affecting conditions for salmonid species is mining that affected riparian and stream conditions as early as the 1860s (Mullan et al. 1992). Like mining, intense

[14] *VSPs are defined in terms of abundance, productivity, spatial structure, and diversity. The determination of viability references major spawning areas (MaSA) and independent populations, a number which can form major population groups (MPGs). When combined MPGs make up a DPS or ESU. A viable DPS or ESU is naturally self-sustaining, with a high probability of persistence of a 100-year time period.*

livestock grazing from the late 1800s to the 1930s, water diversion for irrigation, and timber harvest reduced habitat diversity, connectivity, water quantity and quality, and riparian function in the Wenatchee (Mullan et al. 1992). Some headwater areas were spared the impacts of management and today serve as "strongholds" for listed species and species of concern. The primary habitat conditions in the Wenatchee Basin that currently limit abundance, productivity, spatial structure, and diversity of salmon and steelhead include a lack of habitat diversity and quantity, excessive sediment loading, blocked passage, channel instability, low flows, and high summer temperatures. The RTT prioritized assessment units in the Wenatchee Basin based on ecological concerns and actions to improve riparian conditions; these include:

Nason Creek
Icicle Creek
Lower Mainstem
Little Wenatchee
Middle Wenatchee
Chiwawa River
Upper Wenatchee
Peshastin Creek
Mission Creek
White River
Chumstick Creek

2.2. The Entiat Basin

Historical patterns of land use in the Entiat Basin are similar to those in the Wenatchee. Mining also affected riparian and stream conditions; and as in the Wenatchee flow diversion and timber harvest reduced habitat diversity, connectivity, water quantity and quality, and riparian function in many assessment units within the basin. The headwaters of the Entiat include several "strongholds" that provide habitat for listed species and species of concern. Conditions limiting abundance, productivity, spatial structure, and diversity for salmon and steelhead include stream channel configuration and complexity. Straightened channels, lack of pools, lack of large wood, and disconnected side channels, wetlands, and floodplains are primary among factors contributing to degraded conditions for salmonids. The RTT prioritized the following assessment units for restoration and protection:

Middle Entiat (Stillwaters)
Upper-Middle Entiat
Lower Entiat
Mad River

2.3. The Methow Basin

Like a number of drainages in the UCR, the Methow Basin has been impacted by mining, livestock grazing, water diversion for irrigation, and timber harvest. These activities reduced habitat diversity, connectivity, water quantity and quality, and riparian function (Mullan et al. 1992). Although intact portions of headwater tributaries provide more "pristine" habitat, the middle and lower mainstem and tributaries have been impacted by highways, roads, and housing and agricultural development that have diminished the function of stream channels and floodplains. Development has impaired stream complexity, wood and gravel recruitment, floodwater retention, and water quality. In addition to direct impacts from development or management, tributary streams are affected by low instream flows that affect migration, spawning, and rearing habitat. Based on these factors, the RTT prioritized the following assessment units for restoration and protection:

Upper, Middle, and Lower Methow River
Upper, Lower Chewuch River
Wolf Creek
Libby Creek
Lost River
Upper, Lower Twisp River
Beaver Creek
Gold Creek
Early Winters Creek

2.4. The Okanogan Basin

The Okanogan/ Similkameen is the largest and most complex subbasin in the region. Among the management activities, the affects which must be rectified, transboundary planning is critical to improvement of habitat for salmon because more than half of the Okanogan subbasin is in British Columbia. Transboundary planning is of relevance, particularly in light of some of the land management actions that affected conditions for salmon and steelhead in the Okanogan Basin. For example, mining that brought an influx of people to the valley in the mid-1800s extended into the Fraser River Basin in British Columbia. Getting there resulted in large cattle drives up the Okanogan River Valley that resulted in degraded riparian conditions. Current conditions that limit potential for salmonid productivity and use include barriers to migration, poor water quality, and reduced instream flows.

Elevated water temperatures in the Okanogan often exceed lethal tolerance levels for salmonids. High temperatures due in part to low gradient, aspect, high ambient air temperatures, and upstream lake effects are exacerbated by the impacts of dam operations, irrigation, and land management. Based on these factors, the RTT prioritized the following assessment units for restoration and protection:

Upper, Lower Salmon Creek
Okanogan River
Upper, Lower Antoine Creek
Johnson Creek
Loup Loup Creek
Upper, Lower Omak Creek
Nine Mile Creek
Lower, Middle Similkameen River

2.5. The Foster Creek and Moses Coulee Subbasins

Relative to other subbasins the Foster Creek and Moses Coulee subbasins have limited capability to support salmonids. This limitation is resultant of low levels of precipitation and resultant stream flows, and stream channel characteristics. Agricultural practices and conversion of upland, riparian, and wetland habitats to arable land reduced storage capacity of the floodplain, affected runoff, and contributed to sediment loading in valley streams. The immediate strategy for Foster Creek and Moses Coulee would be to monitor salmonid use and distribution, assess habitat condition, and evaluate barriers to upstream passage.

2.6. Squilchuck and Stemilt and Small Tributaries

A number of small tributaries drain directly into the Columbia River between the Wenatchee River and Crab Creek. Some have documented juvenile *O. mykiss* habitat that ranges from several hundred feet to several miles (WDFW unpublished data). Recent spring spawning ground surveys identified adult steelhead presence, redds, or carcasses in Squilchuck, Tarpiscan, Trinidad, Tekison, Quilomene, Brushy, Skookumchuck, and Johnson creeks (WDFW unpublished data). A combination of protection and restoration (depending on ownership) was considered by the RTT for these drainages.

3.0 Information Needs

The effects of altered fluvial processes on life stage specific survival in many UCR streams are not fully understood. Stream channels in many areas are constrained by railroads, highways, dikes, and development. These constraints result in reduced channel sinuosity, flood aggravation, reduced gravel recruitment, reduced large woody debris recruitment, and lost connection to side channels. Information needs include historical and current channel migration rates, factors affecting current channel migration rates, options to restore floodplain function, and appropriate types and locations of restoration.

More information is needed on the water balance and the relation of surface and groundwater in UCR streams. A hydrologic assessment should identify critical ground-water recharge areas and determine locations where groundwater contributes to surface water. The role of upslope forest and range management on water balance and hyporheic flows needs to be further understood as well.

Where they have not been completed, an inventory and assessment of fish passage barrier and screens, and prioritization of these passage issues should be pursued. A comprehensive inventory of artificial and natural barriers (culverts, diversions, diversion dams, gradients, etc.), diversions, and screens should be assembled for the Wenatchee, Entiat, Methow, and portions of the Okanogan subbasins.

A better understanding of habitat-productivity relationships in UCR streams is being addressed through the ISEMP program. This work will help guide land and water management decisions contributing to recovery of salmonids in the region. Increased effort and continuation of upstream/downstream salmonid migrant trapping, parr and spawning ground surveys in representative streams has greatly contributed to our knowledge base, and has resulted in appropriate resource allocation decisions.

The extent of salmonid spawning and rearing in small-order tributaries to the Columbia River is not well known. Many streams (such as Douglas, Sand, Rock Island, Colockum, Stemilt, Squilchuck, Tarpiscan, Trinidad, Quilomene, and Skookumchuck creeks) appear to offer rearing habitat and overwinter refuges that could be important to the population and spatial structure and dispersal patterns of salmonids in the ESU/DPS. The presence, extent, and distribution of *O. mykiss* in some of these streams has been evaluated and monitored; however, a more comprehensive evaluation would be needed to determine the current and potential future roll of these systems in the Upper Columbia steelhead DPS.

Appendix F identifies specific informational needs within the entire UCR. This information was initially gleaned from the Biological Strategy (RTT 2002) and the recovery plan (UCSRB 2007). However, the Monitoring and Data Management Committee (MaDMC) periodically updates and prioritizes the information needs (Appendix F).

4.0. Adaptive Management Process

In January, 2010, the RTT hosted the first five-year analysis and synthesis workshop. This workshop is a component of the UCSRB's adaptive management process for salmon and steelhead recovery in the UCR. Topics at the workshop were:

Status of VSP by population and ESU: fish status and trend

Implementation, limiting factors, and threats

Habitat status and trend

Habitat action effectiveness, and

Data gaps and research needs

A report of the workshop was adopted by the RTT in October 2010 (Ward et al. 2010). The information presented at the workshop was captured in Ward et al. (2010).

5.0 Project Evaluation Criteria

The RTT has defined criteria to assist in the development of project proposals. The adequacy of proposals affects the RTT's ability to assess and score potential benefits and is determined based on clearly defined objectives and methods, and inclusion of supporting materials (figures, maps, references). The RRT also evaluates a proposals cost effectiveness given the activities proposed. After proposals are scored for expected benefits, costs are used to develop a benefit:cost ratio.

Scoring Criteria

Scoring criteria are based on ecological concerns and overall effect of an action on freshwater productivity. These factors form the basis for evaluating restoration, protection, design, or assessment projects. Each category of projects is assigned separate criteria for scoring. Each criterion is weighted based on relative importance to other criteria in each category. For example, the criterion addressing a primary ecological concern will be weighted higher than the criterion of landowner acceptance. Both are important, but addressing primary ecological concerns has been determined to be more important from a technical perspective than landowner acceptance. The weight assigned to each question generates a total score that varies among projects.

Restoration Projects

1. Addresses Primary Ecological Concerns (25% of total score)

*a) Extent to which the proposed restoration project will reduce the effects of **primary** ecological concerns (as identified in the UCRTT Biological Strategy, Appendix E)?*

> **Rationale**: Proposed restoration actions must address **primary** ecological concerns limiting the freshwater survival and/or distribution of fish species within a priority sub-watershed or assessment unit. Projects that address more than one primary ecological concern, or fully rectify a single ecological concern, achieve the highest scores.

2. Methodology, Location, and Scale of the Restoration Project (15% of total score)

a) Extent to which the proposed restoration project is sited within a priority spawning/rearing area (as identified in Appendix E), or provides access to habitat that would function as priority spawning/rearing habitat?

> **Rationale**: Streams vary in intrinsic potential (i.e., potential quality and quantity of spawning/rearing habitat) because of differences in geology, geomorphology, valley width, elevation, stream size, gradient, and other factors. The RTT has incorporated intrinsic potential in the identification of priority restoration areas. Projects that improve habitat quantity and quality within streams of high intrinsic potential, or provide access to such habitat, will achieve the highest scores. For projects that are targeting only bull trout, known habitat use by life stage will be used since intrinsic potential has not been developed for bull trout.

b) Extent to which the restoration project is appropriately scaled and scoped.

> **Rationale**: Projects must be placed so that they function within the fluvial-geomorphic context of the stream reach or watershed. Projects sited without consideration of stream flow, sediment dynamics, and geomorphology are presumed to have a high likelihood of failure or to provide limited long-term physical and biological benefit, and thus are scored low. Similarly projects may be too small in scope to achieve purported benefits.

3. Longevity of Proposed Restoration Action (15% of total score)

a) Over what time period will the proposed restoration action and its benefits persist?

> **Rationale**: Restoration projects that promote long-term habitat improvement, and/or require little to no on-going maintenance are likely to have the greatest biological benefit and are scored high. Projects that treat only symptoms of degraded watershed processes, or require on-going maintenance are unlikely to persist for long periods and are assigned lower scores.

b) Extent to which the project promotes natural stream/watershed processes that are consistent with the fluvial geomorphology at the reach or assessment unit scale?

> **Rationale**: The RTT defines *natural stream/watershed processes* as those processes where habitat functions at large spatial and temporal scales. Connectivity to the floodplain, absence of barriers, and large, intact riparian zones are all features of natural stream/watershed processes. As discussed within the body of the biological strategy, “process based restoration” refers to projects that will result in long-term changes to natural watershed and fluvial processes. Projects like riparian plantings, increasing flows, removing structures that limit floodplain connection are all examples of projects that restore natural processes.

4. Benefits to Freshwater Survival (30% of total score)

a) Extent to which the project would improve freshwater survival of target species at the primary sub-watershed or assessment unit scale?

> **Rationale**: Habitat restoration projects are implemented to increase freshwater survival and/or distribution of target fish species. Therefore, it is important to assess the effects of restoration actions on pre-spawn survival, egg-smolt survival, and spawner distribution. These metrics are evaluated at the scale of the primary sub-watershed or assessment unit.

Protection Projects

1. Placement of Protection Project (30% of total score)

a) Extent to which the proposed protection project is sited within a priority spawning/rearing area (as identified in Appendix E)?

Rationale: Streams vary in intrinsic potential (i.e., potential quality and quantity of spawning/rearing habitat) because of differences in geology, geomorphology, valley width, elevation, stream size, gradient, and other factors. Projects that protect habitat within or along streams of high intrinsic potential will achieve the highest scores.

b) Extent to which the project protects high-quality habitat or habitat that can be restored to high quality with appropriate restoration actions?

Rationale: Maintaining high-quality habitat within priority spawning and rearing areas is critical to the viability of target fish populations. Thus, protecting these areas, or areas with high restoration potential, is important to the conservation of the target species.

c) Extent to which the protection project is connected with other protected properties?

Rationale: Large parcels of high-quality riparian/floodplain habitat may have a greater effect on freshwater survival than smaller, discontinuous parcels of high-quality riparian/floodplain habitat. Therefore, projects protecting smaller, isolated "islands" of habitat will receive lower scores than large, connected parcels of high-quality habitat.

2. Potential Loss of Habitat Without Project (35% of total score)

a) What would be the anticipated loss in freshwater survival and/or distribution of target species if the proposed area was developed (i.e., what habitat values would be lost and to what degree would that loss reduce freshwater survival and/or distribution of target species at the assessment unit scale)?

Rationale: Freshwater survival is related to the quality of stream habitat. The loss of high quality habitat will result in reduced freshwater survival or distribution of target fish species.

3. Threat (15% of total score)

a) How imminent is the threat to the proposed land?

Rationale: Because salmon recovery funds are limited, the most pressing concerns need to be addressed first. When evaluating proposals, the RTT tries to predict the extent to which a project will change habitat conditions and to assess the significance of that change to fish populations. Therefore, to evaluate a habitat protection project, one must have a reasonable basis for comparing what would happen with and without the project. The ability to predict the fate of a proposed parcel of land for protection or easement is poor, but improved when informed by knowledge of the intentions of the present landowner, market conditions, and local critical areas and zoning laws among others. Scoring protection projects by default as if all extant habitat values will be lost but for the project, would substantially and artificially inflate the value of these projects as compared to restoration projects.

4. Cost Effectiveness of Protection Project (15% of total score)

a) How cost effective is the proposed project compared to other projects being proposed within the same funding cycle?

Rationale: As with restoration projects, the benefits associated with protecting a parcel of riparian/floodplain habitat should justify the cost of the acquisition or conservation easement.

Comments to be included in regard to this criterion (not part of the scoring):

1. Does the RTT believe there are cost efficiencies that could be gained?

2. Are there any costs that could be improved?

3. Was there a "value engineering review" (mostly design projects)?

5. Conditions Affecting the Project (5% of total score)

a) Are there any conditions regarding the protection of the property that could limit the existing high quality habitat?

Rationale: Purchase of a property with explicit provisions for activities or anthropogenic features that may affect the quality of habitat may reduce the

Assessment Projects

1. Address Primary Ecological Concerns (25% of total score)

*a) Extent to which the proposed assessment will inform the development of projects that will reduce the effects of **primary** ecological concerns (as identified in the UCRTT Biological Strategy, Appendix E)?*

Rationale: All assessments proposed should link directly to restoration or protection actions addressing **primary** ecological concerns that limit freshwater survival and/or distribution of fish species. Assessment projects that inform actions that address more than one primary ecological concern, or fully rectify a single ecological concern, will achieve the highest scores. Sequencing will also affect scores.

2. Area covered by Assessment (20% of total score)

a) Extent to which the proposed assessment is sited within a priority spawning/rearing area (as identified in Appendix E)?

Rationale: Streams vary in intrinsic potential (i.e., potential quality and quantity of spawning/rearing habitat) because of differences in geology, geomorphology, valley width, elevation, stream size, gradient, and other factors. Assessment projects that inform actions that improve habitat quantity and quality within priority areas, or provide access to such habitat, will achieve the highest scores.

b) Extent to which the assessment is appropriately scaled and scoped?

Rationale: Assessment projects must be sufficiently comprehensive to anticipate the physical and ecological issues that potentially influence the effectiveness of the restoration projects they will inform.

3. Use of Information (20% of total score)

a) Extent to which the assessment will fill data gaps identified in Appendix F of the Biological Strategy and will provide information that will lead directly to restoration and/or protection actions.

Rationale: An assessment must be designed to lead to specific projects, or inform critical data gaps, as identified by the RTT in Appendix F of the Biological Strategy.

4. Methods (20% of total score)

a) Are the methods outlined within the assessment proposal adequate to achieve the stated objectives?

Rationale: The assessment must clearly describe the methods that will be used to gather and analyze the information. The proposal should demonstrate that it is using an accepted approach. If it is innovative, the proposal should discuss how the methods will achieve the stated objectives of the assessment and demonstrate the benefits of the methods relative to a standard method.

5. Cost Effectiveness of Assessment Project (10% of total score)

a) How cost effective is the proposed project compared to other projects being proposed within the same funding cycle?

Rationale: For an assessment project, it is important that the cost reflects the appropriate amount of effort to obtain the information.

Comments to be included in regard to this criterion (not part of the scoring):

1. Does the RTT believe there are potential cost efficiencies that could be gained?

2. Are there any costs that could be improved?

3. Was there a “value engineering review” (mostly design projects)?

6. Dissemination of information (5% of total score)

a) Is there an avenue described for disseminating information to interested parties upon completion of the assessment?

Rationale: It is important that the proposal clearly identify how this information will be disseminated and accessed (e.g., on the web) once the project is complete.

Design Projects

1. Address Primary Ecological Concerns (25% of total score)

a) *Extent to which the proposed design will lead to the development of projects that will reduce the effects of **primary** ecological concerns (as identified in the UCRTT Biological Strategy, Appendix E)?*

Rationale: All designs should link directly to restoration or protection actions addressing **primary** ecological concerns that limit freshwater survival and/or distribution of fish species. Design projects with a direct linkage to development of actions addressing more than one important ecological concern, or fully rectifying a single ecological concern, achieve the highest scores. Sequencing also affects scores.

2. Area covered by Design (25% of total score)

a) Extent to which the proposed project (created from the design) is sited within a priority spawning/rearing area, or creates or provides access to habitat that could function as priority spawning/rearing habitat?

Rationale: Streams vary in intrinsic potential (i.e., potential quality and quantity of spawning/rearing habitat) because of differences in geology, geomorphology, valley width, elevation, stream size, gradient, and other factors. Design projects directly leading to actions that improve habitat quantity and quality within priority areas, or provide access to such habitat, will achieve the highest scores.

b) Extent to which the design is appropriately scaled and scoped?

Rationale: Projects must be designed so that they will function within the fluvial-geomorphic context of the stream reach or watershed. Projects that are sited without consideration of stream flows, sediment dynamics, and geomorphology are anticipated to fail or to provide limited long-term physical and biological benefit and will be scored low. Similarly a project may be too small in scope to achieve the purported benefits.

3. Methods (25% of total score)

a) Are the methods outlined within the design proposal adequate to achieve the stated objectives?

Rationale: The design must clearly illustrate what methods will lead to an action (project). The project proponent should demonstrate that the methods proposed are “accepted” as standard. Innovative designs must be discussed in terms of how approach will achieve the stated objectives and demonstrate the benefits of the method relative to a standard or alternative.

4. Cost Effectiveness of Design Project (15% of total score)

a) How cost effective is the proposed project compared to other projects being proposed within the same funding cycle?

Rationale: For a design, it is important that the cost reflects the appropriate amount of effort to develop appropriate actions.

Comments to be included in regard to this criterion (not part of the scoring):

1. Does the RTT believe that there are potential cost efficiencies that could be gained?

2. Are there any costs that could be improved?

3. Was there a “value engineering review” (mostly design projects)?

5. Level of completeness (10% of total score)

a) To what level of completion will the design be developed?

Rationale: It is important that the project proponent identify how complete the design will be (e.g., permit-ready, bid-ready, etc.); whether there is a preferred alternative; and whether permits will be applied for or in-hand once the design is complete. This will aid the RTT in determining the level of completeness of the proposed design.

b) Are there milestones for future check-ins with the RTT as the design progresses?

Rationale: Future check-in prior to full project development assists the project proponent and the RTT in ensuring that the best possible alternative for an action is designed.

Attachment 2: Summary: Snake River Salmon Recovery Plan for Southeast Washington

Original Text Prepared By **Snake River Salmon Recovery Board** *for the* Washington Governor's Salmon Recovery Office December 2006. *http://hwsconnect.ekosystem.us/File/320/2194.*

HABITAT STRATEGY

Protection and Restoration

The Snake River Salmon Recovery Plan habitat strategy is based on protection and/or restoration. Protection involves preserving high quality or productive habitat to maintain or not degrade current conditions. Restoration, which can be active or passive, is intended to improve degraded habitat. Within the context of the federal Recovery Plan for salmonids, habitat protection and restoration are balanced by considering the number of listed species and their abundance in a given portion of a subbasin; costs and benefits of protecting high quality habitat vs. restoring historic habitat; the cost and benefits of eliminating known fish passage obstructions, screening problems, or pollution sources; and the time frame in which benefits to salmon will accrue.

Based on these considerations, habitat protection and restoration are prioritized based on imminent threats to fish life in areas containing listed populations of salmon and steelhead. Actions in these areas receive the highest priority. Examples of "imminent threats" include adult fish passage barriers such as culverts or dams, unscreened or poorly screened irrigation diversions, stream crossings in spawning areas, dewatered reaches that strand or kill fish and act as passage barriers, and point sources of toxic pollutants. Removing imminent threats such as these are anticipated to deliver the greatest increase in fish survival over the shortest time.

While habitat actions are proposed only in the Washington portion of each subbasin, the analysis assumes that the State of Oregon will also improve habitat within its jurisdiction consistent with the level of improvement described in subbasin plans.

Active and Passive Restoration

Habitat restoration can be either active or passive. In the case of passive restoration legal tools may be used to secure land and achieve the ultimate goal of reducing disturbance. Conservation Reserve Enhancement Program (CREP) riparian buffers, conservation easements, and land acquisition are examples of passive restoration. Active restoration on the other hand involves direct intervention, often within the stream channel. Areas targeted for active restoration may include acquired parcels. Examples of active restoration include engineered restoration of stream channels; engineered log jams and addition of large woody debris; removal or relocation of dikes, levees, and embankments; creation of pools; and hydraulic reconnection of historical side channels.

For active restoration, stream reaches supporting listed populations take precedence over other reaches. Reaches supporting greater numbers of listed fish species or stocks take precedence over those supporting fewer listed populations. Protection of reaches with high productivity takes precedence over restoration of potentially productive reaches. The location of a reach within the

stream can affect priority. For example, salmon, passage projects in downstream areas would take precedence over those higher in the stream. However, for bull trout, which reside primarily in upstream areas, projects higher in the drainage would be assigned a higher priority than those downstream. Upstream projects for bull trout would be given equal priority to downstream passage projects to benefit salmon and steelhead. Actions target important reaches in each subbasin; with a reach considered "important" if improvements will result in increased fish abundance and productivity. Major Spawning Areas (MSA) are considered important reaches. Selection of habitat strategies and priority areas is subject to economic, legal, socio-cultural, and political constraints to recovery in the region. For example, the recovery region is highly dependent on agricultural production so restoration actions must be considered within the context of what economically drives and sustains the area. Likewise, legal, social, cultural and political constraints to project implementation must be given due consideration as projects are evaluated for their feasibility.

HABITAT ACTIONS

Habitat actions proposed by the Snake River Salmon Recovery Board are aimed at MSAs and are grouped under "Approach Categories" that define the approach to be taken (restoration or protection) to achieve the desired future conditions and recovery goals for habitat. Approaches are designed to improve upland habitat, riparian condition, floodplain function, instream habitat, water quantity, and water quality. Approaches are prioritized using the following criteria:

- **Effectiveness**: What is the probability that implementing this strategy will achieve the objective?
- **Technical Feasibility**: How feasible is the strategy from a technical perspective?
- **Cost/benefit**: Are the benefits to fish habitat large relative to the cost of the strategy?

Approach categories are assigned priority values from 1 (highest) to 5 (lowest). Habitat factors (attributes) are correlated with sets of approaches, each of which is prioritized. Actions proposed to achieve improvements are defined for each MSA and each habitat factor. The habitat factors are then arranged in order from the most important to least important for each MSA. In most cases, attributes were combined to obtain a single value for a habitat factor. For example, the value for the habitat factor "embeddedness" is the total of the related attributes turbidity, percent fines, and embeddedness.

IMPLEMENTATION STRUCTURE, ROLES, FUNCTIONS AND RESPONSIBILITIES

The Snake River Salmon Recovery Board agrees the federal plan to recover salmonids is scientifically sound and has local support. This section describes how administratively plan elements can be implemented. The Snake River Salmon Recovery Board is committed to implementation, monitoring and reporting to support the Plan and has adopted an adaptive management approach that involves the local community and natural resource agencies in the endeavor. Natural resource agencies, county planning departments, Tribes, conservation districts and the Regional Fisheries Groups assist in Plan maintenance and update. Plan implementation is coordinated with subbasin plans, watershed plans, Lead Entity processes, habitat conservation plans, and related local, state and federal efforts. The Snake River Salmon Recovery Board relies on staff and others to communicate, coordinate, and integrate processes and programs within the region and uses the Lead Entity program for public outreach, project identification and proposal development.

Public Support

Public involvement is essential for successful Plan implementation. It is vital that the public understand and support the priority areas and actions as well as the programs and potential policies necessary for salmon recovery. This involvement and support vests the public in the process and fosters a sense of ownership. The Snake River Salmon Recovery Board strives to reinforce understanding about the multiple planning efforts on-going in the region and assurance that these efforts are coordinated and to the extent possible.

For example, there is a Lead Entity program, watershed planning, habitat conservation planning, a regional fisheries enhancement group, Walla Walla watershed alliance, and dozens of state and federal programs like CREP, irrigation efficiencies, and the water trust. The Snake River Salmon Recovery Board coordinates information sharing among these entities to ensure actions are coordinated.

In addition to programs aimed at habitat, the region also supports efforts and priorities aimed at hatcheries, harvest and hydropower system management and improvement. The Snake River Salmon Recovery Board also promotes and supports greater accountability and understanding of these priorities and of other federal and state initiatives, and interfaces with the public on such matters.

Projects are implemented by citizens, state agencies, tribal organizations, regional fisheries groups, planning units, conservation districts and other organizations. These entities rely on a good understanding of priority areas and actions to guide project location and selection. The Snake River Salmon Recovery Board maintains a list of projects completed, scheduled for completion, and those project on the to-do list. This list guides the public, elected officials, and agencies in demonstrating the strategic approach to project implementation and address of limiting factors.

Technical Support

The Snake River Salmon Recovery Board acknowledges that the federal Recovery Plan is dynamic and that implementation of Plan elements will evolve over time. Changes to the Plan will require technical input and review; and the Snake River Salmon Recovery Board will rely on the RTT and the lead entity organization for technical support.

Regional Technical Team (RTT). The RTT is a science group with responsibility for RME coordination, adaptive management, and project review. This team operates at the regional level. In addition to local and state technical agencies and representatives, the RTT interfaces directly with federal agencies to identify issues and opportunities for enhancing Plan implementation and to elevate issues for consideration as the Plan is revised over time.

Implementation Work Group (IWG). The IWG in the Walla Walla Basin is responsible for reviewing and rating habitat and assessment projects for most funding sources. This group also ranks habitat and assessment projects for funding at the regional level. The IWG is composed of technical and citizen members from the three counties in the Walla Walla Basin.

Lead Entity Program. The Lead Entity program works with the Salmon Recovery Fund Board grant program and sponsors to develop applications for funding. Five CountyConservation Districts are co-leads contracted by the Board for county-specific tasks. In addition to the co-leads, the Lead Entity Program relies on a citizen-technical committee to review and rate projects for funding. Projects are presented to the Board for consideration and development of a final ranked list for Salmon Recovery Funding Board consideration. The Lead Entity program operates at the local and regional levels.

Regional Representation. The Snake River Salmon Recovery Board developed a strong relationship with federal fisheries agencies as the Recovery Plan was being developed. The board will continue to serve as the Southeast Washington liaison to federal agencies as issues related to the Plan

arise. Prior to the establishment of the Snake River Salmon Recovery Board, neither the local communities nor the federal government had a mechanism for engaging in policy and technical matters related to the Plan. Because the Snake River Salmon Recovery Board's geographic area includes the populations of mid-Columbia and Snake River listed stocks, the Board expects to be an active participant in Recovery Plan Implementation at the ESU scale.

LEAD ENTITY STRATEGY FOR IMPLEMENTING HABITAT PROTECTION AND RESTORATION PROJECTS

The Lead Entity process is used to identify and solicit habitat protection and restoration projects. As the Lead Entity, the Snake River Salmon Recovery Board reviews and ranks projects and submits these for funding requests to the Salmon Recovery Fund Board. The Lead Entity committee reviews, scores, and ranks proposals before sending them to them for review and concurrence. The scoring criteria were developed by the Lead Entity and have been used since 1999.

The Recovery Plan analysis provides the technical foundation for prioritizing the protection and restoration actions and the location of these. Stream reaches are rated for "preservation" based on current habitat condition. Reaches rated for "restoration" are based on a comparison between current and historic habitat condition. MSAs are overlaid on priority restoration and protection reaches to illustrate that actions in these areas will contribute to augmented spatial structure for salmonids within the recovery region.

Prioritized projects are organized into "tiers" ranging from 1 to 4. Tier 1 includes projects that address imminent threats. Tier 2 includes projects to restore habitat function within priority reaches of MSAs. Projects designed to protect priority areas are included in Tier 3. Tier 4 comprises projects in areas supporting salmon outside of identified MSAs.

Points are awarded to projects based on location and the proposed action. Evaluators rate each project according to its benefits to salmonids and their habitats. Benefits are ranked as **High, Medium,** or **Low** based on the project's proximity to priority areas, fish health and population status, fish productivity, life stage, number of fish species, habitat conditions, watershed-forming processes, and cost effectiveness.

Evaluators also assess the certainty that a project will deliver the expected benefits for fish. This determination is based on the project location, current habitat condition, habitat-forming processes, the degree to which historical functions will be protected or restored, the success of similar projects, the likelihood that benefits will be achieved, the appropriateness of the proposed methodology, and the potential for continued habitat degradation if the project does not take place.

Projects are awarded points for certainty, longevity, and size. Projects that have a high degree of certainty, will last in perpetuity, and affect a large area are scored high. Projects the certainty which is speculative, which benefits are anticipated to for less than 10 years, and that affect a relatively small area are scored low.

Agencies, citizens, tribal representatives, and conservation districts identify potential projects. Project sponsors apply to the Conservation District (co-lead entity) in the county which the project would be located. The co-lead entity reviews the project and determines community support and technical applicability. The Lead Entity then reviews projects forwarded from the co-leads. Any technical issues or concerns regarding implementation are addressed at this point before the assessment of benefit and certainty occurs.

SNAKE RIVER SALMON REGION – PROVISIONAL WORK PLAN 2013-2018

http://hwsconnect.ekosystem.us/File/320/3841

INTRODUCTION

The Snake River Salmon Region – Provisional Work Plan is produced by the Snake River Salmon Recovery Board as a guide for salmon and steelhead recovery actions within the Snake River Region. The Snake River Salmon Recovery Board RTT has developed and prioritized the actions and projects for habitat restoration, habitat assessments, research monitoring and evaluation, hatchery and information education and policy.

Recovery priorities are reviewed annually and new priority projects are identified, making the work plan a living document. The Snake River Salmon Recovery Board uses the work plan format to provide priority projects lists for habitat restoration, assessments, research/monitoring and evaluation, hatchery activities, information/education or regulations for those who are preparing projects and those who provide funding for salmon recovery actions.

This document is structured to list both general and specific actions for restoration by priority areas in each MSA as illustrated in the Snake River Reaches Priority Reaches Map. The projects listed as priorities are identified as needing attention over the next 1 to 3 years.

The 2013-2018 work plan has been partitioned into two sections; 1 - WRIA 32 33 & 35's Habitat Restoration & Protection, 2 – Habitat Assessments.

The RTT has worked to provide general project categories for conducting habitat restoration in priority restoration and protection reaches in the Snake River Recovery Region. The guidelines are designed to aid project sponsors in developing restoration projects into beneficial salmon projects. The following General Project Category outline lists actions designed and tested for addressing regional limiting factors.

General Project Categories for Priority Restoration Reaches Include:

- Restore and Protect Floodplain and Riparian Function o Easements (CREP, Permanent Conservation)
    - o Remove and modify river dikes that constrict floodplain function
    - o Control noxious weeds that reduce riparian function
    - o Riparian restoration projects (Fencing, planting, stock relocation)
    - o Land use and planning
- Restore Habitat Complexity
    - o Enhance stream channel complexity (wood placement, structures)
    - o Extend stream length (Meander projects, & side channel construction)
    - o Minimize confinement caused by channel training
- Reduce Fine Sediments
    - o Upland BMPs (Direct seed, grass waterways, sediment ponds, native grass, & reforestation)
    - o Fine sediment routing assessment and Implementation (Roadway maintenance, ephemeral stream, stream fords management, storm water)

- Remove Imminent Threats
    - o Assess and remove / modify fish passage barriers
    - o Screen and meter stream diversions
- Maintain or Restore In-stream Flow
    - o Conduct water efficiency
    - o Springhead inventory and protection
    - o Aquifer Recharge
    - o Assess and enhance stream flows

General Project Categories for Priority Protection Reaches:

- Protect Floodplain and Riparian Function
    - o Easements (CREP & Permanent Conservation)
    - o Control noxious weeds that reduce riparian function
    - o Riparian restoration projects (fencing, planting, stock relocation, & alternative water developments)
- Reduce Fine Sediments
    - o Upland BMPs (Direct seed, grass waterways, sediment ponds, native grass)
    - o Fine sediment routing assessment and Implementation (roadway maintenance, ephemeral stream, stream fords)
- Remove Imminent Threats
    - o Assess and remove fish passage barriers
    - o Screen and meter stream diversions
- Maintain or Restore In-stream Flow
    - o Conduct water efficiency
    - o Springhead inventory and protection
    - o Assess and enhance stream flows
- Water Quality
    - o Maintain or improve water quality consistent with TMDL plans

Attachment 3: Explanation of the Calculation of Tributary Habitat Benefits

This paper explains, in a step-by-step fashion, how the Action Agencies arrived at the numbers presented in the 2013 Comprehensive Evaluation Table 35, Section 2 (columns 6-8 labeled "From Expert Panel Results"). The Expert Panel process is employed for the 2008/2010 Federal Columbia River Power System Biological Opinion (FCRPS BiOp) to evaluate changes in habitat quality improvement associated with completion of habitat improvement field projects that address key limiting factors for most of the Snake River and upper Columbia River chinook and steelhead populations identified in RPA Action 35, Table 5. The habitat quality improvements, determined with expert panel input, represent the measure of RPA Action 35, Table 5 progress.

This evaluation of tributary habitat improvement project benefits by expert panels, by its nature, employs expert opinion and, in that sense, is qualitative. Expert opinions are judgments used as a form of scientific evidence, in contrast to evidence derived from direct empirical observation or to model-driven extrapolation based on empirical evidence. Expert knowledge is used widely in conservation science, particularly where data are scarce, problems are complex, and decisions are needed in a short time frame (Martin et al. 2011). NOAA and the Action Agencies employed collaboration with States and Tribes to develop the Proposed Action contained in the 2007 FCRPS Biological Assessment and the ensuing 2008 FCRPS Biological Opinion. The panels base their evaluations on the best available scientific information, including data on the status of fish runs; subbasin plans developed for the NPCC's subbasin planning process; NOAA Fisheries' ESA recovery plans and draft recovery plans; Reclamation's tributary and reach assessments; results of relevant research and monitoring; and other sources(including modeling such as Ecosystem Diagnostic and Treatment modeling, where it has been developed for the populations in question) (2013 Draft CE; BPA and Reclamation 2013b). Thus informed by scientific information, panels evaluate and debate effects of habitat improvement projects on changes in habitat condition limiting factors and apply their collective professional judgment to determine that change.

The numbers in the CE Table 35 should not be viewed as "precise measurements", like those obtained from a scientific measuring device such as mass spectrophotometer that can measure and report the concentration of a chemical constituent in parts per billion. Rather, these numbers represent results from a reasonable, systematic, widely applicable, biologically-based method of estimating benefits given the current state of the science. In addition, the Action Agencies, together with partners, continue to improve the science underpinnings that support the planning, development, prioritization, implementation and monitoring of tributary habitat improvement projects. For example, the Action Agencies work under RPA Actions 50, 56, and 57 continues to inform the expert panels and advance our knowledge of the benefits of tributary habitat projects. Although new science findings and modeling continue to develop and provide guidance and insight into stream habitat and fish-habitat relationships for the ESA listed Chinook salmon and steelhead populations, the state of the science cannot yet replace the Expert Panel process to evaluate tributary habitat improvements on the scale and scope of this process.

The expert panel process was developed through collaboration among NOAA Fisheries, the Action Agencies, and Pacific Northwest sovereign states and tribes for the 2008 FCRPS BiOp. The Habitat Collaboration Workgroup (HCW) that developed the process was convened by NOAA Fisheries in 2006 and first researched the availability of existing methods that could be used to correlate the construction of habitat improvement projects to changes in habitat quality improvement needed to satisfy the FCRPS BiOp. These included any direct methods such as monitoring or other measurement techniques, and indirect methods such as numerical modeling that relies on established relations between construction of habitat improvement projects and fish response. The group could not identify

any readily-available direct or indirect empirical methods that could be applied uniformly across the Columbia River basin. Consequently, the HCW developed the Expert Panel process.

The process represents a cause-and-effect chain of events that links the completion of habitat improvement actions to changes in habitat conditions; and changes in habitat conditions to changes in habitat quality improvement. Seven expert panels were assembled for the 20080/2010 FCRPS BiOp. Six address salmon and steelhead populations in the upper Columbia River, lower Snake River, Wallowa and Imnaha rivers, upper Grande Ronde River, lower Salmon River, and upper Salmon River. A seventh panel addresses Clearwater River steelhead. Expert panels in each of these areas comprise federal, tribal, state and local project sponsors who have specific knowledge about habitat improvement planning and implementation and federal, tribal, state and local fish biologists who have specific knowledge and experience on how habitat improvement projects affect salmon and steelhead spawning and rearing habitat requirements. For more information, see Science and the evaluation of habitat improvement projects in Columbia River tributaries (BPA and Reclamation 2013b).

Following the guidance prepared by the HCW (FCRPS CA, Appendix C, Attachment C-1), the expert panels:

Identify key limiting factors -- This includes environmental characteristics that negatively affect spawning, redds (nests of fish eggs), emergence, summer and winter growth and rearing, and smolting of salmon and steelhead populations in tributaries to the main stem of the Columbia and Snake rivers. Access to quality spawning and rearing habitat, mechanical injury, lack of sufficient streamflow, and lack of in-stream channel complexity are examples of key limiting factors. Different groups of key limiting factors affect fish survival in different parts of each tributary. Parts of tributaries with a common set of limiting factors are called assessment units. Assessment unit boundaries and associated key limiting factors can be different for each salmon and steelhead population, even when they occupy the same tributaries. Expert panels adopted a set of standardized limiting factors and definitions in 2012 (Hamm, 2012).

Identify limiting factor status and weights -- Each limiting factor is assessed three numeric values between zero and one. The numeric values are related to Proper Functioning Condition (BLM, 1998). A low value indicates that the status of the limiting factor is poor and there is a large need for improvement. A higher value indicates that the status of the limiting factor is relatively better. The first value assessed by the Expert Panel represents the *current* limiting factor condition and is called the “low bookend.” Two other values represent the *potential* to which each limiting factor could be increased by the construction of all reasonably feasible habitat improvement actions by 2018. The first of these represent the potential limiting factor status attainable by 2018 (the end of the 2008/2010 FCRPS BiOp). The second represents the potential limiting factor status attainable by 2033 (25 years after the end of the 2008/2010 FCRPS BiOp). These are called the “2018 and 2033 high bookends,” respectively. The purpose of the 2018 high bookend is to establish a ruler to gage the effects of constructing habitat improvement projects between the current status (low bookend) and 2018 (the term of the 2008/2010 FCRPS BiOp). The purpose of the 2033 high bookend is to establish a ruler to gage the effects of constructing habitat improvement projects that may accrue between 2018 and up to 25 years after the end of the 2008/2010 FCRPS BiOp. For example, the riparian condition limiting factor may be assessed a low bookend of 40 percent, a 2018 high bookend of 50 percent, and a 2033 high bookend of 80 percent. This assessment recognizes a relatively small potential for riparian vegetation to grow and provide improvements by 2018. But as the vegetation matures, the full value of the action accrues between 2018 and 2033. In another example, the access limiting factor may be assessed a low bookend of 40 percent and both 2018 and 2033 high bookends are assessed at 80 percent. This represents the fact that project completion provides an immediate improvement with no accrued future improvement.

Identify limiting factor weights -- Some limiting factors may be more important to improving habitat conditions for salmon and steelhead than others. Expert panels have the opportunity to assign a weight between zero and one to recognize the relative importance of each limiting factor in each assessment unit. For example, a panel may assign a weight of 60 percent for lack of sufficient streamflow and 20 percent each to riparian condition and lack of in-stream channel complexity if water availability currently influences improvements more than the other two limiting factors. Limiting factor weights must total to one among all limiting factors in each assessment unit.

Identify assessment unit weights -- Tributary habitat conditions in some assessment units provide greater spawning and rearing habitat potential than others. Assessment unit weights were initialized from the analysis of intrinsic potential conducted by the NOAA Northwest Fish Science Center (NWFSC). The expert panels have the opportunity to adjust these values based on justifications that supplement the scientific data used in the NOAA NWFSC intrinsic potential analysis.

Develop "look back" project lists -- This process compares habitat improvement projects planned for the last implementation cycle to those actually completed for each limiting factor in each assessment unit for each salmon and steelhead population that occupies each tributary. Expert panels are scheduled to meet once every three years at Expert Panel workshops convened by the Action Agencies. Before each Expert Panel workshop is convened, the panel determines whether the projects planned for completion at the last workshop were: a) completed as planned, b) completed with additions or subtractions, c) not completed, or d) completed but not planned at the earlier workshop. Panels also establish the metrics (cfs/acre-feet of flow, number of screens, miles of access, habitat complexity, riparian protection/enhancement, etc.) that are associated with each completed project to evaluate the a-b-c-d status outlined above. Table 1A shows part of the "look back" project list for the Tucannon steelhead[15] population.

Develop "look forward" project lists -- This process identifies planned projects and associated metrics for the next implementation cycle for each limiting factor in each assessment unit for each salmon and steelhead population that occupies each tributary. Table C2 shows part of the "look forward" project list for the Tucannon steelhead population.

Evaluate changes in limiting factors –This process is associated with completed and planned habitat improvement projects. At each Expert Panel workshop, panels evaluate the change in limiting factors associated with the group of habitat actions associated with each limiting factor in each assessment unit for each salmon and steelhead population that occupies the tributary. First, the panels evaluate the look back project list. If projects are (a) completed as planned, the change in limiting factor that was estimated for the planned projects at the last workshop is accepted (unless there is documented scientific evidence that would support an increase or decrease to the original estimate). If projects are (b) completed with additions or subtractions compared to what was planned, the panels debate and decide whether the change in the limiting factor should be increased or decreased accordingly. If planned projects were (c) not completed, the panel discounts the limiting factor change estimated at the last workshop for the planned projects. If the projects were (d) completed but not planned at the last workshop, the panel determines the improvement to the limiting factor associated with the new completed projects. This process is repeated for each limiting factor, for each assessment unit, and each steelhead and chinook population. A similar process is then followed to estimate changes in limiting factors for the look forward projects associated with each limiting factor.

The Action Agencies compile all the limiting factor changes associated with the assessment of look

[15] *Steelhead is used rather than Chinook to illustrate how values roll up over more than one assessment unit.*

back and look forward project lists made by the expert panels in a database system. Once the Action Agencies are satisfied that all the Expert Panel inputs have been accounted for in the database, tables that contain the look back and look forward limiting factors, limiting factor low and high bookends and weighting factors, assessment units and weights, actions that address the limiting factors, and the changes in limiting factors associated with the actions that address each limiting factor for each steelhead and chinook assessment unit are returned to the expert panels for final review before all comments are addressed and the records are finalized by the Action Agencies. The preceding description summarizes the role of the expert panels to evaluate limiting factors and changes in limiting factors associated with completed and planned habitat improvement projects. The Action Agencies prepared a website that provides background information about the expert panel process; contains materials presented and obtained from pre-workshop preparatory meetings, workshops, and post-workshop meetings; and includes final Expert Panel inputs in tabular and map form.

The Action Agencies finalize the Expert Panel input upon receipt of the final review comments from the expert panels and then use a mathematical procedure established by the HCW to convert the changes in limiting factors to changes in HQIs to address FCRPS BiOp RPA 35, Table 5 requirements. In summary, the procedure compares the current status of the limiting factors (low bookends) evaluated by the expert panels with the status of the limiting factors associated with completed (look back) or planned (look forward) projects evaluated by the panels. The procedure incorporates limiting factors and weights, assessment units and weights, and the chinook and steelhead factor that converts habitat condition change to habitat quality (survival) change. Final results of this procedure depict how Action Agency and regional partner progress on completing habitat improvement actions address FCRPS BiOp RPA Action 35, Table 5 habitat quality improvement requirements.

A large amount of detailed biological information (expert judgments on the degree to which salmon habitat limiting factors are improved by a suite of habitat projects in a particular place for a particular salmon population) is combined arithmetically by the Action Agencies. The following steps describe the mathematical procedure in more detail (the Tucannon steelhead Expert Panel results are used below as an example). This calculation is made separately for the look back and look forward set of habitat improvement actions. Look forward conditions (Appendix D, Attachment 3,Table C3) are presented for this example. This is also displayed in Figure 1 as a linear diagram.

The Action Agencies:

Calculate “weighted current limiting factor condition”— by multiplying the limiting factor weight by the current limiting factor condition (low bookend) for each limiting factor in the assessment unit (Appendix D, Attachment 3, Table C3, col G = col E * col F [e.g., .05 x 75 = 3.8[16]]). These calculations represent the overall current status of all limiting factors in each assessment unit without any additional habitat improvement actions.

Calculate “weighted estimated 2018 limiting factor condition”— by multiplying the limiting factor weight by the estimated 2018 limiting factor condition associated with completed or planned habitat improvement actions for each limiting factor in the assessment unit (Appendix D, Attachment 3, Table C3, col L = col E * col K [e.g., 0.05 x 95 = 4.8]). These calculations represent the overall status of all limiting factors in each assessment unit accounting for all of the habitat improvement actions evaluated by the Expert Panel (Appendix D, Attachment 3, Table C2).

Calculate “current assessment unit habitat condition (Table C3, col H) — by summing the weighted

[16] Calculations are done in a spreadsheet or database and numbers shown here are rounded thus creating slight discrepancies compared to the actual computations.

current assessment unit limiting factor condition values within each assessment unit (Appendix D, Attachment 3,Table C3, col G) [e.g., 3.8+0+1.9+3.9+7.8+0+21+6.4+3.4+0+4.5=52.7 for the Upper Tucannon – Pataha up to Panjab assessment unit].

Calculate "estimated 2018 assessment unit habitat condition" (Table C3, col M) — by summing the weighted estimated 2018 assessment unit limiting factor condition values within each assessment unit (Appendix D, Attachment 3,Table C3, col L [e.g., [4.75+0+1.9+6.8+22.5+0+24+6.8+5+0+4.75=76.5 for the Upper Tucannon – Pataha up to Panjab assessment unit]).

Calculate "current population habitat condition (Appendix D, Attachment 3, Table C3, col I) — by multiplying assessment unit weight (Appendix D, Attachment 3, Table C3, col C) by current assessment unit habitat condition (Appendix D, Attachment 3, Table C3, col H) for each assessment unit and summing the results for the population [e.g., (0.85 x 52.7)+(0.05 x 44.9) = (0.01 x 7) = 47.7].

Calculate "estimated 2018 population habitat condition" (Appendix D, Attachment 3, Table C3, col N) — by multiplying assessment unit weight (Appendix D, Attachment 3,Table C3, col C) by estimated 2018 assessment unit habitat condition (Appendix D, Attachment 3,Table C3, col M) for each assessment unit and summing the results for the population [e.g., (0.85 x 76.5) + (0.05 x 72.5) = 68.7].

Calculate "current habitat quality" (Appendix D, Attachment 3,Table C3, col J) — by multiplying the current population habitat condition (Appendix D, Attachment 3,Table C3, col I) by the appropriate chinook (0.0018) or steelhead (0.0004) factor that converts habitat condition to habitat quality (survival) [e.g., (47.7 x 0.0004) = 0.0191].

Calculate "estimated 2018 habitat quality" (Appendix D, Attachment 3,Table C3, col O) — by multiplying the estimated 2018 population habitat condition (Appendix D, Attachment 3,Table C3, col N) by the appropriate chinook (0.0018) or steelhead (0.0004) factor that converts habitat condition to habitat quality (survival[e.g., (68.7 x 0.0004) = 0.0275)]) .

Calculate "percent change in habitat quality[17]" (Appendix D, Attachment 3,Table C3, col P) — by dividing estimated 2018 habitat quality (Appendix D, Attachment 3,Table C3, col O) by current habitat quality (Appendix D, Attachment 3,Table C3, col J), subtract 1, and multiply by 100 [e.g., ((0.0275/0.0191) -1) x 100 = 44%.

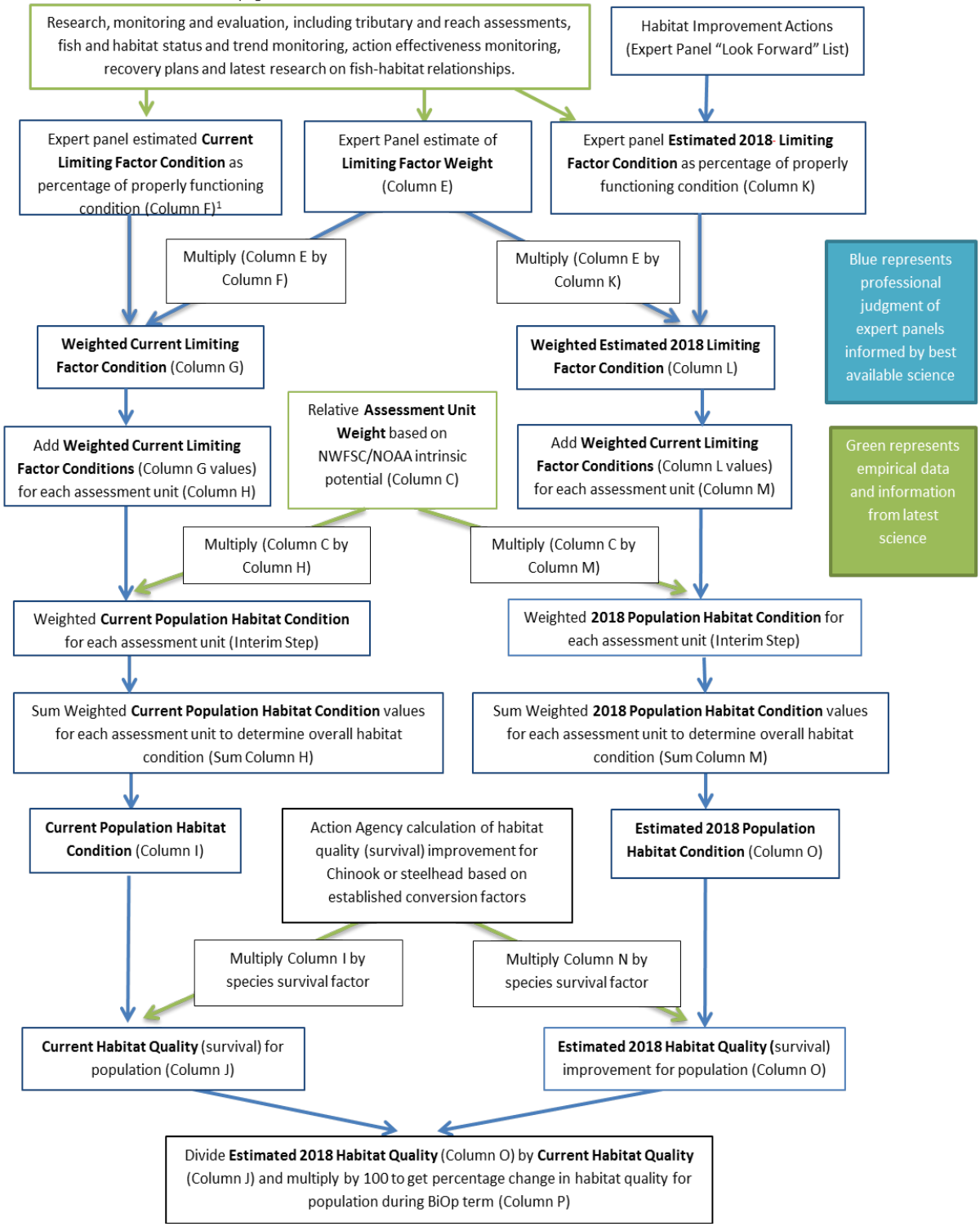
The 44 percent habitat quality improvement, shown as 1.44 in column P of Table C3 corresponds with the difference between the 2011 + 2012-18 and the 2011 HQIs achieved from expert panel results for Tucannon Steelhead presented in Table 35 in Section 2 of the 2013 Comprehensive Evaluation (3%). This result illustrates a nuance in the general procedure described above. HQI is calculated incrementally for each implementation cycle evaluated by the expert panels within the term of the BiOp. The incremental HQI for completed projects is accumulated with HQI for future projects evaluated by the expert panels to gage progress on RPA Action 35, Table 5 requirements. Thus, in Table 35 of the CE, the 47% habitat quality improvement for Tucannon steelhead represents a 44% improvement related to the look forward list of projects (2012-2018) plus 3% HQI from the look back (already completed as of the 2012 expert panel workshop) list of projects. The target for the Tucannon was a 5% improvement by 2018 for steelhead.

[17] *Because this is a ratio, the % improvement for habitat quality or population survival is represented by the same number*

Table descriptions

The following Tables C-1, 2 and 3 (Appendix D, Attachment 3) display information from the 2012 expert panel workshop for the Tucannon River Steelhead population. Table C-1 shows the Habitat Actions in the "Look Back" list for actions completed during 2009-2011. Table C-2 shows the Habitat Actions in the "Look Forward" list for actions planned for implementation for 2012-2018. Because the 2012 expert panel workshops took place early in the year, the actions implemented in 2012 which were mostly done after July are on the "Look Forward " list and will be evaluated in future expert panel workshops as part of the "Look Back" list. Table C-3 displays the Habitat Function values from the expert panel workshops and the subsequent HQI calculations.

Figure 1: Calculation of Tributary Habitat Benefits



[1] *Column references refter to Appendix D, Attachment 3, Table C3.*

Lower Snake Example - Table C1. 2009-2012 "Look Back" Actions for Tucannon River Steelhead												
DPS	**Population**	**Assess-ment Unit Code**	**Assess-ment Unit**	**2009 Limiting Factor**	**Action**	**Metric**	**Plan Value**	**Plan Comment**	**Actual Value**	**Actual Comment**	**Status**	**Work Element (In Progress / Planned)**
Snake River Steelhead	Tucannon River	TUS1	Tucannon	Barriers	No Action			No passage planned.	2011: CTUIR removed 2 passage barriers; Little Tucannon ADD IN BARRIER PROJECTS FROM CHINOOK PROJECTS	The barriers were on lower Pataha and opened up 23 miles; 3.3 miles from Little Tucannon; 0.5 miles from Russell & 0.25 Hartsock	New and Completed	85. Remove/Breach Fish Passage Barrier
Snake River Steelhead	Tucannon River	TUS1	Tucannon	Screens	No Action			No diversion screen projects planned.	No Action			
Snake River Steelhead	Tucannon River	TUS1	Tucannon	Riparian degradation	See comments.		2010, 2011, 2012: See comments.	Benefits from High Water Temperature projects.	2010: CTUIR planted 1 mile of Spring Cr.; 2011: CTUIR planted 0.5 miles/6 acres of Spring Cr. & 0.5/5 acres on Hartsock Cr. & 0.2/5 acres on the Tucannon		New and Completed	47. Plant Vegetation
Snake River Steelhead	Tucannon River	TUS1	Tucannon	Floodplain confinement	No Action		2012: CCD - 1-2 offsite dike projects are planned to restore floodplain connectivity and function.	No actions planned.	2011: CCD 1 river levee removal (5440 ft) and offsite dike (13,640 ft) 2012: WDFW remove 1300 river levee (move to look forward).	2011: CCD Minimize confinement over 3.7 RM 2012: WDFW remove confinement on 2 RM. The 2012 WDFW work will be evaluated as part of the "look forward" estimates because it is not yet completed.	In Progress / Planned	180. Enhance Floodplain/Remove, Modify, Breach Dike

Lower Snake Example - Table C1. 2009-2012 "Look Back" Actions for Tucannon River Steelhead												
DPS	**Population**	**Assess-ment Unit Code**	**Assess-ment Unit**	**2009 Limiting Factor**	**Action**	**Metric**	**Plan Value**	**Plan Comment**	**Actual Value**	**Actual Comment**	**Status**	**Work Element (In Progress / Planned)**
Snake River Steelhead	Tucannon River	TUS1	Tucannon	Habitat diversity (LWD)	See comments.		2010, 2011, 2012: See comments.	CCD - Total of 3 instream habitat projects; all include spawning and rearing habitat; locations to be determined.	2011: CCD instream restoration at Hovrud (750 ft 6 LWD structures placed). 2010: CTUIR 3.3 mile channel complexity 180 structures placed Cummings Cr, Spring Cr, & Hartsock Cr. 2012	These projects were completed in the tributaries with the exception of one structure placed at the mouth of Spring Cr in the main Tucannon River. Hovrud in mainstem. 750' instream complexity from Pataha Passage project.	Completed	29. Increase Instream Habitat Complexity and Stabilization
Snake River Steelhead	Tucannon River	TUS1	Tucannon	High water temperature	See comments.		2010, 2011, 2012: See comments.	CCD - For the 2010-2012 period, 5 additional CREP extensions will be purchased (10 year extensions).	8 contracts	73/303 acres in the lower Tucannon/Upper Tucannon	Completed	5. Land Purchase and/or Conservation Easement

Lower Snake Steelhead Example Table C2 - 2012-2018 "Look Forward" Actions for Tucannon River Steelhead									
Population	**Assessment Unit Code**	**Assessment Unit**	**2012 Standardized Limiting Factor**	**Action**	**Work Element**	**Metric**	**Metric Plan Value**	**Project source documentation**	**Plan Comment**
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	2.3: Injury and Mortality: Mechanical Injury	No Action					

Lower Snake Steelhead Example Table C2 - 2012-2018 "Look Forward" Actions for Tucannon River Steelhead									
Population	**Assessment Unit Code**	**Assessment Unit**	**2012 Standardized Limiting Factor**	**Action**	**Work Element**	**Metric**	**Metric Plan Value**	**Project source documentation**	**Plan Comment**
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	4.1: Riparian Condition: Riparian Vegetation	Project 1 relocate campground from floodplain to upland area	181. Create, Restore, and/or Enhance Wetland	1691. # of acres of riparian habitat restored/re-established	3 acres	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	move campground up slope out of floodplain Cost Range: $25,000 - $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	4.1: Riparian Condition: Riparian Vegetation	Riparian planting: Project Area 10 & 11 forty acres each, Project Area 12 eighteen acres, Project Area 17 seventeen acres	47. Plant Vegetation	1403. # of riparian acres treated	115 acres	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	Areas Burn on WDFW and residential areas near Last Resort Cost Range: Over $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Project 28 Set back river levee and remove rip rap and hard points	180. Enhance Floodplain/Remove, Modify, Breach Dike	1441. # of miles of habitat accessed to the next upstream barrier(s) or likely limit of habitable range	0.125 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	removing structures will provide access to 22 acres of low lying floodplain Cost Range: Over $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Project 17 Excavate side channel habitat	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	0.3 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	Cost Range: Over $200,003

Lower Snake Steelhead Example Table C2 - 2012-2018 "Look Forward" Actions for Tucannon River Steelhead									
Population	**Assessment Unit Code**	**Assessment Unit**	**2012 Standardized Limiting Factor**	**Action**	**Work Element**	**Metric**	**Metric Plan Value**	**Project source documentation**	**Plan Comment**
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Project 3 remove small spoil berm to open low floodplain	180. Enhance Floodplain/Remove, Modify, Breach Dike	1441. # of miles of habitat accessed to the next upstream barrier(s) or likely limit of habitable range	0.07 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule, WDFW Floodplain Management Plan	remove 380 ft of riprap to reestablish approx. 0.59 acres of Low floodplain Cost Range: $25,000 - $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Project 4 & 5 Camp Wooten & Tucannon Camp Ground river levee removal and set back	180. Enhance Floodplain/Remove, Modify, Breach Dike	1441. # of miles of habitat accessed to the next upstream barrier(s) or likely limit of habitable range	0.43 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	Cost Range: Over $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Project 8 Curl Lake Levee	180. Enhance Floodplain/Remove, Modify, Breach Dike	1441. # of miles of habitat accessed to the next upstream barrier(s) or likely limit of habitable range	0.13 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	This conceptual plan could be constructed without reconfiguring the lake and would reduce confinement and add I acre of floodplain Cost Range: Over $200,000

Lower Snake Steelhead Example Table C2 - 2012-2018 "Look Forward" Actions for Tucannon River Steelhead									
Population	**Assessment Unit Code**	**Assessment Unit**	**2012 Standardized Limiting Factor**	**Action**	**Work Element**	**Metric**	**Metric Plan Value**	**Project source documentation**	**Plan Comment**
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Project 8 Curl Lake Levee	30. Realign, Connect, and/or Create Channel	1476. # of stream miles after treatment	0.29 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	This conceptual plan could be constructed without reconfiguring the lake and would reduce confinement and add I acre of floodplain Cost Range: $25,000 - $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Project Area 10 LWD Project Big 4 to Beaver Lake Diversion	180. Enhance Floodplain/Remove, Modify, Breach Dike	1441. # of miles of habitat accessed to the next upstream barrier(s) or likely limit of habitable range	0.25 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	this will remove 1300 ft of levees and spoil piles limiting channel migration Cost Range: $25,000 - $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Project 11 Infrastructure removal, relocate access road to Beave Watson Lake	33. Decommission Road/Relocate Road	1394. # of miles of road improved or decommissioned in a riparian area	0.29 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule, WDFW Floodplain Management Plan	This would be tied to the Beave Watson proposed concept Cost Range: $25,000 - $200,000

Lower Snake Steelhead Example Table C2 - 2012-2018 "Look Forward" Actions for Tucannon River Steelhead									
Population	**Assessment Unit Code**	**Assessment Unit**	**2012 Standardized Limiting Factor**	**Action**	**Work Element**	**Metric**	**Metric Plan Value**	**Project source documentation**	**Plan Comment**
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Project 14 remove channel confining structures and material	180. Enhance Floodplain/Remove, Modify, Breach Dike	1441. # of miles of habitat accessed to the next upstream barrier(s) or likely limit of habitable range	0.03 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	This metric is a bit odd is not good for representing reducing confinement. will open 18 acres of low-lying floodplain Cost Range: $25,000 - $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Project 23 Ramirez	180. Enhance Floodplain/Remove, Modify, Breach Dike	1441. # of miles of habitat accessed to the next upstream barrier(s) or likely limit of habitable range	0.41 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	Approx 9.5 acres of low-lying floodplain possible, 890 ft of setback levee needed Cost Range: Over $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Project 4 & 5 Camp Wooten & Tucannon Camp Ground, create new side channel	30. Realign, Connect, and/or Create Channel	1476. # of stream miles after treatment	0.53 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	Stream channel would be increased by 820 ft Cost Range: $25,000 - $200,000

Lower Snake Steelhead Example Table C2 - 2012-2018 "Look Forward" Actions for Tucannon River Steelhead									
Population	**Assessment Unit Code**	**Assessment Unit**	**2012 Standardized Limiting Factor**	**Action**	**Work Element**	**Metric**	**Metric Plan Value**	**Project source documentation**	**Plan Comment**
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Project 7 USFS Ranger Station Road Set Back	33. Decommission Road/Relocate Road	1394. # of miles of road improved or decommissioned in a riparian area	0.5 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	Remove 2700 ft of Tucannon Rd and about 340 linear ft of riprap. Rd would be relocated up slope. This entails removing 380 ft of rip rap along the road that is proposed to be removed Cost Range: Over $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Tucannon Lakes reconfiguration and infrastructure removal	180. Enhance Floodplain/Remove, Modify, Breach Dike	1441. # of miles of habitat accessed to the next upstream barrier(s) or likely limit of habitable range	1.59 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule, WDFW Floodplain Management Plan	This metric is for Big 4, Beaver Watson, Curl and Rainbow. Deer lake was not included but will be part of the floodplain management assessment. Complexity work associated with these projects is listed separately. Cost Range: Over $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Project 24, Golf Course	180. Enhance Floodplain/Remove, Modify, Breach Dike	1441. # of miles of habitat accessed to the next upstream barrier(s) or likely limit of habitable range	0.48 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	This is a measurement of the river reach which would have confinement minimized Cost Range: Over $200,000

Lower Snake Steelhead Example Table C2 - 2012-2018 "Look Forward" Actions for Tucannon River Steelhead									
Population	**Assessment Unit Code**	**Assessment Unit**	**2012 Standardized Limiting Factor**	**Action**	**Work Element**	**Metric**	**Metric Plan Value**	**Project source documentation**	**Plan Comment**
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Project 27 River levee removal to encourage river meander width	180. Enhance Floodplain/Remove, Modify, Breach Dike	1441. # of miles of habitat accessed to the next upstream barrier(s) or likely limit of habitable range	0.05 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	this levee removal project will require 2800 ft of setback Cost Range: Over $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Project 15, Headquarters	180. Enhance Floodplain/Remove, Modify, Breach Dike	1441. # of miles of habitat accessed to the next upstream barrier(s) or likely limit of habitable range	0.16 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	This structure prevents lateral movement of the channel Cost Range: $25,000 - $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Project 17 Remove river levee to reconnect low-lying floodplain	180. Enhance Floodplain/Remove, Modify, Breach Dike	1441. # of miles of habitat accessed to the next upstream barrier(s) or likely limit of habitable range	0.13 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	would reconnect 2.25 acres of floodplain Cost Range: Over $200,001
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Project 18 remove infrastructure and access routes from floodplain	180. Enhance Floodplain/Remove, Modify, Breach Dike	1441. # of miles of habitat accessed to the next upstream barrier(s) or likely limit of habitable range	? Miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	Cost Range: $25,000 - $200,000

Lower Snake Steelhead Example Table C2 - 2012-2018 "Look Forward" Actions for Tucannon River Steelhead									
Population	**Assessment Unit Code**	**Assessment Unit**	**2012 Standardized Limiting Factor**	**Action**	**Work Element**	**Metric**	**Metric Plan Value**	**Project source documentation**	**Plan Comment**
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Project 19 Remove river levee to increase channel meander width	180. Enhance Floodplain/Remove, Modify, Breach Dike	1441. # of miles of habitat accessed to the next upstream barrier(s) or likely limit of habitable range	0.03 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	removing hard points restricting channel movement Cost Range: $25,000 - $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Project 21 Remove river levee and river confining structure	180. Enhance Floodplain/Remove, Modify, Breach Dike	1441. # of miles of habitat accessed to the next upstream barrier(s) or likely limit of habitable range	0.33 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	Cost Range: Over $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Project 22 River levee removal to encourage lateral channel migration	180. Enhance Floodplain/Remove, Modify, Breach Dike	1441. # of miles of habitat accessed to the next upstream barrier(s) or likely limit of habitable range	0.56 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	would reconnect 2.45 acres of floodplain and require 190 ft of setback levee Cost Range: Over $200,002
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 11 Beaver Watson place LWD for channel complexity	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	1.8 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	This project will be sequenced with the Tucannon Lakes Reconfiguration Plan Cost Range: Over $200,000

Lower Snake Steelhead Example Table C2 - 2012-2018 "Look Forward" Actions for Tucannon River Steelhead									
Population	**Assessment Unit Code**	**Assessment Unit**	**2012 Standardized Limiting Factor**	**Action**	**Work Element**	**Metric**	**Metric Plan Value**	**Project source documentation**	**Plan Comment**
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 12 Deer Lake Side Channel	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	0.4 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	This work could be completed independently of the lake reconfiguration. Cost Range: $25,000 - $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 13 (Rainbow Lake) LWD placement for habitat complexity	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	0.7 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	This project would be tied or sequenced with modifications of Rainbow Lake Cost Range: Over $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 14 place LWD for complexity	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	1.95 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule, WDFW Floodplain Management Plan	this work is planned for 2013 work window Cost Range: Over $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 27 LWD placement to develop channel complexity	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	0.23 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	Cost Range: Over $200,000

Lower Snake Steelhead Example Table C2 - 2012-2018 "Look Forward" Actions for Tucannon River Steelhead									
Population	**Assessment Unit Code**	**Assessment Unit**	**2012 Standardized Limiting Factor**	**Action**	**Work Element**	**Metric**	**Metric Plan Value**	**Project source documentation**	**Plan Comment**
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 28 Place LWD to improve channel complexity	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	0.2 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	Cost Range: $25,000 - $200,001
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 4 & 5 Camp Wooten & Tucannon Camp Ground LWD placement for channel complexity	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	0.95 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	The proposed wood placement may be dependent on the levee and infrastructure work Cost Range: Over $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 4 & 5 Camp Wooten & Tucannon Camp Ground, decommission roadways	33. Decommission Road/Relocate Road	1394. # of miles of road improved or decommissioned in a riparian area	0.57 miles of road removed	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	this would open up 10.87 acres of floodplain Cost Range: Over $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 6&7 USFS Ranger Station LWD placement to create channel complexity	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	0.7 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	The lower portion of project 6 is in protection. The upper section has a small LWD recommendation which I have combined with project 7 Cost Range: Over $200,000

Lower Snake Steelhead Example Table C2 - 2012-2018 "Look Forward" Actions for Tucannon River Steelhead									
Population	**Assessment Unit Code**	**Assessment Unit**	**2012 Standardized Limiting Factor**	**Action**	**Work Element**	**Metric**	**Metric Plan Value**	**Project source documentation**	**Plan Comment**
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 8 Curl Lake LWD placement for channel complexity	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	0.3 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	This conceptual plan could be constructed without reconfiguring the lake and would reduce confinement and add I acre of floodplain Cost Range: $25,000 - $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 25 LWD placement for complexity	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	0.2 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	This project is small and also in close proximity to the CHAMP monitoring control Cost Range: Over $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 26 Marengo Levee Set Back	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	1.8 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	This work will be designed as the levee removal project has experienced some high flow Cost Range: Over $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 3 place LWD for complexity	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	1.3 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	Cost Range: Over $200,000

Lower Snake Steelhead Example Table C2 - 2012-2018 "Look Forward" Actions for Tucannon River Steelhead									
Population	**Assessment Unit Code**	**Assessment Unit**	**2012 Standardized Limiting Factor**	**Action**	**Work Element**	**Metric**	**Metric Plan Value**	**Project source documentation**	**Plan Comment**
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 19 Add LWD for complexity	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	0.3 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	Cost Range: Over $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 9 (Big 4 Lake)	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	0.6 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	This project is tied to the Tucannon Lake Modification Plan and may be tied to the lake decommissioning Cost Range: Over $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project Area 10 LWD Project North South Camp to Beaver Diversion	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	1.6 miles improved complexity	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	220 trees placed in channel scheduled for 2012 Cost Range: Over $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 15, Headquarters	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	0.8 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	This project will be going to design in the summer of 2012 with implementation in 2013-2014 Cost Range: Over $200,000

Lower Snake Steelhead Example Table C2 - 2012-2018 "Look Forward" Actions for Tucannon River Steelhead									
Population	**Assessment Unit Code**	**Assessment Unit**	**2012 Standardized Limiting Factor**	**Action**	**Work Element**	**Metric**	**Metric Plan Value**	**Project source documentation**	**Plan Comment**
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 17 Add LWD for increasing channel roughness	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	0.6 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	Cost Range: Over $200,002
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 18 LWD supplementation to meet restoration objective of 1 key piece per channel width	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	0.7 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	Cost Range: Over $200,004
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 21 LWD placement for the development of channel complexity	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	1.1 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	Cost Range: Over $200,001
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 22 LWD placement to increase channel complexity	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	1 mile	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	Cost Range: Over $200,003

Lower Snake Steelhead Example Table C2 - 2012-2018 "Look Forward" Actions for Tucannon River Steelhead									
Population	**Assessment Unit Code**	**Assessment Unit**	**2012 Standardized Limiting Factor**	**Action**	**Work Element**	**Metric**	**Metric Plan Value**	**Project source documentation**	**Plan Comment**
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 24, Golf course	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	0.75 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	Cost Range: Over $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 23 Ramirez	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	0.95 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	Cost Range: Over $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 1 place LWD for complexity	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	1.3 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	Project is being phase so the floodplain work will be completed prior to engaging in channel design and implementation Cost Range: $25,000 - $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project 2 reconnect side channel	30. Realign, Connect, and/or Create Channel	1476. # of stream miles after treatment	0.27 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	200 foot excavation would reconnect channel Cost Range: $5,000 - $25,000

Lower Snake Steelhead Example Table C2 - 2012-2018 "Look Forward" Actions for Tucannon River Steelhead									
Population	**Assessment Unit Code**	**Assessment Unit**	**2012 Standardized Limiting Factor**	**Action**	**Work Element**	**Metric**	**Metric Plan Value**	**Project source documentation**	**Plan Comment**
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	6.2: Channel Structure and Form: Instream Structural Complexity	Project Area 2 (below Panjab Bridge) LWD placement for channel complexity	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	0.2 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	This project is both on private and public lands Cost Range: $25,000 - $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	8.1: Water Quality: Temperature	Project 18, 20 and 25 Conservation Easements	5. Land Purchase and/or Conservation Easement	1379. # of riparian miles protected	1.3 miles	Conceptual Restoration Plan, Reaches 6-10 Tucannon River Phase II, SRSRB Implementation Schedule	These are protection reaches identified in the plan. Habitat is in excellent or recovered condition. Project 18 protection piece is below bridge 13 Cost Range: Over $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	8.4: Water Quality: Turbidity	Road Decommissioning Tucannon, Pataha	33. Decommission Road/Relocate Road	1394. # of miles of road improved or decommissioned in a riparian area	10 miles	Salmon Recovery Plan for SE Washington 3 Yr Work Plan	Cost Range: $25,000 - $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	8.4: Water Quality: Turbidity	Road Decommissioning Tucannon, Pataha	33. Decommission Road/Relocate Road	1395. # of miles of road improved or decommissioned in an upland area	30 miles	Salmon Recovery Plan for SE Washington 3 Yr Work Plan	Cost Range: $25,000 - $200,000

Lower Snake Steelhead Example Table C2 - 2012-2018 "Look Forward" Actions for Tucannon River Steelhead									
Population	**Assessment Unit Code**	**Assessment Unit**	**2012 Standardized Limiting Factor**	**Action**	**Work Element**	**Metric**	**Metric Plan Value**	**Project source documentation**	**Plan Comment**
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	9.2: Water Quantity: Decreased Water Quantity	Road Decommission Tucannon, Pataha	33. Decommission Road/Relocate Road	1395. # of miles of road improved or decommissioned in an upland area	30 miles	Salmon Recovery Plan for SE Washington 3 Yr Work Plan	Cost Range: $25,000 - $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	9.2: Water Quantity: Decreased Water Quantity	Tucannon Water efficiency	164. Acquire Water Instream	1452. Amount of water secured in acre-feet/year	23.4 ac-ft	CCD	Project should be completed in 2012 Cost Range: $25,000 - $200,000
Tucannon River	TUS1A	Upper Tucannon - Pataha up to Panjab	9.2: Water Quantity: Decreased Water Quantity	Road Decommission Tucannon, Pataha	33. Decommission Road/Relocate Road	1394. # of miles of road improved or decommissioned in a riparian area	10 miles	Salmon Recovery Plan for SE Washington 3 Yr Work Plan	Cost Range: $25,000 - $200,000
Tucannon River	TUS1B	Lower Tucannon - Mouth to Pataha	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Tucannon Ranch Levee setback	180. Enhance Floodplain/Remove, Modify, Breach Dike	1441. # of miles of habitat accessed to the next upstream barrier(s) or likely limit of habitable range	1 mile	Salmon Recovery Plan for SE Washington 3 Yr Work Plan	Preliminary designs completed Cost Range: Over $200,000
Tucannon River	TUS1B	Lower Tucannon - Mouth to Pataha	6.2: Channel Structure and Form: Instream Structural Complexity	Tucannon Ranch Levee setback LWD placement for complexity	29. Increase Instream Habitat Complexity and Stabilization	1387. # of miles of stream with improved complexity	2 miles	Salmon Recovery Plan for SE Washington 3 Yr Work Plan	Cost Range: Over $200,000
Tucannon River	TUS1B	Lower Tucannon - Mouth to Pataha	6.2: Channel Structure and Form: Instream Structural Complexity	Small Tucannon River Tributary LWD Placement	30. Realign, Connect, and/or Create Channel	1476. # of stream miles after treatment	2 miles	Salmon Recovery Plan for SE Washington 3 Yr Work Plan	Cummins Creek Cost Range: $25,000 - $200,000

Lower Snake Steelhead Example Table C2 - 2012-2018 "Look Forward" Actions for Tucannon River Steelhead									
Population	**Assessment Unit Code**	**Assessment Unit**	**2012 Standardized Limiting Factor**	**Action**	**Work Element**	**Metric**	**Metric Plan Value**	**Project source documentation**	**Plan Comment**
Tucannon River	TUS1B	Lower Tucannon - Mouth to Pataha	8.1: Water Quality: Temperature	Tucannon Ranch Levee setback	47. Plant Vegetation	1403. # of riparian acres treated	5 acres	Salmon Recovery Plan for SE Washington 3 Yr Work Plan	Cost Range: $25,000 - $200,000
Tucannon River	TUS1B	Lower Tucannon - Mouth to Pataha	9.2: Water Quantity: Decreased Water Quantity	Tucannon Water efficiency	164. Acquire Water Instream	1452. Amount of water secured in acre-feet/year	23.4 ac-ft	CCD	Project should be completed in 2012 Cost Range: $25,000 - $200,000
Tucannon River	TUS1C	Pataha	1.1: Habitat Quantity: Anthropogenic Barriers	Pataha Public Rd Culvert Fish Passage Project 35-00144	85. Remove/Breach Fish Passage Barrier	1441. # of miles of habitat accessed to the next upstream barrier(s) or likely limit of habitable range	30 miles	Salmon Recovery Plan for SE Washington 3 Yr Work Plan	The lower barriers are partial but have more than 30 miles of habitat up to them. The upper barriers have aproximatly4 miles of habitat above them Cost Range: Over $200,000
Tucannon River	TUS1C	Pataha	5.2: Peripheral and Transitional Habitats: Floodplain Condition	Small Tucannon River Tributary Connectivity	85. Remove/Breach Fish Passage Barrier	1441. # of miles of habitat accessed to the next upstream barrier(s) or likely limit of habitable range	2 miles	Salmon Recovery Plan for SE Washington 3 Yr Work Plan	These tribs were identified in RTT discussion as a concern for steelhead only Cost Range: Over $200,000
Tucannon River	TUS1C	Pataha	8.1: Water Quality: Temperature	Pataha Riparian	47. Plant Vegetation	1403. # of riparian acres treated	20 acres	Salmon Recovery Plan for SE Washington 3 Yr Work Plan	Cost Range: Over $200,000

Lower Snake Steelhead Example Table C2 - 2012-2018 "Look Forward" Actions for Tucannon River Steelhead									
Population	**Assessment Unit Code**	**Assessment Unit**	**2012 Standardized Limiting Factor**	**Action**	**Work Element**	**Metric**	**Metric Plan Value**	**Project source documentation**	**Plan Comment**
Tucannon River	TUS1C	Pataha	8.4: Water Quality: Turbidity	Relocate Stock Water Out of Sensitive Riparian Areas in Pataha Creek	40. Install Fence	1488. # of river miles treated	5 miles	Salmon Recovery Plan for SE Washington 3 Yr Work Plan	Cost Range: Over $200,000
Tucannon River	TUS1C	Pataha	8.4: Water Quality: Turbidity	Pataha Creek Willow Whips	47. Plant Vegetation	1406. # of riparian miles treated	5 miles	Salmon Recovery Plan for SE Washington 3 Yr Work Plan	These planting would take place in the inset floodplain Cost Range: Over $200,000
Tucannon River	TUS1C	Pataha	8.4: Water Quality: Turbidity	Road Decommissioning Tucannon, Pataha	33. Decommission Road/Relocate Road	1394. # of miles of road improved or decommissioned in a riparian area	10 miles	Salmon Recovery Plan for SE Washington 3 Yr Work Plan	Cost Range: $25,000 - $200,000
Tucannon River	TUS1C	Pataha	8.4: Water Quality: Turbidity	Road Decommissioning Tucannon, Pataha	33. Decommission Road/Relocate Road	1395. # of miles of road improved or decommissioned in an upland area	30 miles	Salmon Recovery Plan for SE Washington 3 Yr Work Plan	Cost Range: $25,000 - $200,000

Lower Snake Steelhead Table C3. Example Habitat Quality Improvement estimation method for Tucannon River Steelhead

Assessment Unit Characteristics					**Current Conditions- Before Actions Are Implemented**					**Estimated Conditions- After Actions Are Implemented**					
Assess-ment Unit	**Assess-ment Unit Code**	**Assess-ment Unit Weight**	**2012 Standard-ized Limiting Factor**	**Limit-ing Factor Weight**	**Current Limiting Factor Condi-tion (*Low Book-end*)**	**Weighte d Current Limiting Factor Condi-tion = (E)*(F)**	**Current Assess ment Unit Habitat Condi-tion = sum of (G)**	**Current Populati on Habitat Condi-tion = sum of (H)*(C)**	**Current Habitat Quality (I*con-version factor[1])**	**Estima ted 2018 Limit-ing Factor Condi-tion**	**Weighted Estimated 2018 Limiting Factor Condition = (E)*(K)**	**Estimated 2018 Assess-ment Unit Habitat Condition = sum of (L)**	**Estimated 2018 Popula-tion Habitat Condition = sum of (M)*(C)**	**Estimated 2018 Habitat Quality (N*con-version factor[1])**	**Habitat Quality Im-prove-ment (O/J)**
(A)	**(B)**	**(C)**	**(D)**	**(E)**	**(F)**	**(G)**	**(H)**	**(I)**	**(J)**	**(K)**	**(L)**	**(M)**	**(N)**	**(O)**	**(P)**
Upper Tucan-non - Pataha up to Panjab	TUS1A	85%	1.1: Habitat Quantity: Anthropo-genic Barriers	5%	75	3.8	52.7	47.7	0.0191	95	4.75	76.5	68.7	0.0275	1.44
			10.4: Population Level Effects: Life History Changes	0%	25	0					0				
			2.3: Injury and Mortality: Mechanical Injury	2%	96	1.9				96	1.9				
			4.1: Riparian Condition: Riparian Vegetation	10%	39	3.9				68	6.8				

Lower Snake Steelhead Table C3. Example Habitat Quality Improvement estimation method for Tucannon River Steelhead															
Assessment Unit Characteristics					**Current Conditions- Before Actions Are Implemented**					**Estimated Conditions- After Actions Are Implemented**					
Assessment Unit	**Assessment Unit Code**	**Assessment Unit Weight**	**2012 Standardized Limiting Factor**	**Limiting Factor Weight**	**Current Limiting Factor Condition (*Low Book-end*)**	**Weighted Current Limiting Factor Condition = (E)*(F)**	**Current Assessment Unit Habitat Condition = sum of (G)**	**Current Population Habitat Condition = sum of (H)*(C)**	**Current Habitat Quality (I*conversion factor[1])**	**Estimated 2018 Limiting Factor Condition**	**Weighted Estimated 2018 Limiting Factor Condition = (E)*(K)**	**Estimated 2018 Assessment Unit Habitat Condition = sum of (L)**	**Estimated 2018 Population Habitat Condition = sum of (M)*(C)**	**Estimated 2018 Habitat Quality (N*conversion factor[1])**	**Habitat Quality Improvement (O/J)**
(A)	**(B)**	**(C)**	**(D)**	**(E)**	**(F)**	**(G)**	**(H)**	**(I)**	**(J)**	**(K)**	**(L)**	**(M)**	**(N)**	**(O)**	**(P)**
			5.2: Peripheral and Transitional Habitats: Floodplain Condition	30%	26	7.8				75	22.5				
			6.1: Channel Structure and Form: Bed and Channel Form	0%	51	0					0				
			6.2: Channel Structure and Form: Instream Structural Complexity	30%	70	21.0				80	24.0				
			7.2: Sediment Conditions: Increased Sediment	8%	80	6.4				85	6.8				

Lower Snake Steelhead Table C3. Example Habitat Quality Improvement estimation method for Tucannon River Steelhead															
Assessment Unit Characteristics					**Current Conditions- Before Actions Are Implemented**					**Estimated Conditions- After Actions Are Implemented**					
Assess-ment Unit	**Assess-ment Unit Code**	**Assess-ment Unit Weight**	**2012 Standard-ized Limiting Factor**	**Limit-ing Factor Weight**	**Current Limiting Factor Condi-tion (*Low Book-end*)**	**Weighte d Current Limiting Factor Condi-tion = (E)*(F)**	**Current Assess ment Unit Habitat Condi-tion = sum of (G)**	**Current Populati on Habitat Condi-tion = sum of (H)*(C)**	**Current Habitat Quality (I*con-version factor[1])**	**Estima ted 2018 Limit-ing Factor Condi-tion**	**Weighted Estimated 2018 Limiting Factor Condition = (E)*(K)**	**Estimated 2018 Assess-ment Unit Habitat Condition = sum of (L)**	**Estimated 2018 Popula-tion Habitat Condition = sum of (M)*(C)**	**Estimated 2018 Habitat Quality (N*con-version factor[1])**	**Habitat Quality Im-prove-ment (O/J)**
(A)	**(B)**	**(C)**	**(D)**	**(E)**	**(F)**	**(G)**	**(H)**	**(I)**	**(J)**	**(K)**	**(L)**	**(M)**	**(N)**	**(O)**	**(P)**
			Quantity												
			8.1: Water Quality: Tempera-ture	10%	34	3.4				50	5.0				
			8.4: Water Quality: Turbidity	0%	97	0					0				
			9.2: Water Quantity: Decreased Water Quantity	5%	90	4.5				95	4.75				
Lower Tucan-non - Mouth to Pataha	TUS1B	5%	1.1: Habitat Quantity: Anthropo-genic Barriers	5%	95	4.8	44.9			96	4.8	72.5			

Lower Snake Steelhead Table C3. Example Habitat Quality Improvement estimation method for Tucannon River Steelhead															
Assessment Unit Characteristics					**Current Conditions- Before Actions Are Implemented**					**Estimated Conditions- After Actions Are Implemented**					
Assessment Unit	**Assessment Unit Code**	**Assessment Unit Weight**	**2012 Standardized Limiting Factor**	**Limiting Factor Weight**	**Current Limiting Factor Condition (*Low Bookend*)**	**Weighted Current Limiting Factor Condition = (E)*(F)**	**Current Assessment Unit Habitat Condition = sum of (G)**	**Current Population Habitat Condition = sum of (H)*(C)**	**Current Habitat Quality (I*conversion factor[1])**	**Estimated 2018 Limiting Factor Condition**	**Weighted Estimated 2018 Limiting Factor Condition = (E)*(K)**	**Estimated 2018 Assessment Unit Habitat Condition = sum of (L)**	**Estimated 2018 Population Habitat Condition = sum of (M)*(C)**	**Estimated 2018 Habitat Quality (N*conversion factor[1])**	**Habitat Quality Improvement (O/J)**
(A)	**(B)**	**(C)**	**(D)**	**(E)**	**(F)**	**(G)**	**(H)**	**(I)**	**(J)**	**(K)**	**(L)**	**(M)**	**(N)**	**(O)**	**(P)**
Lower Tucannon - Mouth to Pataha	TUS1B	5%	10.4: Population Level Effects: Life History Changes	0%	25	0					0				
Lower Tucannon - Mouth to Pataha	TUS1B	5%	2.3: Injury and Mortality: Mechanical Injury	2%	96	1.9				96	1.9				
Lower Tucannon - Mouth to Pataha	TUS1B	5%	4.1: Riparian Condition: Riparian Vegetation	10%	32	3.2				68	6.8				
Lower Tucannon - Mouth to Pataha	TUS1B	5%	5.2: Peripheral and Transitional Habitats: Floodplain Condition	30%	27	8.1				75	22.5				

Lower Snake Steelhead Table C3. Example Habitat Quality Improvement estimation method for Tucannon River Steelhead															
Assessment Unit Characteristics					**Current Conditions- Before Actions Are Implemented**					**Estimated Conditions- After Actions Are Implemented**					
Assess-ment Unit	**Assess-ment Unit Code**	**Assess-ment Unit Weight**	**2012 Standard-ized Limiting Factor**	**Limit-ing Factor Weight**	**Current Limiting Factor Condi-tion (*Low Book-end*)**	**Weighte d Current Limiting Factor Condi-tion = (E)*(F)**	**Current Assess ment Unit Habitat Condi-tion = sum of (G)**	**Current Populati on Habitat Condi-tion = sum of (H)*(C)**	**Current Habitat Quality (I*con-version factor[1])**	**Estima ted 2018 Limit-ing Factor Condi-tion**	**Weighted Estimated 2018 Limiting Factor Condition = (E)*(K)**	**Estimated 2018 Assess-ment Unit Habitat Condition = sum of (L)**	**Estimated 2018 Popula-tion Habitat Condition = sum of (M)*(C)**	**Estimated 2018 Habitat Quality (N*con-version factor[1])**	**Habitat Quality Im-prove-ment (O/J)**
(A)	**(B)**	**(C)**	**(D)**	**(E)**	**(F)**	**(G)**	**(H)**	**(I)**	**(J)**	**(K)**	**(L)**	**(M)**	**(N)**	**(O)**	**(P)**
Lower Tucan-non - Mouth to Pataha	TUS1B	5%	6.1: Channel Structure and Form: Bed and Channel Form	10%	54	5.4				75	7.5				
Lower Tucan-non - Mouth to Pataha	TUS1B	5%	6.2: Channel Structure and Form: Instream Structural Complexit y	20%	36	7.2				62	12.4				
Lower Tucan-non - Mouth to Pataha	TUS1B	5%	7.2: Sediment Conditions : Increased Sediment Quantity	8%	80	6.4				85	6.8				
Lower Tucan-non - Mouth to Pataha	TUS1B	5%	8.1: Water Quality: Tempera-ture	10%	34	3.4				50	5.0				

Lower Snake Steelhead Table C3. Example Habitat Quality Improvement estimation method for Tucannon River Steelhead															
Assessment Unit Characteristics					**Current Conditions- Before Actions Are Implemented**					**Estimated Conditions- After Actions Are Implemented**					
Assessment Unit	**Assessment Unit Code**	**Assessment Unit Weight**	**2012 Standardized Limiting Factor**	**Limiting Factor Weight**	**Current Limiting Factor Condition (*Low Bookend*)**	**Weighted Current Limiting Factor Condition = (E)*(F)**	**Current Assessment Unit Habitat Condition = sum of (G)**	**Current Population Habitat Condition = sum of (H)*(C)**	**Current Habitat Quality (I*conversion factor[1])**	**Estimated 2018 Limiting Factor Condition**	**Weighted Estimated 2018 Limiting Factor Condition = (E)*(K)**	**Estimated 2018 Assessment Unit Habitat Condition = sum of (L)**	**Estimated 2018 Population Habitat Condition = sum of (M)*(C)**	**Estimated 2018 Habitat Quality (N*conversion factor[1])**	**Habitat Quality Improvement (O/J)**
(A)	**(B)**	**(C)**	**(D)**	**(E)**	**(F)**	**(G)**	**(H)**	**(I)**	**(J)**	**(K)**	**(L)**	**(M)**	**(N)**	**(O)**	**(P)**
Lower Tucannon - Mouth to Pataha	TUS1B	5%	8.4: Water Quality: Turbidity	0%	80	0					0				
Lower Tucannon - Mouth to Pataha	TUS1B	5%	9.2: Water Quantity: Decreased Water Quantity	5%	90	4.5				95	4.75				
Pataha	TUS1C	10%	1.1: Habitat Quantity: Anthropogenic Barriers	5%		0	7.0				0	0			
Pataha	TUS1C	10%	10.4: Population Level Effects: Life History Changes	0%		0					0				

Lower Snake Steelhead Table C3. Example Habitat Quality Improvement estimation method for Tucannon River Steelhead															
Assessment Unit Characteristics					**Current Conditions- Before Actions Are Implemented**					**Estimated Conditions- After Actions Are Implemented**					
Assess-ment Unit	**Assess-ment Unit Code**	**Assess-ment Unit Weight**	**2012 Standard-ized Limiting Factor**	**Limit-ing Factor Weight**	**Current Limiting Factor Condi-tion (*Low Book-end*)**	**Weighte d Current Limiting Factor Condi-tion = (E)*(F)**	**Current Assess ment Unit Habitat Condi-tion = sum of (G)**	**Current Popula tion Habitat Condi-tion = sum of (H)*(C)**	**Current Habitat Quality (I*con-version factor[1])**	**Estima ted 2018 Limit-ing Factor Condi-tion**	**Weighted Estimated 2018 Limiting Factor Condition = (E)*(K)**	**Estimated 2018 Assess-ment Unit Habitat Condition = sum of (L)**	**Estimated 2018 Popula-tion Habitat Condition = sum of (M)*(C)**	**Estimated 2018 Habitat Quality (N*con-version factor[1])**	**Habitat Quality Im-prove-ment (O/J)**
(A)	**(B)**	**(C)**	**(D)**	**(E)**	**(F)**	**(G)**	**(H)**	**(I)**	**(J)**	**(K)**	**(L)**	**(M)**	**(N)**	**(O)**	**(P)**
Pataha	TUS1C	10%	2.3: Injury and Mortality: Mechanical Injury	2%		0					0				
Pataha	TUS1C	10%	4.1: Riparian Condition: Riparian Vegetation	10%	40	4.0					0				
Pataha	TUS1C	10%	5.2: Peripheral and Transition-al Habitats: Floodplain Condition	30%		0					0				
Pataha	TUS1C	10%	6.1: Channel Structure and Form: Bed and Channel Form	10%		0					0				

Lower Snake Steelhead Table C3. Example Habitat Quality Improvement estimation method for Tucannon River Steelhead															
Assessment Unit Characteristics					**Current Conditions- Before Actions Are Implemented**					**Estimated Conditions- After Actions Are Implemented**					
Assess-ment Unit	**Assess-ment Unit Code**	**Assess-ment Unit Weight**	**2012 Standard-ized Limiting Factor**	**Limit-ing Factor Weight**	**Current Limiting Factor Condi-tion (*Low Book-end*)**	**Weighte d Current Limiting Factor Condi-tion = (E)*(F)**	**Current Assess ment Unit Habitat Condi-tion = sum of (G)**	**Current Populati on Habitat Condi-tion = sum of (H)*(C)**	**Current Habitat Quality (I*con-version factor[1])**	**Estima ted 2018 Limit-ing Factor Condi-tion**	**Weighted Estimated 2018 Limiting Factor Condition = (E)*(K)**	**Estimated 2018 Assess-ment Unit Habitat Condition = sum of (L)**	**Estimated 2018 Popula-tion Habitat Condition = sum of (M)*(C)**	**Estimated 2018 Habitat Quality (N*con-version factor[1])**	**Habitat Quality Im-prove-ment (O/J)**
(A)	**(B)**	**(C)**	**(D)**	**(E)**	**(F)**	**(G)**	**(H)**	**(I)**	**(J)**	**(K)**	**(L)**	**(M)**	**(N)**	**(O)**	**(P)**
Pataha	TUS1C	10%	6.2: Channel Structure and Form: Instream Structural Complex-ity	20%		0					0				
Pataha	TUS1C	10%	7.2: Sediment Conditions : Increased Sediment Quantity	5%		0					0				
Pataha	TUS1C	10%	8.1: Water Quality: Tempera-ture	10%	30	3.0					0				
Pataha	TUS1C	10%	8.4: Water Quality: Turbidity	3%		0					0				

Lower Snake Steelhead Table C3. Example Habitat Quality Improvement estimation method for Tucannon River Steelhead

Assessment Unit Characteristics					**Current Conditions- Before Actions Are Implemented**					**Estimated Conditions- After Actions Are Implemented**					
Assessment Unit	**Assessment Unit Code**	**Assessment Unit Weight**	**2012 Standardized Limiting Factor**	**Limiting Factor Weight**	**Current Limiting Factor Condition (*Low Bookend*)**	**Weighted Current Limiting Factor Condition = (E)*(F)**	**Current Assessment Unit Habitat Condition = sum of (G)**	**Current Population Habitat Condition = sum of (H)*(C)**	**Current Habitat Quality (I*conversion factor[1])**	**Estimated 2018 Limiting Factor Condition**	**Weighted Estimated 2018 Limiting Factor Condition = (E)*(K)**	**Estimated 2018 Assessment Unit Habitat Condition = sum of (L)**	**Estimated 2018 Population Habitat Condition = sum of (M)*(C)**	**Estimated 2018 Habitat Quality (N*conversion factor[1])**	**Habitat Quality Improvement (O/J)**
(A)	**(B)**	**(C)**	**(D)**	**(E)**	**(F)**	**(G)**	**(H)**	**(I)**	**(J)**	**(K)**	**(L)**	**(M)**	**(N)**	**(O)**	**(P)**
Pataha	TUS1C	10%	9.2: Water Quantity: Decreased Water Quantity	5%		0					0				

[1] Conversion Factors:

Steelhead: 0.0004

Chinook: 0.0018

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Attachment 4: BPA Business Administration to Support the Implementation of FCRPS Tributary Habitat Actions

Background

Since 2003 the Bonneville Power Administration (BPA) Fish and Wildlife Division has developed, used, and adapted "PISCES" as the business system of record for the development, administration, and management of contracted actions to support the Fish and Wildlife Program. In 2008, the Fish and Wildlife Division developed the "TAURUS"[18] tool as a means to track the accomplishments of contracted work elements and related metrics that are required for reporting under the Federal Columbia River Power System (FCRPS) Biological Opinion (BiOp). Technological advancements in WEB SERVICES has facilitated "linking" PISCES to TAURUS, so today the systems can "communicate" in real time on planned/contracted work and actual completed work. As the agency has already demonstrated in recent years, BPA will continue to invest in the development and refinement of these systems to enhance capabilities that facilitate linking projects to metrics and standardized limiting factors. We expect this to improve the Action Agency's ability to report on BiOp and other Fish and Wildlife Program accomplishments. The data that populates PISCES and the TAURUS system can be accessed through CBFISH.ORG.

PISCES/TAURUS Interface and Tracking of Contracted Actions

The value of the PISCES and TAURUS systems to the Action Agencies is how the systems facilitate sorting contracted actions included in BPA projects and portfolios of work. Both systems use unique numerical identifiers. Even projects that pre-dated the 2008 or previous BiOps can be identified in the system based on the Contract ID and contract start date. Whether these projects have subsequently been modified over time to include actions that support BiOp implementation, the projects retain the unique numerical identifier.

As PISCES continue to be refined and TAURUS has come on line, some projects have been "labeled" with identifiers that distinguish "BiOp" actions from other BPA funded actions (e.g., Accord and non-BiOp actions). These identifiers allow users to sort on portfolios on projects. Likewise, other unique identifiers including work elements, metrics, and Reasonable and Prudent Alternative (RPA) associations allow users to sort on the types work and deliverables being accomplished. These two systems allow BPA to manage and administer upwards of 700 contracts in the Fish and Wildlife Program annually and as well to roll up and report on specific program accomplishments like those that support FCRPS BiOp implementation.

[18] *TAURUS represents a multi-million dollar investment in the Fish and Wildlife Divisions system of record for the business (i.e., budget management, expert panel, work element review, project proposals, and other business processes). The Division relies on the tool to document business decisions and enforce internal controls. Access is restricted to minimize to risk of data corruption, alteration, or deletion. Any corruption of the system contents would result in a significant cost to reconstruct.*

Tracking FCRPS Tributary Habitat Actions

BPA tributary habitat projects and the associated contracts that deliver on FCRPS BiOp obligations are the outcomes of Expert Panel deliberations, or are included among activities that have been supported by the Action Agencies because the projects are delivering important research, monitoring, and evaluation data and results. BPA projects and the associated contracts that originate from Expert Panel[19] deliberations are discussed in that forum as habitat "actions." These actions are distinguished based on their potential to improve conditions or limiting factors for salmonids.

During the Expert Panel workshops (that are convened every three years) a menu of actions "is delivered" to the expert panels from any number of potential project sponsors or proponents. These entities include Expert Panel members whose affiliations vary among Soil and Water Conservation Districts, Tribes, and Federal and state agencies, to name a few, who are members of a particular Expert Panel. At the completion of the Expert Panel review for a given period (e.g., 2009, 2012, 2015) a set of Expert Panel reviewed "look forward" actions is produced that describes potential actions and their effects on limiting factors for the next implementation cycle. Whether actions are implemented can be influenced by available funding, cost-share, landowner involvement, importance/priority, permitting requirements, and other factors that affect project feasibility. Actions that ultimately are implemented by BPA are entered into the PICES and TAURUS systems. The example which follows illustrates how an Expert Panel reviewed action can be traced through PISCES and TAURUS for management, administration, and accounting.

Example: Grande Ronde Model Watershed

In this example the Expert Panel reviewed action is traced back to BPA **Project 1992-026-01: Grande Ronde Model Watershed.** As mentioned earlier a number of BPA projects that deliver on BiOp obligations predated the 2008 or previous BiOps. The Grande Ronde project is one example. As indicated, the project number is reflective of the start date of work which BPA funded in that basin. New work to support the current or subsequent BiOps will be included under this or another Grande Ronde project as a contracted action and would be assigned a specific contract requisition (CR) number or Contract ID.

To find an Expert Panel reviewed action for the Grande Ronde Basin that currently addresses a tributary habitat RPA (RPAs 34 and 35) a user would log on to CBFISH.ORG and conduct a project search of BPAs portfolio of FCRPS BiOp projects (*http://www.cbfish.org/Portfolio.mvc/Projects/192*) . Once here, a user can conduct a search that discriminates based on:

- ☐ Stage — To see projects that are currently underway **Select** "Implementation"
- ☐ Area — To see tributary projects **Select** "Provincial"
- ☐ Purpose — To remove non-habitat projects (e.g., hatcheries) **Select** "Habitat"
- ☐ Emphasis — To remove RM&E projects **Select** "Restoration/Protection"
- ☐ BiOp Strategy — To see non-estuary tributary projects **Type** "Protect and Improve Tributary Habitat"

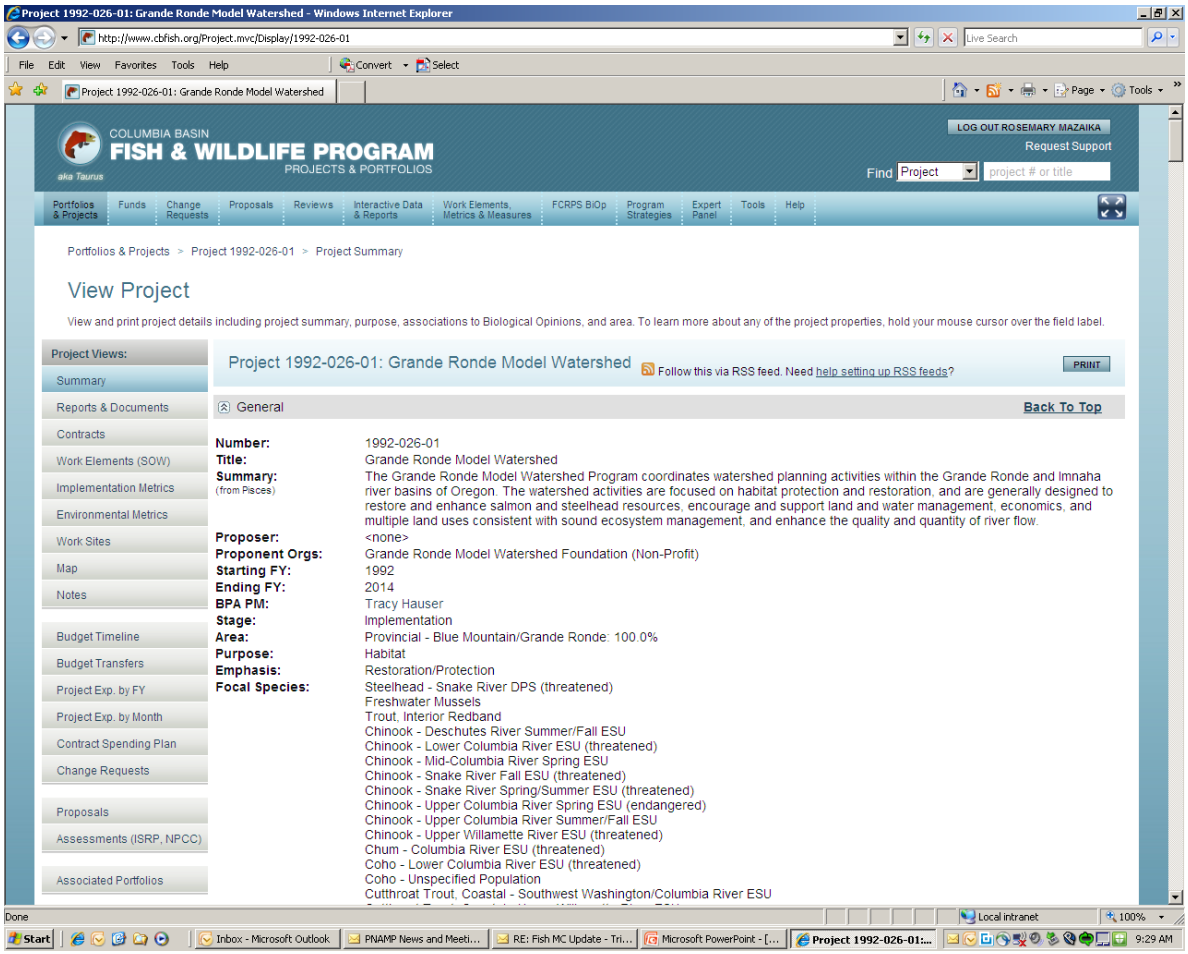
This search will produce a list of projects that support RPAs 34 and 35. From this list a user can scroll down and double click to select **Project 1992-026-01: Grande Ronde Model Watershed.** From

[19] For a discussion of Expert Panel process see "Science and the Evaluation of Habitat Improvement Projects in Columbia River Tributaries." BPA. March 2013.

the "View Project" screen, details like "Contracts" under the project can be reviewed. The screen includes the complete contracting history from the project start date forward to the present.

In this example, to illustrate where an Expert Panel reviewed action is managed as a BPA project/contract, under "Expense Contract Number" sub-heading if the user scrolls down to **CR 5298** and double clicks on the **"52985"** the system will produce the details for:

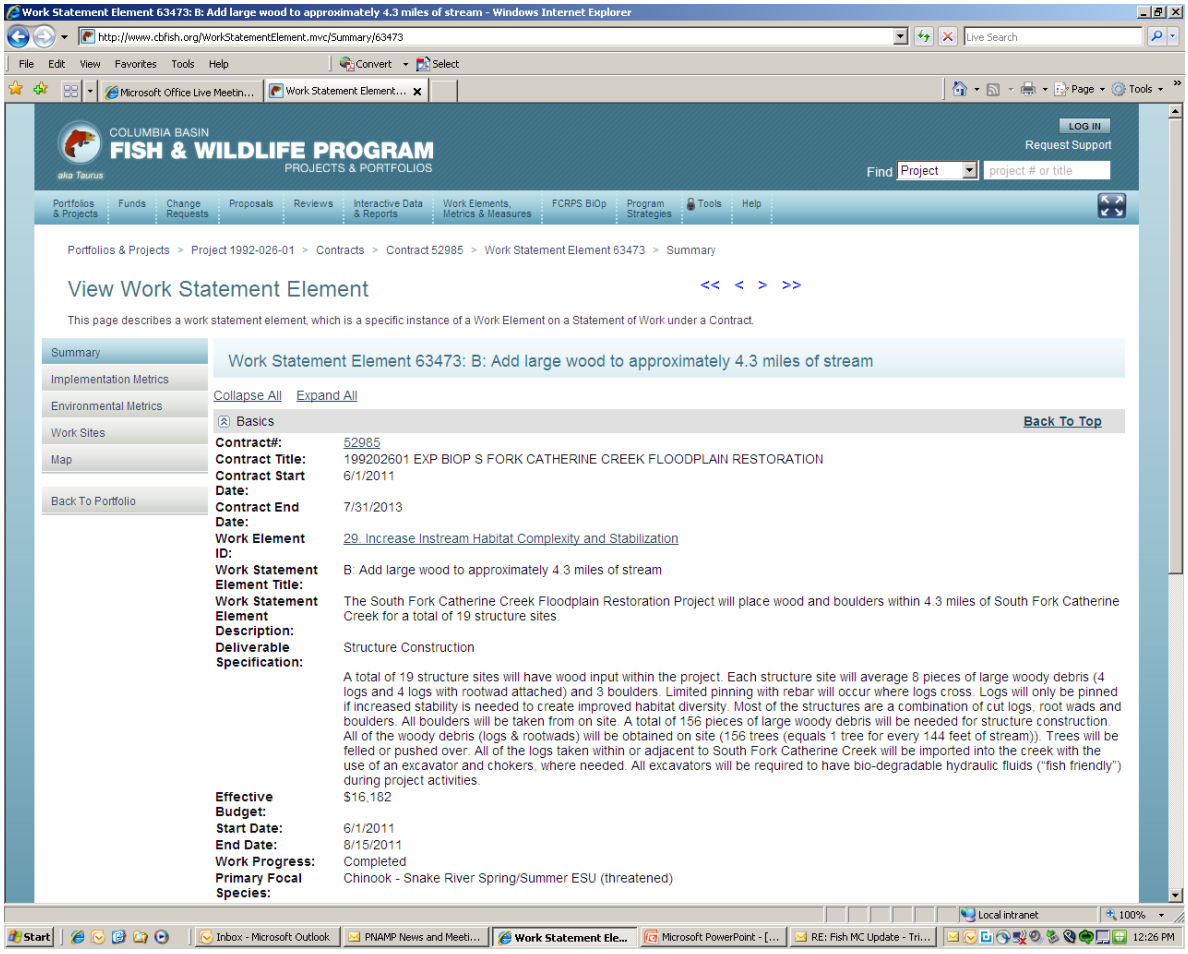
1992-026-01 EXP BIOP S. FORK CATHERINE CREEK FLOODPLAIN RESTORATION



Note: CR 52985 originated as an Expert Panel reviewed action that is traceable for the Upper Grande Ronde Catherine Creek as a Habitat Action in the Expert Panel's Look Back for 2009-2012. This information is also housed in TAURUS and is retrievable via another search that is described below.

Going back into **CR 52985** a user can view the project "SUMMARY" that includes among other details "Work Statement Elements". These Work Statement Elements are included in the statement of work for a contract and are developed with input from the project sponsors working with BPA Contracting Officers Technical Representatives (COTRs). Work Statement Elements include deliverables established in the BPA contract. The outputs of the Work Statement Elements insofar as the BiOp is concerned are metrics that are associated with the unique Work Statement Element.

For this example, if the user scrolls down to select "**Work Element ID"** "29 Increase Instream Habitat Complexity and Stabilization" and the "**Work Element Title" "**B: Add Large Wood to Approximately 4.3 Miles of Stream" and double clicks on the "B", a list of associated metrics for the contract will be produced.



Closer scrutiny of the detail illustrates:

- **Work Element ID:** 29. Increase Instream Habitat Complexity and Stabilization
- **Work Statement Element Title:** B: Add large wood to approximately 4.3 miles of stream
- **Work Statement Element Description:** The South Fork Catherine Creek Floodplain Restoration Project will place wood and boulders within 4.3 miles of South Fork Catherine Creek for a total of 19 structure sites.
- **Deliverable Specification:** Structure Construction A total of 19 structure sites will have wood input within the project. Each structure site will average 8 pieces of large woody debris (4 logs and 4 logs with root wad attached) and 3 boulders. Limited pinning with rebar will occur where logs cross. Logs will only be pinned if increased stability is needed to create improved habitat diversity. Most of the structures are a combination of cut logs, root wads and boulders. All boulders will be taken from on site. A total of 156 pieces of large woody debris will be needed for structure construction. All of the woody debris (logs & root wads) will be obtained on site (156 trees (equals 1 tree for every 144 feet of stream)). Trees will be felled or pushed over. All of the logs taken within or adjacent to South Fork Catherine Creek will be imported into the

creek with the use of an excavator and chokers, where needed. All excavators will be required to have bio-degradable hydraulic fluids ("fish friendly") during project activities.

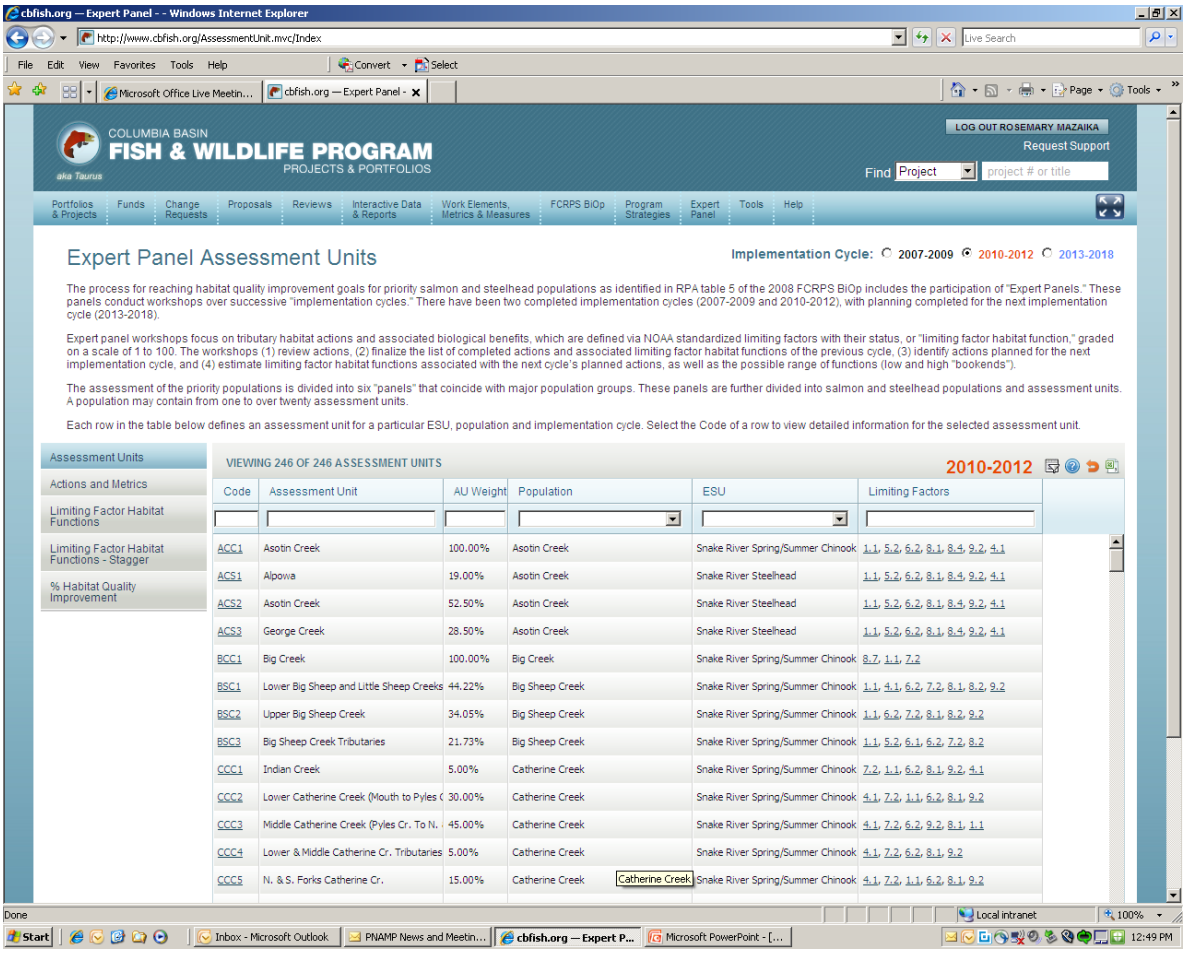
Scrolling down further to the **"Implementation Metrics"** illustrates the metric associations. The "Implementation Metrics" for 29.B Add Large Wood to Approximately 4.3 Miles of Stream"

Metric	Planned	Actual	Measures
1387. # miles of stream with improved complexity	4.30	4.30	miles of stream
1584. # of logjam structures installed for only complexity	19	19	structures installed
1748. # pools created for only complexity	30	30	pools created

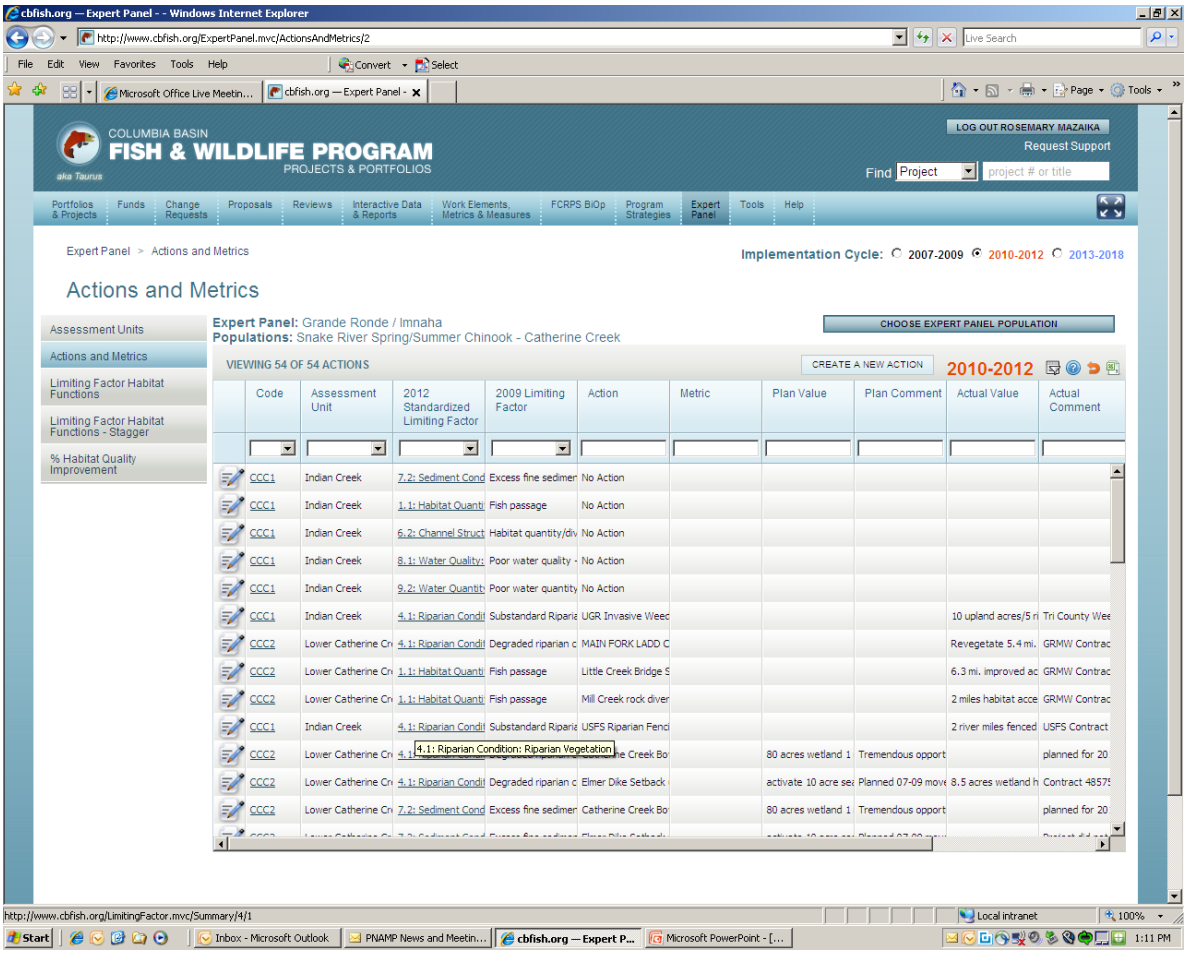
The "Actual" metrics are the delivered outputs that are rolled up for BiOp reporting and included in annual progress reports and comprehensive evaluations. "Planned" metrics are rolled up and reported in implementation plans for populations that are not evaluated by the Expert Panels.

Expert Panel Reviewed Actions/BPA Projects and Contracts

If a user is interested in the relationship of Expert Panel reviewed actions to BPA projects/contracts, CBFISH.ORG facilitates a search of Expert Panel data. To navigate to the Expert Panel actions and metrics a user would GoTo the **"Expert Panel"** and **"Manage Expert Panel Data." Note:** The "Manage Expert Panel Data Option" is a permission based option.



From the fillet on the left margin a user would select **"Actions and Metrics"** for Implementation Cycle **"2010-2012."** A button below the Implementation Cycle choices also prompts the user to **"Choose Expert Panel Population"**, which in this example is the **"Grande Ronde/Imnaha."** The population of interest in this example is the Snake River Spring/Summer Chinook for **"Catherine Creek."** To generate a complete list of actions and metrics by "**Assessment Units"** and "**Limiting Factors"** the user should choose **"All"** in both cases. Double clicking the **"Update Filter"** will yield a complete list of Actions and Metrics.



At the Actions and Metrics screen the user can sort on the **Assessment Unit and Standardized Limiting Factor** to identify the limiting factors addressed and metrics delivered.

- ☐ Assessment Unit — **Select** "N.& S. Fork Catherine Creeks"
- ☐ Standardized Limiting Factor — **Select** "6.2 Channel Structure and Form"

To draw attention to the relationship between the actions produced by the expert panels and BPA projects/contracts, look at the "Standardized Limiting Factor" metrics produced. The "4.3 miles of improved stream complexity (added LWD); 30 pools created; 19 logjam structures installed; .25 miles of side channel created; and 2.2 miles dike removed" cross walks directly from the Expert Panel data set for Catherine Creek to BPA Contract 52985. PISCES and TAURUS allow for the type of interrogation and corroboration of outputs illustrated by this example.