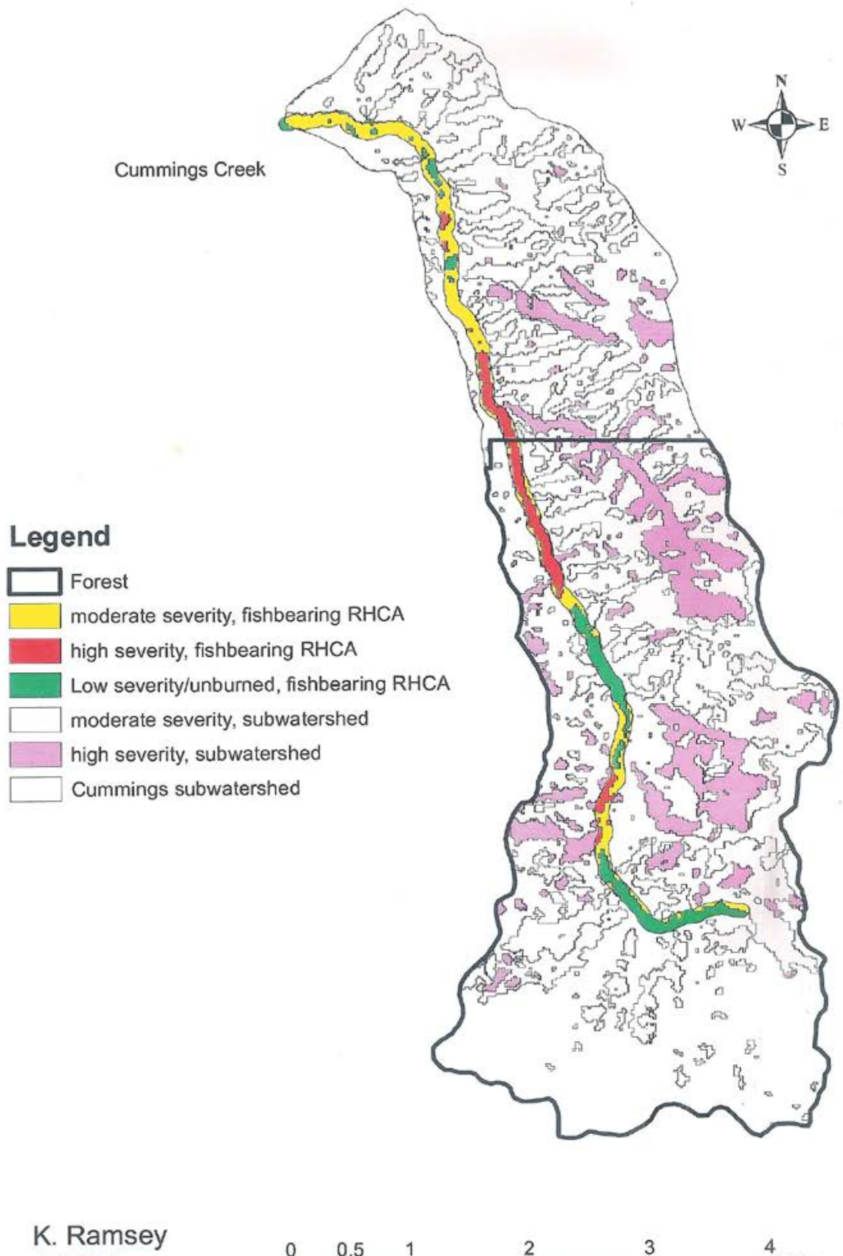
CUMMINGS CREEK (RM 2-4, 2008 & 2009):

USGS Quadrangle: Hopkins Ridge
N 46˚ 19' 57.72" W 117˚ 40' 25.94"

This project was a cooperative project between CTUIR, the United States Forest Service (USFS) and Washington Department Fish and Wildlife (WDFW). The objectives of this project were to address the limiting factors by opportunistically cutting down dead standing timber killed during the School Canyon fire of 2005 and landing the trees in the wetted channel. Fires killed much timber adjacent to the Cummings Creek in 2005 (Figure 18).

Figure 18. Map of 2005 School Canyon Fire, Cummings Creek & burn severity

Map 9. Burn severity distribution, Cummings Creek subwatershed



K. Ramsey
1/13/06

Cummings Creek contains steelhead, rainbow and bull trout populations. A direct fish kill associated with the fire over a 2 mile reach was reported. The treatment area was state-owned property, which encompasses the lowest 3-4 miles of Cummings Creek from the mouth to the USFS property line. LWD treatments were intermittently spaced throughout the reach, concentrating on RM 2-4 where dead or unhealthy stands of trees are observed in the riparian areas and the possibility for cutting and dropping them into the creek existed.

Objectives were to restore aquatic habitat complexity and in stream woody debris lost due to the School Canyon Fire, rebuild simplified channel characteristics which had become entrenched and simplified, comprised of barren features. Restore proper riverine function, channel complexity and efficiency. Attention was paid in regard to potential wildlife value of dead timber upon making decisions for selecting trees for treatment. Substrate was comprised of the following 78% were gravel, 18% cobble, 3% sand, 1% boulder. Elevation ranged from 2200 to 2900 feet. Gradient for the treatment area was approximately 2.8%. Sinuosity was estimated at 1.1. Bank full width was estimated at 4.5m and flood prone width was 14m. Increased # LWD in creek channel from 23 to 81 by adding 57 large coniferous trees resulting in the following improvements: habitat complexity ratings jumped from 1.4 to 3.1, mean DBH increased from .19 to .52m, stem length improved from 7.9 to 14.2m.

<u>River Vision Goals</u>

- Hydrology: Increased sinuosity and channel complexity
- Connectivity: Increased braiding and secondary channels
- Geomorphology: Addition of LWD
- Riparian Vegetation: Promote natural recruitment via sediment retention/seed capture
- Aquatic Biota: Steelhead and rainbow trout spawning and rearing

Project Cooperators and financial contribution: USFS $5,000, WDFW $1,500, CTUIR $1000
Dozens of mature conifers killed by wildfire were felled into Cummings Creek, one of the most productive steelhead producing tributaries in the Tucannon Basin. Figure 19 illustrates Pre and post restoration status of Cummings Creek.

Figure 19. Pre and post restoration status of Cummings Creek

RUSSEL SPRINGS CREEK (2 phases; RM 0-0.3 in 2009 and RM 0.3-0.7 in 2010): The project was a cooperative project between CTUIR and WDFW and located on state lands in Columbia County (Figure 20). Project Cooperators and financial contribution: CTUIR $50,000, WDFW $25,000. BPA funded the project under the Columbia Basin Fish Accords agreement.
GPS points: 46.34366 and 117.67989

<u>River Vision Goals</u>

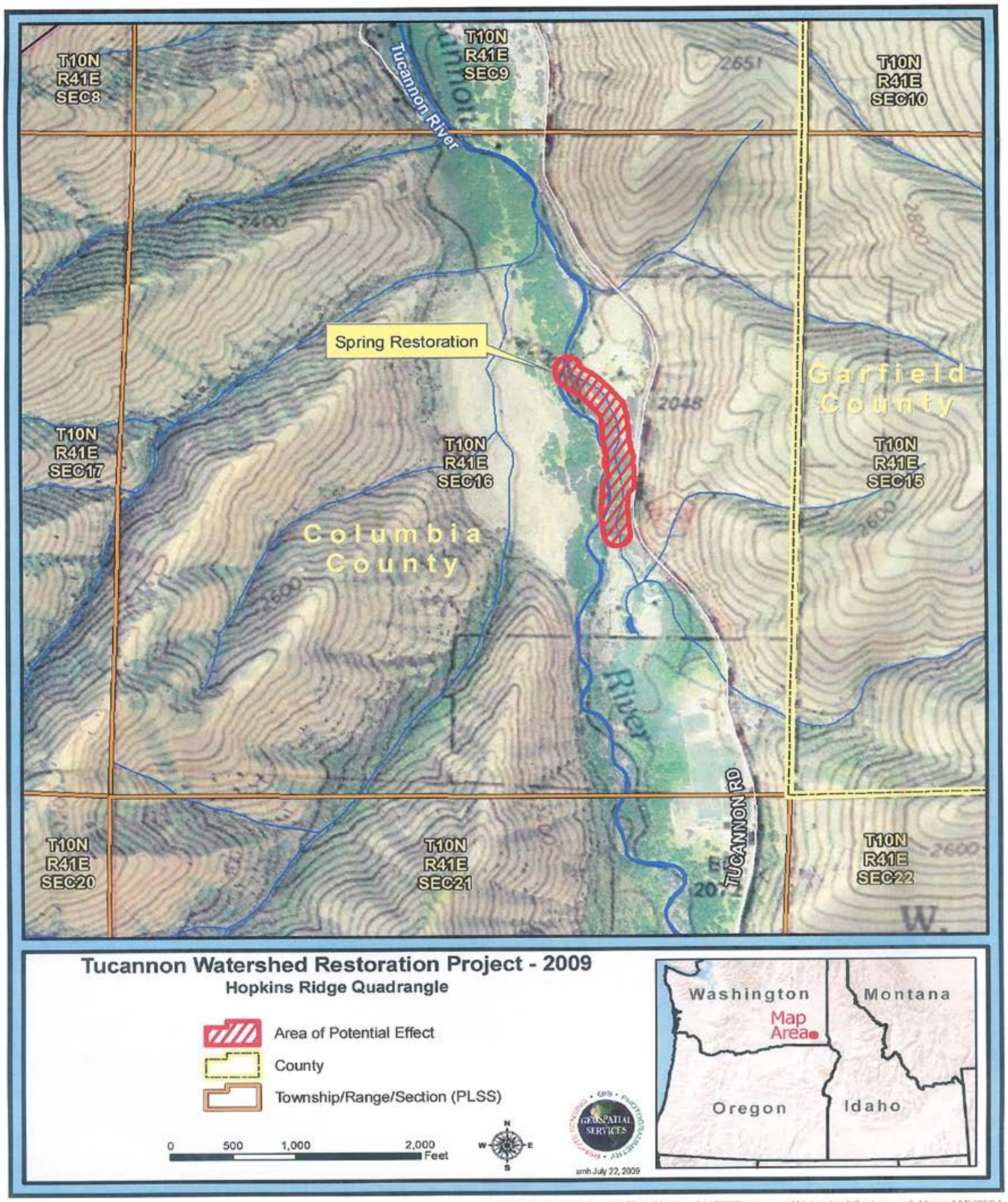
- Hydrology: Flow enhancement
- Connectivity: Increased sinuosity and removal of passage barrier
- Geomorphology: Bank shaping and addition of LWD and boulders
- Riparian Vegetation: Sedge, sapling and native grass plantings

- Aquatic Biota: Chinook Salmon rearing, Steelhead spawning and rearing, mussels

Objectives; Create suitable spawning and rearing areas for listed Salmonid species, re-establish habitat complexity, flows and fish passage of a once-prominent spring that had been severely degraded by anthropogenic changes.

Russel Springs Creek is located adjacent to the Tucannon River, approximately ½ mile upstream from where Tumalum Creek enters the Tucannon River (Figure 20).

Figure 20. Map of Russel Springs habitat restoration project area



Particular attention and effort was paid in the planning process in regard to utilizing trained and experienced personnel for capturing and moving all fishes from the work area prior to implementation. Prior to implementation, fish salvage was conducted from the mouth to where spring flows subside 265 m upstream. The salvage was conducted on 10/27/2009. Water temperature was recorded as 48 degrees. Average channel width was 3.6 m. Two passes were conducted and yielded the following catch; 16 rainbow/steelhead trout (54-108mm), 3 chinook salmon (71-79mm), and 48 sculpin spp. (34-101m). In addition, 68 aquatic mussels were also temporarily relocated. This task was carried out effectively and as a result helped preserve the health of the species captured. Data from the fish salvage effort will serve as a pre-project baseline data set and utilized further for monitoring the magnitude of change associated with our habitat restoration efforts at the project sites. Turbidity was minimized by planned strategy to work as much in the dry as possible by using generators and temporarily re-routing the flow away from the implementation area. The plan worked very well as virtually no turbidity could be observed. Considerable time was spent on attention to details in regard to minimizing construction scars upon exiting the site.

The length of the creek in the restoration reach was planted with native trees and shrubs, and treated with large wood and boulders. The large wood was placed by a track hoe, mini excavator and supplemented by hand placement. Fish passage was a concern due to; low flow due to tree felling activities performed by the local power company that diverted the spring flow directly into the Tucannon River prematurely, excessive growth of Reed Canary Grass, and a 12” step at a culvert crossing. Cross vanes made of wood and rock were constructed upstream and downstream of the culvert to restore proper gradient and increase water depth in the culvert to rectify the jump step at the outfall. Channel reshaping was conducted to enhance the formerly straightened channel by adding sinuosity to improve connection with the floodplain. Fish passage was rectified most effectively by restoring flows to the previously dry or intermittent channel. In stream habitat diversity and complexity was accomplished by the addition of LWD, boulders, spawning gravel and sedges. An engineered logjam was built at the mouth of the spring to reduce sheer stress from the Tucannon River on an actively eroding bank with mature cottonwood galleries, provide overhead cover for salmoninds and create a backwater pool to attract influx of fishes from the adjacent, fast-flowing, warmer main stem. Large sections of whole trees were partially buried to construct a foundation for the engineered log-jam. Additional wood and trees were threaded into the jam, and river spoils (substrate) were used as ballast. The resulting pool provides improved access for juvenile salmonids into the spring branch as well as winter habitat. Winter habitat and off channel rearing opportunities are two major limiting factors for ESA-Llisted salmonids in the Tucannon Basin, and have been identified as high priorities under the Snake River Salmon Recovery Plan**.**

Riparian conditions were improved by the physical removal of invasive Reed Canary Grass in favor of Native Grasses, and the addition of 1000 saplings planted with grazing reduction measures. 300’ sedge mats were placed in the wetted channel margins to reduce channel width and provide fertile vegetative growth at waters’ edge. Small, one meter plots were dug adjacent to the spring and partially filled with soil/compost mix, rooted water birch, black cottonwoods, and dogwoods will be planted in the soil mixture and the capped with the native substrate. Temporary fencing will be placed around the trees to provide protection from browsing for 3-4 years to improve plant survival. Long term improvements are expected in the riparian areas after vegetation is given a chance to grow and invasive reed canary grass is reduced further by physical removal as the TFHP uses no herbicides. Riparian vegetation will provide increased stream shade and cover and will provide a source for nutrients and food base for salmonids. Grazing reduction via fencing efforts had successfully restricted local deer populations from killing trees that were planted.

Spring Creek habitat was restored very effectively. Specific results of the restoration effort were; the addition of 100 logs and 200 boulders to wetted channel, planted 1000 saplings, 100 sedges, fixed 1 passage barrier, removed Reed Canary Grass, reduced erosion, re-connected and re-watered 212m previously dry channel. Improved; habitat complexity 163%, wetted channel depth 200%, undercut 17%, width:depth ration 36%, channel shade 18%, wood complexity rating 54%, steelhead redds from 0 to 9 annually. Pre project flows were estimated around 1 CFS, post project flows were estimated near 7 CFS after removing Reed Canary Grass and channel blockage. Results of the project are; improvements to fish passage at the culvert and through the migration corridor due to channel manipulation, increased habitat complexity in the channel due to an increase in the overall pool and pocket water, as well as increased quantities of boulders, woody debris and wood ratings in relation to fish habitat, increased spawning areas created by the incorporation of gravel substrate into strategic areas of the spring (Figure 21).

Figure 21. Pre and post restoration results

Actively Eroding Bank and High Terrace

ELJ Constructed to protect bank from eroding

Creation of contrasting attraction water

2 steelhead attracted to spawn in spring outlet

Figure Pre project conditions, plane bed form, straightened riffles

	
Riffle converted to sinuous riffle with pockets	Forced Straight scour pool
	
Conversion of glide to scour pool, reduced width	Edge effect habitat complexity created
	
Spawning gravel added produced annual redds	Forced meandering and lateral pools

Cars in riparian areas

WDF utilized restored spring to stock chinook

Sinuosity created with tall whips planted

Upper plug created corner pool with undercut

Complex habitat, Bull trout observed post-project

Plug planted for long term stability with whips

Mussel colony

Tree trimming under powerlines detoured flow

Trees felled under powerline

Spawning gravel added, redds identified

Close-up of mussel abundance

Adult steelhead 6 months after implementation

Sedge mat added to Wide glide crossing

Crossing discouraged with sedge mats

Close up of trees felled by power company

Small steelhead redd, passage to upper spring

Straight scour pool created by constriction

Forced thalweg to build velocity to form pools

Automobiles staged before removal from riparian

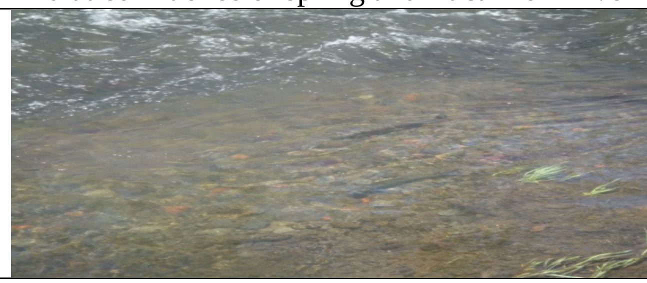
Miscellaneous debris removed, spring corridor

Fencing to restrict deer grazing on plantings

Results after 3 years of grazing reduction

Small trees used to create restrictive fence

Natural regeneration of cottonwood trees

	
Steelhead staging near ELJ	ELJ at confluence of spring and Tucannon River
	
Restrictive fence made of natural materials	Attraction at confluence; spring/Tucannon River
	
Adult steelhead entering spring at confluence	Establishing canopy at confluence

Changes in physical habitat have resulted in biological improvements in regard to fish populations. The number of juvenile rainbow/steelhead trout has doubled and the juvenile chinook salmon population has tripled. Vast improvements in adult presence are reflected by steelhead trout redd counts rising from 0 in 2009 to 10 in 2010 (Figure 22).

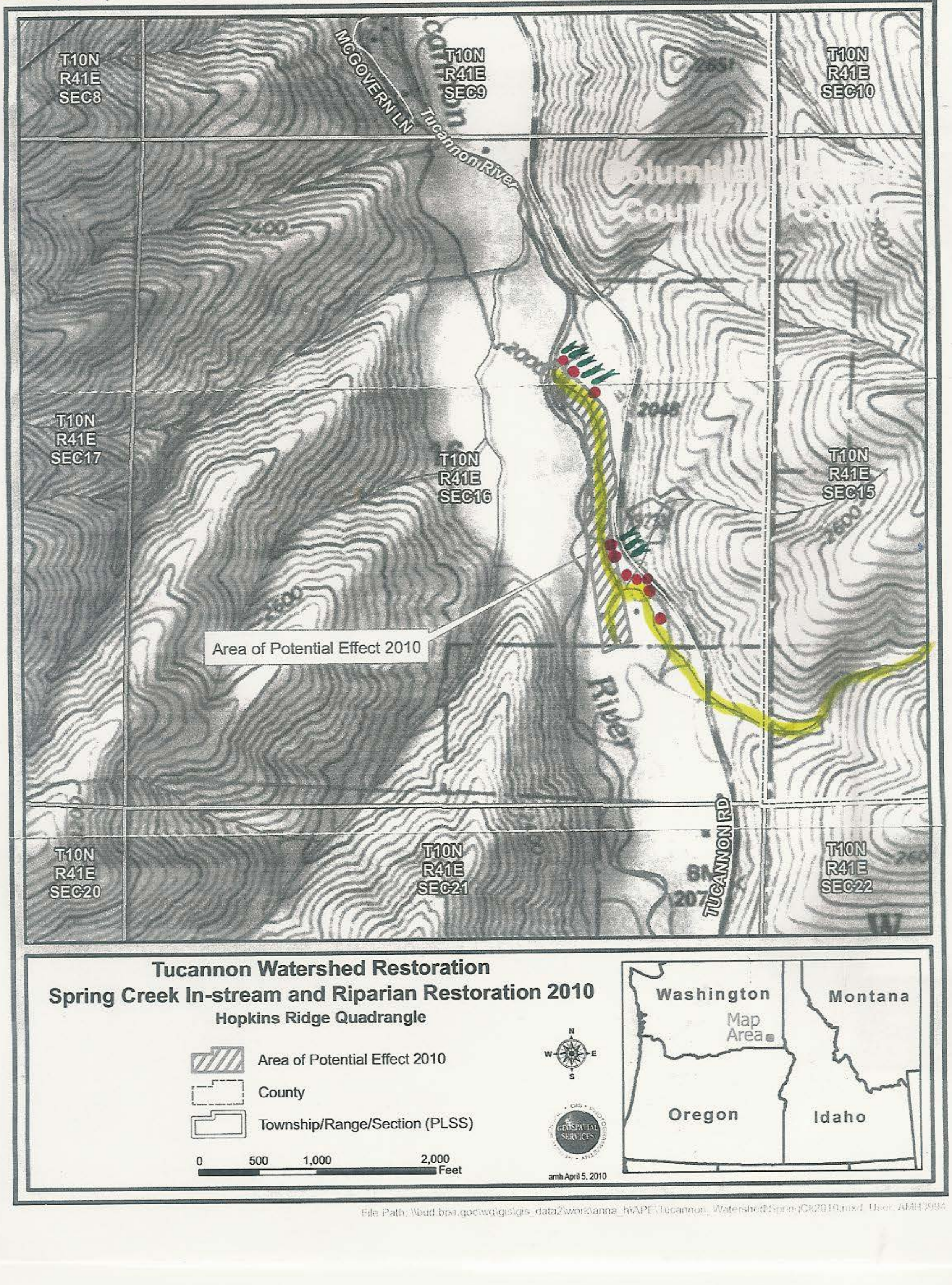
Figure 22. General locations of 10 steelhead trout redds counted in Russel Springs Creek

SPRING CREEK 2010 Redd Surveys: STEELHEAD

4/9 = 5 Fish, 2 Redds

4/23 = 3 fish, 8 Redds

*Notes: only 1 Redd was Large (Confluence). Water temperature was 12°C.



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Results of restoration activities produced substantial increases and utilization of spawning and rearing habitat. Increases in the distribution of aquatic mussels as well as salmonids were observed. A 124 mm bull trout was captured from a scour pool created by LWD and boulder placement during post-implementation monitoring. Steelhead fry were observed at channel margins post-treatment and redds increased over an expanded range and successive years.

The outcome was well-received by the professional entities in the region and was considered as a project of special interest by the WA state governors office as nominated by the local SRSRB. BPA compiled a video posting to You Tube titled “Salmon Restoration” and posted an informative report entitled “Spring-fed creek restored; fish return” on their internet site to publicize the project. The contents of that report are featured below;

Spring-fed creek restored; fish return

A spring-fed creek that was choked with canary reed grass is now flowing clear and cold. Once home to rusted-out submerged cars, today the creek harbors steelhead redds. “We have a customer,” says Eric Hoverson, Tucannon Habitat project manager for the CTUIR, pointing out a steelhead nest in the stream. The red was located where anticipated, due to the addition of gravel into a fast flowing area of the spring during recent restoration.

Russell Spring Creek, in the Tucannon Basin in southeast Washington, is prime steelhead and spring chinook habitat. But a road culvert blocked the salmon from using the best parts of the stream. Attempts to shore up the places prone to flooding with old automobiles parked along the banks eventually led to decline and neglect. The stream had been straightened and grazed in the past, and had become overgrown with Reed Canary Grass, which made it impassable to fish. Rural Electric Association trimmed many mature deciduous trees that were growing beneath their telephone poles & wires. Several of the trees were felled across the Russell Springs channel and over time this act actually diverted the water through a new distributary braid. To complicate matters, Reed Canary Grass encroached on what used to be the primary channel, which now had reduced flows due to the diversion and it became a better environment for this invasive grass that is known for blocking low flow channels. Discovering the downed trees and associated results and the benefit to reconnecting the much longer former primary channel, we removed sections of the felled trees, dug out the intake for the historic channel with a mini track hoe, planted willow whips and replanted native sedges to build up the “plug” that we established. The result was increased dimensions of the historic primary wetted channel of which actually had gone dry for 166 meters, but flows have been restored as increases of approximately seven-fold have occurred.

HARTSOCK SPRINGS CREEK (RM 0.3 in 2010):

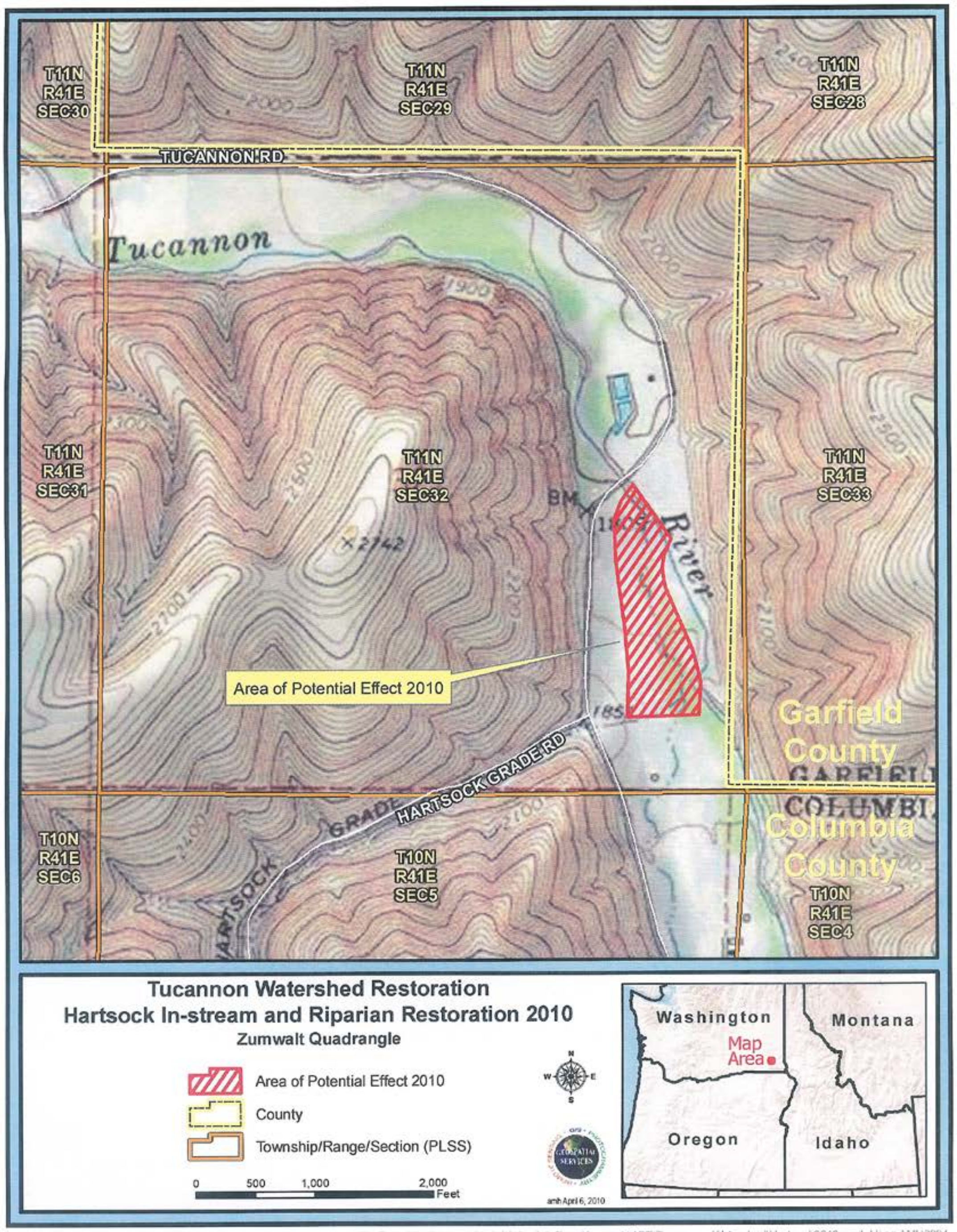
<u>River Vision Goals</u>

- Hydrology: Flow enhancement
- Connectivity: Increased sinuosity
- Geomorphology: Bank shaping, LWD & boulder addition, removal of vehicle crossing
- Riparian Vegetation: Sapling plantings and native grasses
- Aquatic Biota: Chinook Salmon rearing, Steelhead spawning and rearing, mussels

Project Cooperators and financial contribution: CTUIR $25,000, WDFW $15,000

In the Tucannon Basin, isolated pool habitat has been reduced to a fraction of historic abundance. Therefore reconnecting and restoring Hartsock Springs was deemed a high priority. Reinvigorating degraded habitat features of Hartsock Springs would provide salmonid benefits to all life stages. The primary objective was to reconnect and enhance habitat diversity in a unique wetland spring that had become isolated from the Tucannon River. The property is owned by WDFW and located adjacent to the main stem Tucannon River at the base of Hartsock Grade (Figure 23). Hartsock Springs is located approximately 2 miles downstream of Russel Springs Creek.

(Figure 23). Location of Hartsock Springs Creek restoration site



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Secondary goals were to address the following limiting factors; reshape and re-establish a defined, single channel with increased sinuosity to improve passage and habitat complexity conditions throughout the reach which had been overtaken by Reed Canary Grass, resulting in an excessively wide channel dimension lacking depth or defined channel margins making fish migration extremely difficult. The addition of a small bridge suitable to foot traffic and four-wheeler access replaced a full sized vehicle drive-through crossing that had significantly degraded adjacent stream characteristics and represented a public relations issue due to the high visibility location and utilization by state owned vehicles within a designated Wildlife Area. In-stream habitat diversity and complexity was accomplished by the addition of LWD, boulders, spawning gravel and sedges. Riparian conditions were improved by the addition of 1000 saplings planted. The riparian area was covered with a tarp to suppress unwanted re-establishment of invasive weeds, and the physical removal of noxious Reed Canary Grass in favor of native grasses.

Restored 100m of stream at the base of the Hartsock road grade on WDFW property. A mini excavator was used to dig a 2' wide and 2' deep single channel through Reed Canary Grass which has spread out into tiny braids where surface water was not visible. The gully that runs down Hartsock grade had been disconnected from the spring and probably contributed flows in the past. It has been converted to a silt laden trench now and flows into sediment collection ponds. The restoration strategy involved the addition of 20 logs, 20 boulders, 10 cubic yards of spawning gravel to channel, re-connected historic oxbow braid, removed reed canary grass, reduced erosion, installed 100m riparian tarp to both banks, planted 1000 saplings, replaced drive-through crossing with bridge.

Project results showed the following increases; habitat complexity 129%, wetted channel depth 70%, undercut bank 48%, width:depth ratio 300%, channel shade 89%, wood complexity rating 91% (Figure 24), steelhead redds from 0 to 8 annually.

Figure 24. Pre and post restoration conditions at Hartsock Springs Creek

Tarp added, discourage regrowth of Reed Canary

Sinuosity added and channel defined

Spawning gravel added, steelhead redds annually

Two years recovery time, vegetation response

Drive thru crossing eliminated, bridge installed

Pool and riffle sequence with undercut banks

Willow whip technique

Tall whips used to establish shading

	
Whips inserted through slits in tarp	Reed Canary tarped, Cattails and sedges left
	
Tall whips successful	Riparian response after 2 years

PATAHA CREEK (2 phases; RM 1 & RM 10 in 2011):
<u>River Vision Goals</u>

- Hydrology: Increased channel complexity and stream gradient
- Connectivity: Passage improvement at RM 1 & 10, widening of active floodplain
- Geomorphology: Addition of LWD and boulder habitat, bank shaping
- Riparian Vegetation: Saplings and native grass
- Aquatic Biota: Steelhead spawning and rearing, Chinook rearing

Project Cooperators and financial contribution: CTUIR $127K, SRSRB $327K

The total cost of the project was approximately $400,000 as approximately 50K was returned to the SRSRB. Funding was derived from BPA and the SRSRB via competative grant process.

Pataha Creek is a main tributary of the Tucannon River that enters near RM 11 and has a total length of 47 miles to the headwaters, within Water Resources Inventory Area 35. The Pataha drains a watershed of 185 square miles. Pataha Creek channel is a perennial creek with very deeply incised banks, mostly attributed to anthropogenic changes. Banks are commonly 15’ in height with barren slopes. Despite relatively poor habitat conditions, favorable summer water temperatures of 67 degrees exist, with good visibility due to semi-clear water. The headwaters boast summer water temperatures in the low 50’s.

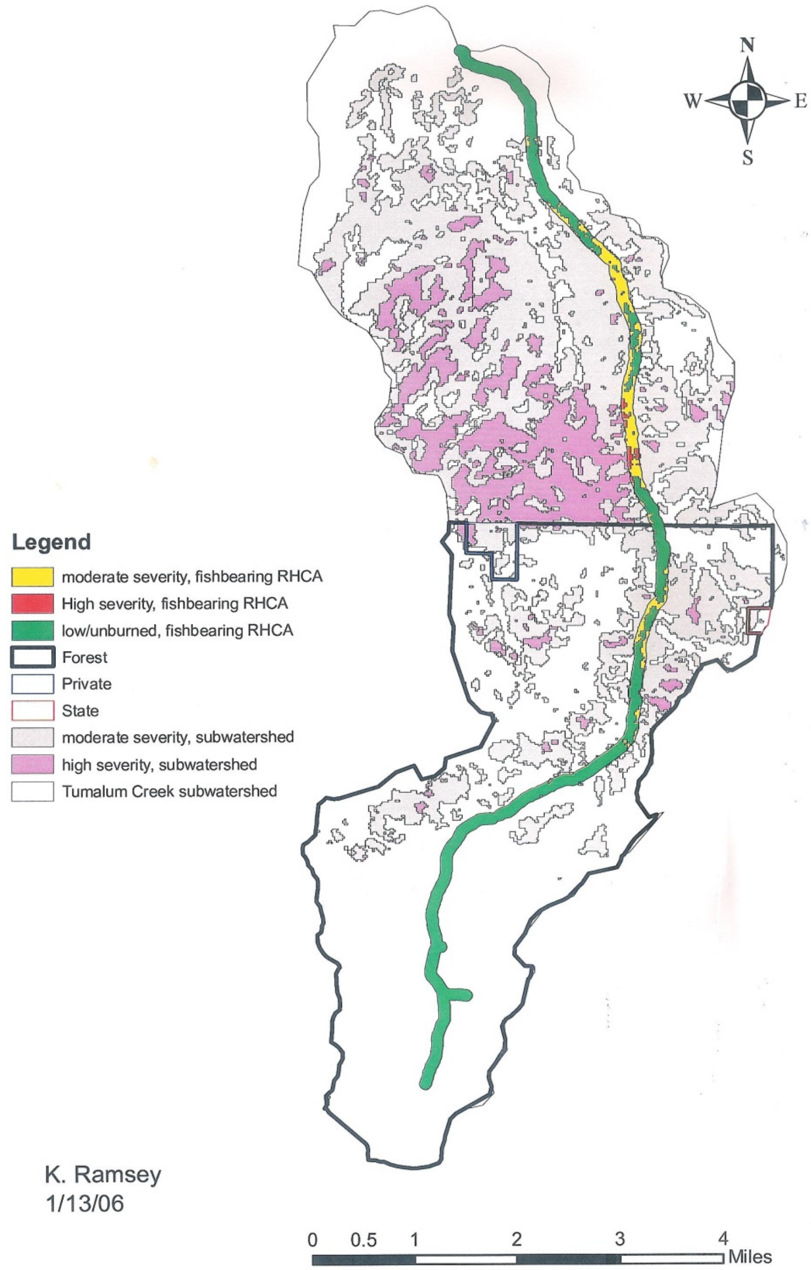
WDFW personnel have documented limited juvenile and adult steelhead use in Pataha Creek through various studies dating back into the 1980's to current. The basis of grant approval was centered around the potential benefits to ESA-Listed salmonids from enhancement activities at the RM 1 & 10 project sites and beyond by gaining improved access to quality habitat within the 47 total river miles of Pataha Creek. Connectivity of Salmonid populations and interchange of genetic material is sought between the Tucannon River and the 47 mile length of Pataha Creek. CTUIR addressed fish passage at two road crossings designated as the highest priorirty barriers in the Tucannon Basin and in the top 5 known barriers in the WRIA 35 region. The SRSRB had classified the locations at RM 1 &10 as "Imminent Threats" for adult and juvenile migratory listed steelhead trout and resident redband/rainbow trout. Rectification of passage at these locations would reduce migrational delays of adults returning from the ocean to spawn in the headwaters as well as enhancing juvenile seasonal migration to optimum habitat and cooler waters upstream during the summer months. The project area is located within the Priority Protection Reach designation as identified in the SRSRB Regional Provisional 3 Year Work Plan. A report issued by the SRSRB in February 2009 identified the locations as areas of "significant habitat gain" potential" in the south central region if passage and habitat quality is improved.

Historic descriptions of the lower 10 miles of creek were described as "bushy", due to willow growth, with larger timber as one progressed toward the headwaters. Currently, intermittent clusters of riparian tree or shrub growth are observed. Canopy cover is less than 5% as most stream shade is provided by channel incision. Some encroachmant by adjacent agriculture fields have had an impact on the habitat status of the creek. Ongoing efforts are being made by several managerial entities to connect vegetative bands of growth into a copntinuous ribbon. There is also some vast expanses of native bunch grasses as part of hundreds of acres enrolled in conservation programs. Suitable outcroppings of spawning gravels exist in pocket areas with overhanging vegetation providing some hiding cover. There is an overall lack of instream cover in regard to woody debris or boulders, of which are scarce. Visual sightings of rainbow trout up to 13 inches in length were recently observed. Increases in fish populations are projected to increase from hundreds to thousands of juveniles and from dozens to hundreds of adults steelhead with restoration and passage remedy. Beechie et al. (2008) measured channel incision at several locations in Pataha Creek and provided the resulting measurements. Incision depths in Pataha Creek decreased in an upstream direction from 19 feet near the confluence with the Tucannon River to 6 to 7 feet near Pomeroy. Incision widths also decreased from 100 feet near the confluence to 34 feet near Pomeroy. Incision in Smith Hollow, a tributary of Pataha averaged 20 feet deep and 80 feet wide and supplies excessive amounts of fine sediments into Pataha and ultimately the mainstem Tucannon River. Approximately 60% of the total width times depth of the incised area been eroded. A study conducted by Hecht et al. (1982) found that the majority of fine-grained sediment that would be carried as suspended load came from Pataha Creek and tributaries. The majority of which is transported during during high flow events, particularly during spring snowmelt runoff. Estimated roughly 60% of annual input Total suspended solids of fine sediment in the Tucannon derive from lateral tributaries in the lower 12.5miles (Pataha confluence) of the basin. The majority of which is sourced by channel incision processes.

The high sediment load in Pataha is due to the system having experienced numerous detrimental anthropogenic changes such as straightening. Pataha Creek originates in the Blue Mountains and flows over high gradient, eroding basalt down through low gradient agriculture. The lower creek channel flows through deep, highly erodible soils, deposited by the Missoula Floods. There is significant down cutting and mass wasting of bank material and not enough flow energy to naturally move bed load. Habitat conditions in Pataha Creek are in relatively poor shape in comparison to its potential, but it is also much more fragile and susceptible to degradation than the Tucannon or other similar alluvial streams. Wildfire impacts to the upper Pataha Basin have also adversely affected stream conditions.

Figure 25. Wildfire footprint in the Pataha Basin

Map 13. Burn severity distribution, Pataha Creek subwatershed



The main objective of the project was to resolve fish passage issues. The incorporation of natural materials **(**woody debris and boulders**)** was to provide function and aesthetic value at the sites, which are highly visible to the public via the state highway crossing. Fresh, whole trees with significant complexity and weight were selected for implementation. Logs were chained deep into the riverbed using duckbill anchors. In addition trees were keyed into the bank and weighted with boulders at strategic locations to ensure they remain in place during high flow regimes. The strategy chosen to rectify passage at the two sites consists of a roughened channel design. Roughened channel strategies require the existing streambed be tumbled and re-mixed. Following the installation of 14 weirs and 10 boulder cluster-structures, assorted substrate is added to seal the channel and minimize potential for water seeping through the streambed during low flow periods. Fine substrate such as sand and gravel are added last at the surface of the streambed to enhance the capability in forming a somewhat of a sealed stream bottom to minimize the potential for the creek to run sub-surface. Gravels can then be utilized for spawning. Spawning is possible in the lower reaches of Pataha since water temperatures are actually lower (67 versus 70) than those of the adjacent Tucannon river at the confluence of the two systems. This information was extremely surprising to local resource management entities, and when combined with recent angling, electrofishing, snorkeling and visual observation information reported by CTUIR, prompted a revisit of lower limit of distribution of spring chinook salmon during the summer of 2012. With passage rectification and further imptovements to habitat features, it is expected that juvenile numbers would increase into the thousands, while adult numbers could increase to hundreds.

Additional effort was concentrated on improving habitat complexity and utilization of quality and quantity of in-stream cover. The lack of large woody debris and micro-pool habitat are limiting factors to fish production in the Tucannon Basin. The project was implemented in the fall of 2011. Logs and boulders were placed strategically in areas of need to improve salmonid carrying capacity in conjunction with passage barrier rectification being funded by SRSRB grant. The passage improvements will allow upstream migration to the most suitable conditions for spawning and rearing in the headwater reach. As conditions in the Pataha Basin are improved, we do expect an expansion of salmonid species range and extended lower limits of distribution. CTUIR forged a mutually beneficial pact with the landowner, of who allowed CTUIR to rectify passage on his property and he shall act as a subcontractor to provide whole trees and deliver them to the work site as well as supplemental substrate materials. The landowner also agreed to restrict cattle grazing in the adjacent riparian zone and has granted a long term entrance easement to allow maintenance of the project area.

CTUIR conducted the operations of the restoration with assistance from the Nez Perce Tribe as it pertained to cultural resource protection. Tetra Tech coordinated with CTUIR to develop the design. Steve Lindley Contracting performed the construction. Fish passage rectification was the main objective of the Pataha Projects located at both RM 1 and RM 10. Excessive step heights during low flow time periods measured 12-24" and water depths within the bridge structures were not sufficient to pass fish effectively. The issue was compounded by velocity barriers during high flow events at constriction points caused by highway bridge infrastructure. Passage was restored using a roughened channel strategy at both sites with modified cross vein structures having notched voids for thalweg control and improved passage that traditional cross veins possess. Additional effort was dedicated towards increasing in-channel habitat and softening the primary rock base of the design by the addition of whole trees for hiding cover and natural aesthetics. Riparian conditions were improved significantly by utilization of natural Coir fabric that was applied to both banks at each site and supplemented with 3000 saplings of low desirability to beaver. Noxious weeds were physically removed and replaced with Native Grass additions.

Additional measures involved the placement of erosion control fabric at both sites to minimize sediment and noxious weeds, promote healing, and prevent potential failing of the structures by allowing the channel to migrate around the structures. Repetitive photo point monitoring is conducted to show change over time to gage project effectiveness. Noxious weeds were removed during implementation with machinery, coir fabric was placed atop banks and maintenance is performed by physically pulling weeds, rather than opting to use herbicides. Tree survival is enhanced by watering and weeding. Supplemental plantings were conducted as necessary to establish a desired level of riparian growth. Retaining a thalweg in the preferred location and clearing excess debris from structures and if they become plugged with tumbleweed and fine sediments, etc. ensures proper function. A problematic feature at the RM 10 site is a cattle panel set across and in the creek by the adjacent landowner to keep his livestock from again trespassing into our project area and re-damaging trees planted. The mesh size of the cattle panel used as fencing is too small for adult steelhead to freely pass through and with the accumulation of debris against the fence, a damming effect is prevalent. Additional detriments to project appearance were the 95% removal of 1500 willows plantings by beaver located at both project sites. This prompted the ordering and planting of 870 bare root trees of species (alder and birch) not preferred as food source for beaver. Another concern is the excessive sedimentation that the Pataha Basin transports. This temporarily plugged up the upstream end of one of the structures and caused water to migrate around the impediment. The mass debris was cleared and the proper function restored. This will be monitored and maintained. The benefits of passage remedy will be realized exponentially when coupled with ongoing restoration efforts that are occurring upstream and in the immediate area.

The most imminent threat to maximizing project success is non-compliance of certain water quality standards occurring in Pataha Creek (Figure 26). For example, pulses of fecal coliform exceed recommended dosages by 47 fold. Water quality may be a limiting factor and needs to be addressed in order for connectivity to be achieved as water quality standards such as fecal coliform are not being met and CTUIR has contacted the agency of responsibility (Department of Ecology) to address and rectify the issue to insure CTUIR's financial investment toward the recovery of Listed salmonids is protected in the Pataha Basin. The coliform numbers exceed 400/100ml during high flows (22 CFS) with the high turbidity that may be flooding areas with livestock concentration. This may indicate animal concentration not very far upstream. The city of Pomeroy sewage effluent was habitually out of compliance in terms of meeting water quality standards in the recent past, but improvements have been made to rectify the issue. The most current detriment to water quality is the presence of free roaming cattle into the creek just upstream from both restoration sites. CTUIR can rectify passage and improve complexity of habitat, but if the water quality is sub-standard, then our investment into this basin won't be validated in the form of listed species population levels. No riparian fencing is maintained as cattle freely enter the creek. A recent lawsuit by DOE with the landowner has had mixed success in attaining responsibility and compliance determination. A recovery plan for the Snake River and tributaries written in 1996 identified the Pomeroy sewer plant as one of the top 5 limiting factors for spring chinook salmon in the Tucannon basin. Several shallow domestic wells in the vicinity of Pataha Creek had to be closed due to excessive nitrates in the 1980's or 1990's. Theories involving the effects of excessive pollutants on straying rates due to reduced detection of natal stream scents are theorized and centered upon nitrates/ammonia/sulfer released from the streambed of Pataha and contributing to salmonids avoiding or missing the Tucannon waterway.

Figure 26. Newspaper article depicting the water quality issues of Pataha Creek

November 11, 2013

Ecology Sends Flurry of Pollution Letters to Landowners

At least four private landowners in Stevens County have been sent warning letters by the Washington State Department of Ecology (DOE) that they are polluting waterways and need to contact DOE to resolve the problem. The letters signal a drastic change in the way DOE is handling water quality problems, according to Dean Hellie of the Stevens County Conservation District.

"DOE is moving into a whole new world of sending letters to people without having a complaint about the property," said Hellie.

Hellie said the SCCD is aware that DOE has sent 36 total enforcement letters to landowners around the state, four per conservation district, warning landowners that they have pollution issues and must contact the agency or their conservation district. Unlike DOE efforts in the past, these letters were not "complaint driven." Incidentally, most of the landowners who received letters own livestock.

Washington Agriculture Legal Foundation(WALF) Executive Director Toni Meacham said that DOE is not using science to pursue water quality testing and does not conduct DNA tests to see if the source of the supposed pollution is livestock, wildlife or human caused.

"How can we get to a solution when we don't know what the problem is?" she asked at a recent meeting of over 170 landowners in Medical Lake on Oct. 4.

Washington Agriculture Legal Foundation and the Washington Farm Bureau said they are working together to help defend landowners who receive letters and advised any recipients to not let DOE on their land without the presence of a third party.

"Don't try to take this on on your won, we can help," she said. "You should never have DOE on your property when you are alone. They are coming onto your property to find evidence to support their conclusions that you are a polluter."

The Lemire connection

Meacham said she recently witnessed the lengths DOE was willing to go in pursuing livestock owners with pollution allegations. Meacham helped defend Dayton area rancher Joe Lemire in a Washington State Supreme Court case where Lemire fought against DOE forcing him to fence his cattle off a creek on his property.

According to a press release by WALF, Lemire was first contacted by DOE in 2003. At that time, Lemire received a letter, regarding his property along Pataha creek in rural Columbia County. The letter informed him that his operations along the creek presented a 'substantial potential to pollute', and encouraged him to seek financial help from his local conservation district, in order to pay for fencing livestock off the creek. Lemire refused, pointing out that no evidence of actual pollution to Pataha creek existed, and that such a fence would make successful ranching on his property impossible. Lemire continued to deny the DOE's request for the next six years.

Finally, in 2009, DOE issued an administrative order, forcing Lemire to install fencing, or face a fine of $10,000 per day, for every day that the fence remained unconstructed.

Lemire appealed, taking his case to the state's Pollution Control Hearings Board (PCHB), where he cited 54 instances where he felt DOE had been incorrect, or had overstepped their authority. He was subsequently informed by PCHB that they had granted summary judgment in favor of DOE, and denied Lemire a hearing to voice his complaints.

Lemire next took his case to Columbia County Superior Court, filing suit against DOE for failing to provide evidence that polluting agents in Pataha creek were the result of his operation prior to taking enforcement action, and claiming that the action amounted to a taking of his private property. DOE, however, argued that specific evidence was not necessary. Under state law, they said, the "potential" of Lemire's cattle to pollute the stream provided sufficient cause for enforcement, whether or not any pollution had actually occurred. The superior court found in favor of Lemire, overturning the summary judgment issued by PCHB. DOE appealed the decision, and the case was brought before the Washington State Supreme Court in November 2012.

The majority ruling, written by Justice Debra Stephens, favored the claims by DOE that direct evidence of pollution by Lemire was unnecessary.

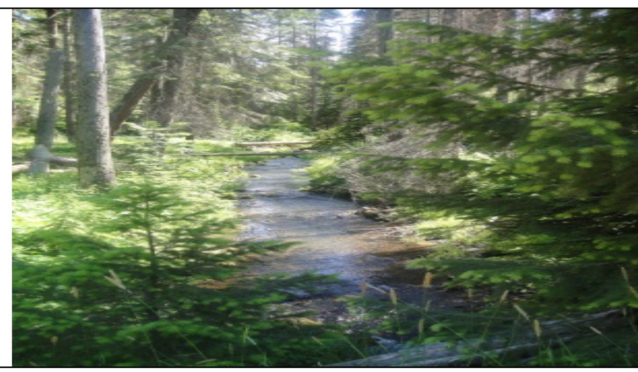
"The statute under which DOE operates does not require it to prove causation," wrote Stephens. According to testimony, she added, access to the stream by cattle was a recognized cause of pollution, namely the introduction of manure into the stream. "Such organic matter tends to cause pollution," wrote Stephens. "Hence, DOE met its statutory burden. It was not required to show that the conditions on Lemire's property were a proximate cause of the polluted creek." The court also dismissed Lemire's takings claim, ruling that he had failed to prove that the required fencing would prevent his cattle from utilizing his entire property.

The Pataha Passage Rectification Project changed local perspectives of Pataha Creek. Pataha is by far the longest tributary (47 miles) of the Tucannon River. It is very easy to drive by Pataha and make judgment that the creek is so degraded that dedicating efforts toward restoration would be a monumental task. Further investigation upstream shows surprisingly in-tact habitat features. CTUIR performed a public relations campaign and educated others on the potential of Pataha. This new perspective was absorbed and reflects in the recent reclassification of Pataha from a Minor to Major Spawning Unit (supporting 500 adult spawning steelhead trout). Pataha is now on local management entities radar and the passage project was a primary factor for the change of perspective in regard to the potential of Pataha Creek as a valued salmonid contributor.

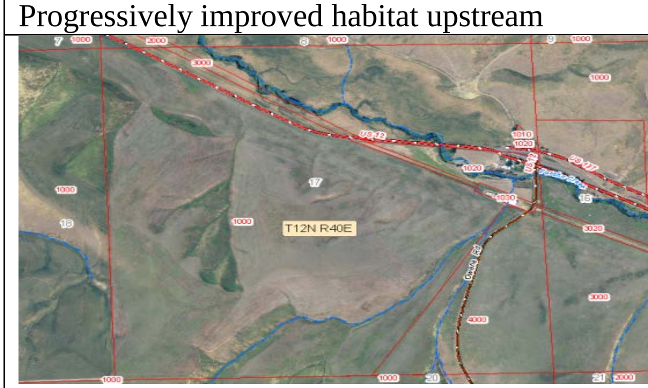
Pre (2011) and post (2012) habitat inventory surveys were conducted by CTUIR. Combined results from both sites have resulted in the following improvements; 27% increase in the number of habitat units (complexity index), 51% increase in average depths, 47% increased undercut, 1443% reduction of eroding, 21% improvement in channel shade, 150% increase in wood classification as it pertains to fish habitat, 1850% increase in the number of wood pieces, 1650% increase in root wad abundance, 250% increase in adult steelhead redds, 48% improvement in the wetted channel width to depth ratio, complete elimination of the 1 and 2 foot tall jump heights associated at the culvert crossings, and steelhead redds documented from 0 to 2 annually (Figure 27).

Figure 27. Pataha Watershed Conditions and pre and post restoration results

Progressively improved habitat upstream



Headwater reach shows strong steelhead potential



Archaic channels apparent pre-straightening

Linear, simplified channels, sinuosity near 1.0

	
Considerable fire damage in watershed, wildfire	Incised channels, detrimental land use common
Pataha Creek, 2011, RM 1;	

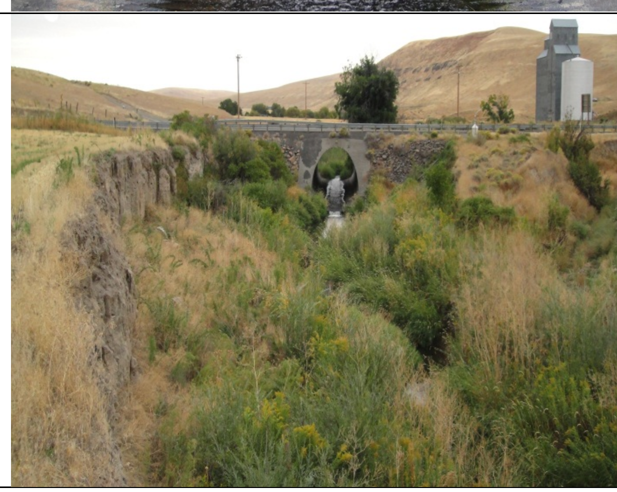
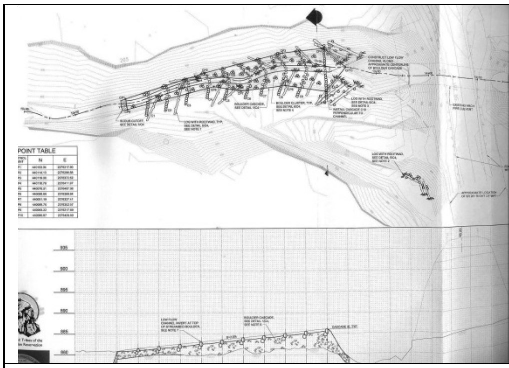
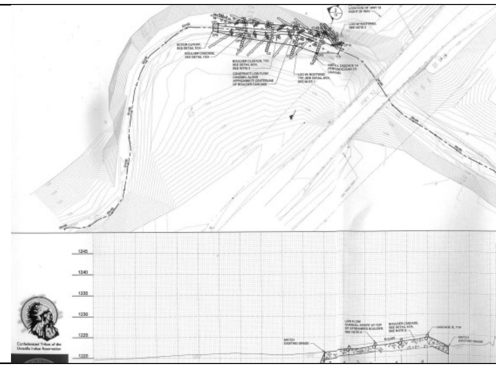
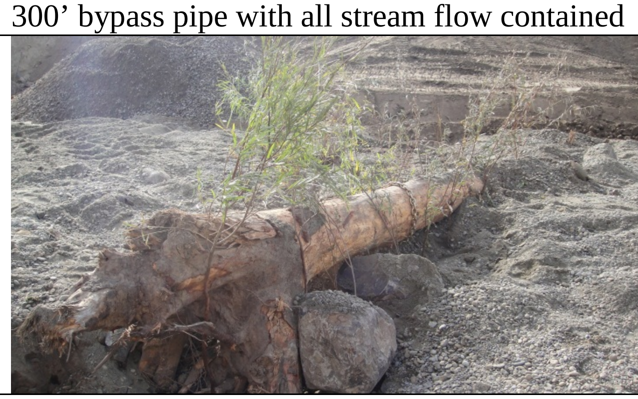


Figure. Pataha Creek, RM 1, Illustration of pre-restoration condition.

	
Final design by Tetra Tech for Pataha RM 1	Final design by Tetra Tech for Pataha RM 10
	
Salvaged preferred vegetation, planted 3000 trees	Extensive grazing damage by beaver

	
De-watering strategy	300’ bypass pipe with all stream flow contained
	
Generator pump used to reduce groundwater seep	Stability methods for retaining LWD

Roughened channel complete, ready to re-water

Slow re-establishment of flow to seal channel

Placement of perpendicular LWD by cross vanes

Notched cross vanes prevent future passage issues

Notched cross vanes provide low flow channel

LWD forces scour pool formation

Overview of project area 1.5 yrs post-implement

Sloped banks seeded with native grasses


Most upstream pool retained and enhanced


1.5 years of recovery, vegetative response


Elimination of 23” step at culvert achieved


Salvaged willow cuttings supplement LWD

Pataha Creek, 2011, RM 10;



Removing root wad barbs from LWD

Less opportunity for debris to collect



1.5 years post-project

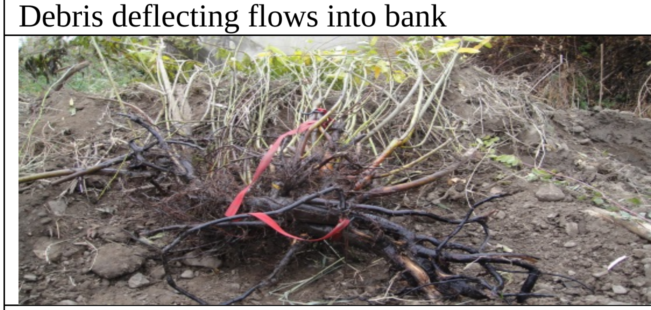

Salvaged & transplanted willows thriving


Rectification of 11’ step, partial barrier


7” water depth in box culvert during low flows


Debris deflecting flows into bank


Debris removed from thalweg, placed on bank


Salvaging mature willows for transplanting


Transplanting salvaged willows

	
Willow whips put in LWD trenches, backfilled	Protecting eroded bank, whips added

Furthering exploring the value of connectivity strategies as they pertain to benefits of restoring habitat in Pataha Creek and the effects of such on the adjacent Tucannon River are being explored. Hook and line sampling suggested the lower limit of distribution of chinook salmon was in need of being updated from the last point of documentation in 1996 (Figure 28). Additional snorkel surveys confirmed the presence of chinook juveniles upstream from the confluence of Pataha Creek and the Tucannon River. This new information prompted rationale for updating the chart in Figure 29 to be altered to reflect an expanded area of occupation. Continuing to restore Pataha Creek heightens to possibility that fishes shall move freely between Pataha and the Tucannon.

Figure 28. 1 of 4 juvenile chinook captured, RM 12, Tucannon River near Pataha Creek

Figure 29. Circled area on chart updated and validates presence of chinook near RM 12-16

Fish Habitat and Distribution

Table 4-1

Distribution of Steelhead, Chinook Salmon, and Bull Trout in the Mainstem Tucannon River

Geographic Area	From (RM)	To (RM)	Summer Steelhead: Spawning	Summer Steelhead: Juvenile Rearing	Summer Steelhead: Adult Holding	Spring Chinook: Spawning	Spring Chinook: Juvenile Rearing	Spring Chinook: Adult Holding	Fall Chinook: Spawning	Fall Chinook: Juvenile Rearing	Fall Chinook: Adult Holding	Bull Trout: Spawning	Bull Trout: Juvenile Rearing	Bull Trout: Adult Holding
Mouth	0	0.7												
Lower Tucannon	0.7	4.8										Note: Migratory and resident fish. Distribution data are limited.		
	4.8	5.5												
	5.5	8.7												
	8.7	12.3												
Pataha-Marengo	12.3	16.5												
	16.5	18.6												
	18.6	22.8								Note: Juveniles out-migrate as subyearlings				
	22.8	26.6												
Marengo-Tumalum	26.6	35.6												
Tumalum-Hatchery	35.6	37.8												
	37.8	41.9												
Hatchery-Little Tucannon	41.9	44.6												
	44.6	45.6												
	45.6	48.1												
Mountain	48.1	50.2												

Notes:

1. Distribution data are summarized from CCD 2004 and updated based on recent data being collected in the basin by WDFW, SRSRB and others (SRSRB 2011b, email comm.). Geographic areas and river mile sections correspond to Ecosystem Diagnosis and Treatment (EDT) analysis reaches utilized during subbasin planning.
2. Darker shades of gray indicate higher densities of fish present during their respective life stages.

Geomorphic Assessment and Habitat Restoration Study
Tucannon River 15 *April 2011* *100687-01.01*

TUCANNON RIVER (RM 42-44, 2012):
T9N, R41E, Sections 3, 10, and 15

The Tucannon River LWD restoration effort was a cooperative project between CTUIR and WDFW and occurred on the Wooten Wildlife Area, Columbia County, WA. CTUIR was identified as the lead sponsor due to having the most experience partaking aerial application of LWD. CTUIR provided technical review and input during the design process and field support prior to and during project construction. Justification for the project was prompted by the significant impacts to both in-channel and riparian habitat in the treatment reach. The project location encompassed a two mile reach from Beaver/Watson Lake (RM 42) upstream to Big 4 Lake (RM 44).

The primary delinquency in regard to habitat components was the lack of quantity of wood in the channel due to most being removed by burning, therefore the strategy to improve habitat for ESA-Listed fishes was to incorporate trees into the channel primarily by helicopter to minimize the footprint of disturbance, and to retain critical length and complexity of whole trees. Some wood placement was conducted in strategic areas by track hoe where good accessibility by land was observed. Track hoes were used in the construction of ELJ's with high catchment capability for trapping mobile LWD and smaller flotsam and jetsam to promote long term establishment of structures and retention of fine substrates for improved riverine process through rebuilding of channel features passively. Supplemental boulders were placed in strategic areas to provide ballast as well as roughness and diversity.

A Tucannon LWD Restoration Assessment identified four main habitat concerns to focus on while assessing the different reaches: existing LWD loading, loss of floodplain connection, level of habitat complexity, and opportunity to re-activate secondary channels. The selected reach between RM 42 and RM 44 had the least floodplain connection and the most opportunity to re-activate secondary channel up on the floodplain. The project was developed to utilize helicopter placement of trees blown down on exposed ridges of USFS land. An aerial application was chosen to minimize impacts to the landscape, retain maximum dimensions of transported trees, and consideration for the size of the treatment reach. The individual structures are designed to increase channel and habitat complexity, encourage channel aggradation to increase surface water elevations and to reconnect the river and floodplain, and activate secondary channels when possible to improve channel length and sinuosity. A total of 60 individual structures and 275 whole trees and 25 boulders (3'-4') were placed in the reach.

Structures range from single trees to large complex structures with 10-20 trees. 57 of the structures for the project were placed by helicopter. The remaining 3 structures were elaborate ELJ's constructed with track hoes and were located at the most downstream end to capture and debris that migrated to that point to protect infrastructure downstream. The ELJ's were located in a natural pinch point in the valley, and in a place that large log jams would have naturally developed. Structures constructed via helicopter application used opportunistic, passive anchoring techniques to counter log buoyancy (e.g. placing them against bank side trees), and increase structural ballast (e.g. stack trees, use adjacent banks and hillsides) to enhance the stability of each structures. Project Best Management Practices and Mitigations were followed and adhered to during project implementation; the project objectives include accomplishing the proposed design without adversely impacting resources and critical habitat within the project reach.

Whole trees ranged from 50-100 feet in length and in diameter from 15 inches to over 30 inches were added to the wetted channel via helicopter. The stability of structures in the system is reliant on the size of trees placed. Size determination was done using WDFW stream restoration guidelines. Trees were transported from the US National Forest, approximately 3-6 miles to the project area and placed in stream using a S64 Sky Crane helicopter. Approximately 500 additional trees were transported to the project site ranging in size from 4-12 inches in diameter and 20-30 feet long and distributed throughout the project reach using the helicopter.

Whole trees were strategically-placed into areas of need identified during prior survey work. Boulders were added to enhance complexity and provide ballast. Riverine function and habitat complexity was significantly improved in the treatment reach (Figure 30).

Figure 30. Pre project condition, results of habitat restoration actions, Tucannon R RM 42.

47: Plant Vegetation

Objectives;
-Establish multi-tiered levels of preferred vegetative species within project riparian areas.
-Achieving a self-sustaining mosaic of vegetative growth in riparian transects adjacent to project areas using species that meet plant hardiness criteria for the Eastern Washington Regional zone of the Pacific Northwest.
-Establishment of multiple levels of canopy height and ground cover using native species with demonstrated survival success and resilience to immediate threats at project site locations to provide stream shading, soil retention capability, filtering, overhead cover, long term recruitment

of LWD, organic exchange of matter to essential trophic levels of biotic components as required to sustain healthy populations of ESA-Listed salmonids.

Planting tasks include site planning and development of planting strategies, collection and preparation of materials (pruning and conditioning of live whip material), pre-order coordination with the CTUIR native plant nursery, and installation. Planting techniques are customized for conditions within each project area. Planting location, species, age, form (cuttings, saplings, bare-roots, potted, plugs), and soil/substrate conditions were considered and addressed during the implementation planning phase. Maintenance of vegetation involves watering, trimming and weeding around plantings. Weeds are physically pulled to improve survival and avoid chemical use. An important aspect of establishing vegetation is the maintenance of structural integrity of riparian enclosure and livestock fencing at project sites. Supplementing riparian areas of existing and new projects with additional vegetation is part of the TFHP's riparian establishment protocol. In 2009, 2010, 2011, and 2012, CTUIR conducted planting projects at the four project locations (Table 3).

Table 3. 2009-2012 Vegetation Plantings at CTUIR habitat restoration sites project sites

Water Body	**RM**	**Pounds Seed**	**Plantings**
Russel Springs	0.3	100	300 Willow, 100 Alder, 100 Birch, 100 Elderberry, 100 Cottonwood.
Hartsock Springs	0.5	100	400 Willow, 100 Alder, 100 River Birch.
Pataha Creek	1.0	500	800 Willow, 200 Alder, 100 River Birch.
Pataha Creek	10.0	300	400 Willow, 100 Alder, 100 River Birch.
TOTAL		**1,000**	**3,000**

85: Install Fish Passage Structure

Key objectives of the barrier rectification projects include:

- Improve access for ESA-Listed salmonids to headwater areas and cool water refuges
- Increase the quantity and quality of accessible salmonid habitat
- Approach historical free-flowing migratory corridor through passage improvement
- Approach natural stream slope, function and appearance
- Improve connectivity for populations of listed salmonid species to improve genetic exchange/integrity to improving fitness and long term survival capability
- Increased salmonid population dynamics and carrying capacity of preferred species
- Fulfill tasks identified in restoration plans by addressing limiting factors
- Improve survival rates by reducing stressors on salmonids
- Reduce impacts to various stream biota associated with structural passage barriers

Anthropogenic barriers and areas of passage concern to all degrees and life stages were addressed and brought into compliance with state step height standards at 3 locations. The fish passage barriers were preventing the migration of adult steelhead ascending upstream to optimal spawning areas and impeding the movement of fish seeking optimal rearing areas and/or cooler water refuge areas during the summer months. Step heights were reduced to less than .8 feet (<9.6") to comply with passage guidelines established by WDFW.

Additionally; velocity barriers, thermal, dry channel, and natural waterfalls in areas such as where exposed bedrock substrate exists are considered for rectification based on the unique characteristics associate with each phenomenon. For example an exposed bedrock outcropping substrate currently acting as a passage concern requires detailed inspection in regard if the barrier is indeed naturally occurring or the result of accelerated down-cutting resulting from anthropogenic alterations encompassed within; channelization, channel relocation, incisional down cutting etc. Results of determinations shall dictate the platform on which to proceed or not proceed with various forms of rectification if merited.

114: Identify and Select Projects

Conduct project solicitation and prioritize projects based on their merit and benefit to salmon recovery. Submit recommended projects to BPA. Provide technical support to project sponsors throughout implementation. The CTUIR TFHP supported the development of the Tucannon River Geomorphic Assessment and Habitat Restoration Study performed in 2011, which prioritized potential projects. The TCC working group assisted in the selection of sponsors for the proposed restoration projects. Funding was then identified and dedicated from BPA sources and additional financial contributors.

The consistency with CTUIR's RV as well as natural geomorphic process criteria was applied. Natural geomorphic processes are the primary factor in creating and maintaining high quality habitat in properly functioning rivers and streams. Designing for geomorphic process or removing inhibitors to geomorphic processes are very important considerations in project prioritization. The sustainability and functionality of the project is highly dependent on consistency with geomorphic processes, and it is the restoration of these processes that will create and maintain habitat features in the long term. The projects that will effectively address the rehabilitation of natural processes received the highest qualitative rating. Consistency with natural geomorphic processes were evaluated within the following categories (1) removes stressors that promote habitat degradation or inhibit natural channel and floodplain processes, (2) promotes reach-scale geomorphic response consistent with natural processes, (3) promotes the retention of LWD and sediment and forces pool-riffle morphology and complex channel plan form.

115: Produce Inventory or Assessment

CTUIR independently collected pre-project data for project effectiveness monitoring on the following: water temperature, aquatic habitat inventory, fish composition, abundance and spawning.

Aquatic habitat methods developed by Oregon Department of Fish and Wildlife (Moore, 2002) were used to inventory aquatic and riparian habitat. Field surveys were conducted by one to two persons walking upstream, dividing the stream into a series of individual habitat quadrats. Quads were identified as riffle, rapid, glide, scour pool, off-channel/sub-unit pool, and numbered sequentially. Dimensions of quadrats were determined primarily on distinct hydraulic features as defined in the methods.

The following data was recorded for each quad; habitat type, latitude, longitude, mean length, wetted and high-flow width, depth, shade, canopy, wood rating, substrate composition, channel type, percent flow, land use, bank class, undercut bank, dominant and secondary vegetation. Blackberries and young deciduous growth were classified as shrub cover. Wood ratings were categorical and useful for quantifying the value of in-river woody debris habitat for fish. In addition, pieces of woody debris were tallied if they met minimum size requirements, and were located within the high water channel. Shade values were taken when standing in the middle of a qaudrat, while canopy estimates were made from each adjacent shoreline. Currently protocol within the CTUIR TFHP recommends that a pre-implementation fish inventory be conducted to ensure the safety of fishes during implementation and to establish baseline data including fish density and species composition. Fish capturing crews made as many passes as necessary in attempt to remove 100% of the fish from the work sites, prior to dewatering or disturbance when in the best interest of fish health. This protocol was established in order to obtain measurable results for our habitat enhancement work over time to determine the effectiveness of habitat enhancement actions.

A crew of two or three persons conducted fish surveys. One backpack electro shocker manufactured by Smith Root Inc. was used to sample fish at site locations previously inventoried for habitat. Block nets were used at the lower and upper ends to isolate each site. Care was taken not to displace fish from the section as nets were being set. A variety of unit-types with different physical characteristics were sampled to represent the habitat complexity within and between unit types. All species were targeted and captured with dip nets and removed on successive electrofishing passes. Electro fishers were operated in a similar manner for the same number of seconds (or slightly more) as the previous pass. Electro shocker settings (i.e., volts, pulse) remained constant for each removal pass.

Captured fish were temporarily held in buckets, and then placed in a flow-through live well upstream from the uppermost block net. A portion of the fish were identified to species, measured and weighed. Differentiation between anadromous steelhead and resident rainbow trout could not be determined; therefore, all were classified as rainbow trout. After examination, fish were released back into the site where captured, or in some cases relocated just up or downstream from the sampled reach if conditions appeared significantly better.

119: Manage and Administer Projects – Produce Quarterly Status Reports to BPA Contracting Officer Technical Representative (COTR)

This work element includes a suite of management actions required to administer the project, including preparation of annual operations and maintenance budgets, managing and preparing statements of work land budgets, and property inventory to the assigned BPA representative. The project leader reports milestone and metrics to BPA using the BPA Pisces Program, supervises, trains, and directs staff activities, conducts vehicle and equipment maintenance and management, performs payroll, purchasing, subcontracting for services, and administers habitat enhancement activities.

2009-Setup satellite office at Walla Walla Community College
2009- 2013; Submitted property inventory to appropriate source using designated template.
2009- 2013; Produced Statement of Work with projected budget to COTR.
2009- 2013; CTUIR Admin. submitted budget accrual estimate to BPA.
2009- 2013; Completed accurate quarterly status reports accepted by COTR.

The baseline budget was designated at 200K annually with a 5% annual increase added for each subsequent year. Supplemental dollars were acquired through grant process or from unspent sources from within the CTUIR hierarchy. CTUIR did not have staff dedicated to work in the Tucannon Basin in the initial start-up years of 2007 and 2008. It was not until August of 2009 that staff was hired to manage the TFHP. Therefore expenditures during the start-up period were small as expected and restoration project size followed the typical trend of starting small in the establishment years and increase in magnitude and level of responsibility and involvement over time. This scenario offers a direct relationship to the operational budget and accompanying expenditures. During the first year of 2009, 40% of the budget was subcontract dollars dedicated to a successful, swiftly developed and mutually beneficial relationship with the Washington Department Fish and Wildlife, of whom owned the property in which our initial restoration efforts were implemented upon. As CTUIR became more prominent in the basin, we have exercised autonomy and subsequently reduced reliance on subcontract costs of which have reduced to zero in 2013. This declining trend is due to becoming more familiar with the characteristics of the Tucannon Basin and the operational procedures in addition to CTUIR possessing the capability to conduct our actions effectively internally due to having a diverse and highly talented support staff. Autonomy was attained while maintaining a cooperative spirit towards achieving common goals with stakeholder entities that comprise natural resource management in various Tucannon forums. Budget spending trends in initial years included higher expenditures towards non-capitol and materials for baseline, essential start up materials to build our establishment off of the Reservation, at our new satellite location at Walla Walla

Community College. Salary and indirect costs have habitually dominated the primary spending dedication annually. In attempt to incrementally keep up with growing responsibilities in the basin, a competitive grant was secured for 327K during fiscal year 2011. A salary spike was observed in Fiscal Year 2011 when an additional staff biologist was hired, but the position was eliminated in 2012 due to inadequate return on investment. Despite the return to one staff member, and plans to experience 5% annual increases to the base budget, the total budget amounts over the past few years have exceeded the forecasted base budget plus 5% amount, due to transferring available dollars in from other sources managed by CTUIR. The additional funds were justified based on rationale provided when requesting the funds and for displaying demonstrated effectiveness and feasibility when utilizing the additional dollars in achieving effective results.
Fluctuations in spending are related to project development and associated tasks. Budget variation is derived from two origins; alternate years dedicated for surveying, designing, permitting, planning etc., versus years earmarked for implementation as well as the distinct difference between reporting timelines between CTUIR's calendar year versus BPA's October 1 fiscal budget year. Therefore expenditures rise and fall and are reflective of both reality and a by-product of offset reporting timelines. To date the THP has conducted habitat enhancement projects of some magnitude each year since the onset of staff employment that initiated in August of 2009. Project size and cost is highly variable and therefore a contributing factor to the spending fluctuation trend. As larger projects are explored and conducted over time, expectations of implementing annually decrease. Experience dictates a more reasonable approach that considers administrative preparatory tasks one year followed by implementation the following. Monitoring and maintenance on all projects implemented continues throughout the year and adds to the work toll, but is embraced due to the importance and effectiveness derived from partaking in such activity.

Being that the TFHP is in essence a very young project, initial reporting of results would have been premature until the TFHP began putting projects on the ground. In addition, physical habitat response understandably takes time to show measurable change and subsequent biological response. The TFHP, being comprised of a one person staff dictates that prioritization of tasks become paramount in importance in regard to achieving objectives within allotted timeframes. Success in achieving 92.31% of tasks in a positive manner is considered an achievement knowing the extent of effort offered to achieve such a proportionately high, A-rating. That being said, the THP strives to achieve 100% positive in the future as annual reporting needs contribute to the success of the project. Quarterly status reports have been habitually submitted in a timely manner, with additional details provided within each comment-column to keep BPA personnel informed about ongoing details as they pertain to conduct of project deliverables held within the PISCES Statement of Work.

W132: Produce Annual Progress Report

CTUIR submitted the comprehensive annual report of work activities for the time period 2009-2012 on March 31, 2013. Reporting shall be conducted on an annual basis hereafter.

Annual reports are responsible for the entire 7.69% of red icons within PISCES are related to annual reporting history. Components of the annual reports have been compiled for assembly into the annual reporting phase of the project. The strategy of prioritization has put annual reporting to the lower tier of tasks with rationale being that staff concentrate on forward thinking actions such as permitting and project planning to accomplish on the ground aspects of implementing projects on a yearly basis by not risking delays due to time spent reporting specifics of past work. This strategy has been foreclosed in open dialogue with BPA representatives. In mutual agreement with BPA, CTUIR is estimating completing of past annual reports in 2013 and subsequent reporting duties shall be completed annually beyond as a higher priority pattern.

162: Analyze/Interpret Data

Analyze/Interpret Scientific Data

Pre and post Aquatic Habitat Inventory results were analyzed and compared to determine progress of restoration activities, gage effectiveness, and determine magnitude of physical change. The objective of physical habitat monitoring analysis is to illustrate progress toward or achievement of the 17% physical habitat improvement goal set by the BPA Accords agreement. Progress is determined by summarization of both the pre data and post data with subsequent comparisons between the two. Pre data was taken just prior to implementation. Post inventory was done within a year of the implementation for reporting purposes, but the real improvement will be most prominent when repeat surveys are conducted near the conclusion of the 10 year Accord period as adequate time is allowed for optimal response to restoration actions. Conscious effort to contribute to the achievement of meeting the goal of 17% improvement of physical habitat conditions steers enhancement activities. One example is the emphasis toward planting and replanting riparian vegetation until a desired level of preferred growth is achieved. Aquatic Habitat Inventory methodology was selected due to compatibility with the pre-existing data set that covered 20 years of utilization of the method by the THP Project Leader in the Umatilla Basin, therefore offering opportunities for; comparability, determination of measurable change through time, and degree of magnitude. The THP was trained in this specific discipline in 1992 by the authors of the methodology and I have since operated as not only an implementer of the method but as a professional instructor internally and externally to Fisheries specialists as well as at the college level, having trained 150 persons in the discipline and having 200 miles of riverine data within 4 basins located in the eastern, WA and OR region over 20 years. The results of the data have been dispersed to cooperating entities

Fish population estimates were derived from catch data incorporated into a model estimator developed by Van Deventer and Platts (1989). Catch per unit effort was tallied by dividing the number of a species captured by the amount of catch effort. Pre-status in regard to fish presence was conducted on all tributary restoration sites as dewatering or fish removal was necessary. A pre implementation count by species was attained for potential use in the future for measuring biological response to habitat actions. At a subbasin and a ceded area scale, CTUIR Fish Habitat projects also rely on biological data collected and analyzed through the CTUIR Fisheries Monitoring and Evaluation Program as well as several subcontracting firms. Specifically, project BPA#2009-014-00 Biomonitoring of Fish Habitat Enhancement has been developed to investigate the effectiveness of habitat actions on anadromous fish populations. Information gathered and reported through this project in combination with other outputs from the M&E Program have provided and will continue to provide important information to the Habitat Program for restoration action prioritization and development.

The CTUIR's Department of Information Technologies houses a significant amount of data for the CTUIR DNR programs. Increasing efforts are currently underway, through an on-site data coordinator, to standardize and better document many sets of data that are used throughout DNR projects. Once fully established, this system will improve our ability to store, query, and share data. Currently all data are kept in a database using a format conducive to existing reporting needs. These data are available at any time and are downloadable in Excel format and will provide project leaders direction and information for developing individual restoration project monitoring plans. This strategy will link project objectives with physical habitat metrics and monitoring methods that are consistent and accepted within the region. By developing a monitoring plan through this strategy, project specific data will be comparable across projects and subbasins. Monitoring information and results from individual plans will be used as adaptive management input for CTUIR projects and could be coordinated with other monitoring efforts. This effort shall make data sharing more probable and identify CTUIR as a professional source for data while preventing overlap or redundancy in regard to cooperating entities and the potential need for collecting data in co-managed basins.

In 2010, CTUIR co- sponsored a LIDAR and orthographic image data set for the Tucannon River valley floor from its confluence with the Snake River upstream to RM 60. One of the more revealing results from the LIDAR exercise was the determination that river channel confinement in the Tucannon River was found to be approximately 80% of the total RM. Additional results from the upper 30 miles of river habitat was measured for LWD presence or absence. LWD deficiencies were noted for a total of 21 of 30 miles. It is estimated to achieve the restoration objective set for the Tucannon a minimum of 2,200 LWD key pieces will need to be placed throughout the upper 30 miles of river.

Some extra effort was dedicated towards documenting baseline, pre-implementation status of fisheries populations by at selected restoration project sites due to the need for salvaging/capturing and relocating fishes to safe areas prior to the onset of heavy equipment operations. Density estimates were achieved through calculating multiple electrofishing pass depletion estimates using computer software. Repeat surveys shall be conducted periodically every 3-5 years to gage biological response to habitat actions and spurn adaptive management ideology. Adult Steelhead spawning surveys were also conducted within restoration reach boundaries by trained and experienced personnel during successive years including before and following habitat improvement actions. This was done to gage utilization, response and magnitude of use of newly created habitat conditions. Biological response will be measured in future years through the CTUIR's Research Monitoring and Evaluation Program.

165: Complete Environmental Consultation Processes

Produce Environmental Documentation-Prepare Biological Assessments for Applicable Projects; Submit permits to State and Federal Entities; Cultural Resource Protection and Preservation CTUIR successfully submitted all applicable and required permitting documents to the appropriate federal, tribal, state, county entities for select implementation projects in a timely manner. Secondary environmental compliance accomplishments during the reporting period included coordination with various compliance personnel to prepare supplemental documentation and reporting for ongoing and planned management actions.

Environmental compliance methods include development of appropriate documentation under various federal, Tribal, state and county laws and regulations governing federally funded project work. Methods involve coordination with various federal and state entities agencies and development and submittal of permit applications, cultural clearances, BAs, National Environmental Policy Act checklists, etc., as necessary. Part of the environmental compliance work element includes planning and developing site-specific proposals tailored to accomplish fisheries goals and meet compliance standards. The details concerning the implementation of treatments and preparations for putting efforts on the ground, including preparations for subcontracting, and specifics in regarding the safeguarding of ESA-Listed species during the implementation process, are outlined in the proposals.

174: Produce Plan

Produced engineered, stamped professional blueprint designs that were followed during project implementation. CTUIR successfully produced the required level of professional blueprints of project designs to attain approval of restoration activities.

185: Produce Pisces Status Reports and Periodic Status Reports for BPA

Quarterly Pisces reports were prepared, reviewed, and accepted by the BPA project COTR. These reports provide a regular update on project progress on status of work elements and associated milestones to allow adaptive management.

191: Watershed Coordination

2009, 2010; Initialized a cooperative agreement processes with WDFW.

2010; Investigated cooperatives with Nez Perce Tribe, USFS. CTUIR formed the TCC.
2011; Established cooperative partner relationship and implemented with NPT and USFS.
2012; Strengthened and advanced partnership with USFS.

Increased emphasis was placed upon coordinating habitat restoration actions with other entities to enable joint planning and participation in habitat enhancement projects and prevent duplication of effort or the potential for conflicting plans and negative effects on projects. Formation and active participation of natural resource management forums as effective relationships are forged with cooperating entities toward achieving common goals.
The CTUIR TFHP conducted project planning and developed work plans for stream habitat protection and restoration in the Tucannon Basin. CTUIR is the primary entity responsible for forming the TCC in 2010, a working group of professionals designed to bring natural resource mangers together to disclose plans and control restoration activities in the Tucannon Basin to achieve common goals as they relate to the association between improved habitat quality conditions and upgraded status of ESA-Listed Salmonids. 2010. The Regional Technical Team was in-place prior to the development of the TCC, but was too broad in scope as it represented topics in multiple basins, therefore leaving only a small portion of time dedicated to the Tucannon Basin. But with growing interest and representation in the Tucannon Basin, it became apparent for the need to share agency intentions and direction to avoid redundancy and streamline effectiveness of shared Tucannon activities towards common goals. The CTUIR THP is responsible for spawning the idea of forming the TCC, of which is essentially the Tucannon Basin branch of the Regional Technical Team. The TCC was dedicated towards increased resource management collaboration and project cooperation by seeking a team orientated concept to address common fishery habitat goals shared by various entities within the Tucannon Watershed. CTUIR has consistently helped build the framework of the TCC by recruiting interested parties to join the group. CTUIR is a primary orchestrator of the organizations content and conviction for frequent monthly meeting cycles to stimulate ongoing dialogues between agency personnel. A major component of the TCC's responsibilities pertains to the identification of project sites and subsequent enumeration of priority assignments and identification of the best suited sponsor within the TCC group. Open lines of communication help sort out details, particularly in the event of multiple entities being both qualified and interested in a project site. In such cases, open dialogue and rational thoughts are lobbied within the group until a decision is made in regard to what agency is best suited for marriage with a particular project site. The TCC functioned as an internal planning platform to prioritize and assign actions to the appropriate entity within or outside of the group if necessary. The CTUIR TFHP brought specific professional skill sets together and matched strengths in other disciplines and areas of responsibilities held by other cooperating entities to form project partnerships teams. Therefore symbiotic partnerships with mutually-shared goals make for project results becoming most effective.

In the two years of the TCC's existence, CTUIR provided the majority of meeting content for the group's monthly meetings to promote further development of the group and stimulate crossover thought-processes. Due to declining returns in regard to effectiveness, the TCC was disbanded in 2012. The TCC was vital in the infancy stages of project coordination and ran its course during the early onset of the planning period. The TCC near the later stages of existence became burdensome in terms of time commitment for attendees and became problematic as inconsistent disclosure was counter- productive. CTUIR's involvement in identifying, prioritizing, assigning and implementing salmonid habitat enhancement projects in the Tucannon Basin is tied directly to the results of the TCC's main driving force in regard to project selection; the Geomorphic Assessment of the Tucannon Watershed document. CTUIR and extended staff will be responsible for developing work element deliverables and producing subsequent results within the framework of work plans.

Potential project sites were identified as tier 1, 2, or 3 level projects based primarily upon biological status and potential for spring chinook salmon based upon a collection of scientifically based knowledge. Benefit to spring chinook salmon is the ultimate determiner of project priority and timelines. Disqualifiers such as unwilling landowner cooperation may allow a tier 3 project to move ahead of a tier 2 project.

Approximately 1.2 million dollars of additional annual funding was recently dedicated to improving the status of spring chinook salmon in the Tucannon Basin. Despite this lofty boost to funding, a limit still exists and does require prioritization and strategic groupings of projects to approach the fiscal ceiling on an annual basis. Planning for longer term implementation typically combines lesser tiered projects after initial years concentrate on higher-tiered projects. Some tier 1 projects get suspended and replaced by lower tiered projects, due to unique issues such as when a landowner does not grant permission. The hope is that the status may change over time and compliance with agency requests is granted. With all players at the table, pairing by years is openly discussed and finalized when consensus is reached.

A review panel led by the local SRSRB office included state, federal, tribal, county, and private fisheries consultants and various natural resource professionals within the forum. The panel theoretically was assembled to select project sponsorship and allocate associated project dollars to selected entities. Conflict of interest issues are of concern in that the SRSRB has basically been granted absolute power towards distributing project funds to members of the TCC group and beyond. Human behavior indicates that complete un-bias is highly unlikely in any organization, but the protocol of review, open discussion and majority selection in regard to chosen sponsorships tempers probability of obvious favoritism and conflicts of interest to some degree. Undeniable advantage exists to state and federal entities that own the majority of lands within the areas of spring chinook habitat and therefore are given first right of acceptance or refusal to implement of pass on the opportunity to implement on their respective boundaries of parcel ownership. Changes in regard to the dilution of the empowerment of one guiding entity in the process of project fund allocation would provide better balance and therefore more diverse application of restoration methods towards achieving common goals of improving the status of chinook salmon habitat. CTUIR was very active in the TCC, but was granted the opportunity to be a lead project sponsor on only 2 of 28 potential projects, which subsequently affected production of the CTUIR TFHP. Despite this, CTUIR donated services and materials in a supportive role to various natural resource entities toward completing projects sponsored by outside entities. The TFHP believes that strong partnerships increase the magnitude and frequency of success and often facilitate additional project opportunities. Professional and effective networking efforts provide opportunities to recruit specialized experts in the profession to jointly develop project strategies to strengthen the result of restoration and enhancement actions.

The CTUIR TFHP puts emphasis on intra-agency coordination by conducting coordination efforts with all habitat projects represented by CTUIR in various basins; Cultural Resources, Research Monitoring & Evaluation, Wildlife, mussel and lamprey programs to ensure project actions are consistent with the Tribes overall RV it relates to protection of FF and culturally significant resources and issues. Each of CTUIR's Habitat Projects in five basins embrace a planning approach that is consistent with in-house protocols and directives towards achieving RV Touchstone objectives while protecting FF interests.

In summary the TFHP makes a conscious effort to network with entities within and beyond Tribal framework to assist in the process of attaining objectives. Future emphasis will be placed upon relationships with private landowners as a result of the experience with the TCC. Building relationships from the ground up is essential towards the growing success of the TFHP. The THP emphasis the importance of strengthening partnerships and project performance with entities acting as extended staff and sharing common goals. Team building brings additional value to a relatively small and young project such as the TFHP. The TFHP desires to establish a regionally recognized value in regard to level of expertise in the discipline of fisheries habitat restoration and contribute by strengthening the capabilities of various extended working groups. Project performance is strengthened by contributions from various entities in their scope of responsibility and filed of expertise. Coordinated efforts with networking partners filling specific roles and sharing common goals is a strategy embraced by the forthcoming actions of the CTUIR TFHP.

As a substitue for the defunct TCC, participation with other subbasin planning teams will be sought to maximize utilization of data sharing fom a variety of resource assessment sources to classify existing habitat status, determine limiting factors, and identify priority areas for restoration activities. A combination of both passive and active restoration strategies were then developed to address habitat deficiencies. Collection of aquatic habitat, geomorphology, water quality and fish abundance data is ongoing and utilized for optimizing adaptive restoration plans at project areas.

In addition, public outreach and education has become increasingly important. CTUIR is firmly established as a partner with Walla Walla Community College (WWCC). WWCC was awarded top community college in the nation in 2013. CTUIR was instrumental in funding and planning the continued development of the WWCC Water and Environmental Center. Such a high quality partner is an asset to CTUIR and has contributed to restoration project success. The TFHP Project Leader also functions as an instructor at WWCC, teaching Watershed Process & Restoration 239. Content is comprised of restoration actions through CTUIR employment. College students are used as volunteers as well as paid technicians to improve appearance and function of BPA funded restoration projects in the Tucannon Basin. CTUIR also participates in WWCC Career Day to inform the public about program actions and in the recruitment and placement of employees associated with natural resources professions.

Multiple project tours were conducted for various audiences to showcase accomplishments of the CTUIR TFHP. CTUIR participated in the development of a salmon restoration video with the National Oceanic & Atmospheric Association.

CONCLUSIONS

Degraded habitat in the basin identifies a need for restoration activities to approach historical habitat conditions and status of preferred biotic species levels. Necessary habitat preservation and restoration actions conducted by the TFHP will achieve the following; uphold the mission statement of CTUIR's TFHP, uphold and protect Tribal Treaty rights, provide FF for traditional and ceremonial purposes, improve the physical habitat and biological response of associated target species such as ESA-listed spring Chinook Salmon, Steelhead and Bull Trout in the Tucannon Basin. Habitat project implementation actions shall be strategically prioritized and conducted in areas of primary importance based upon feasibility, effectiveness, and preferred response potential. Work shall be conduct in an effective manner based on the application of the most pertinent and applicable techniques to generate efficient results. Duration and degree or magnitude of effort shall be based of adaptive management techniques over the period time required to achieve mutually beneficial results shared between funding entities and project sponsors in the best interest of the status of the resource targeted for assistance.

Achievement of optimal riverine ecosystem processes is being achieved through advancing understanding of site specific characteristics and associated causes. The establishment and acceptance of current maximum channel efficiency within the defining parameters and restrictive conditions that may exist due to irreversible degrees of anthropogenic change offers a realistic outlook as to what degree of historic condition can be approached and what restoration methods are chosen.

Learning lessons from past experience and applying the lessons to improve project success is a valued skillset and a point of emphasis within the TFHP. Being receptive to professional review advice and applying the lessons towards future performance is an opportunity to apply adaptive managerial techniques based upon the input from such entities as the ISRP review committee.

Emphasis is placed beyond the project site as focus is enlarged to a magnified watershed-scale while identifying the cause of the issue and the proper remedy to rectify. Using understanding of proper watershed function and associated processes improves the potential for project success. Using this approach, the THP has evolved towards a more coarse vision of understanding and application. Emphasis of salmonid species has shifted from steelhead waterways to chinook habitat. Although it is understood what enhances chinook salmon habitat does indeed improve conditions for other preferred salmonid species. Chinook salmon are currently the primary species targeted for selection of restoration sites and the strategies for habitat restoration are derived according to chinook salmon need and preference.

The TFHP has a only one staff, of which is a biologist of whom has 25 years of related fisheries experience with emphasis on natural production monitoring techniques of salmonid populations as well as aquatic habitat inventory and restoration techniques.

Project personnel in regard to staffing performance, created lessons in regard to the myth that; increases of project personnel, payroll and potential work output do not necessarily translate to more production of acceptable quality. The TFHP is very attentive to spending BPA monies in an efficient manner, while accomplishing highly respected results. Therefore after what essentially became a one year experiment in regard to adding an additional biologist to the TFHP, the individual was released due to lack of fulfilling expectations in regard to productivity. The TFHP took the responsible, pro-active approach to improve overall project performance by minimizing the potential for ongoing negative impacts. The right match to the position could pay dividends in the future if the decision is made to hire additional personnel, of highly motivated and effective nature.

From an in-stream aspect, several important changes to protocol and techniques were successfully adopted: philosophical migrations toward softer-approaches such as utilizing LWD and natural materials whenever possible to achieve a more natural aesthetic appearance in performing proper riverine function is an ongoing emphasis. Knowledge of cutting edge techniques is gained and strengthened through active participation in continued education. Emphasis on techniques to reduce implementation footprints and increased attention to finishing detail improves not only public perception of the work we perform, but accelerated recovery and improved conditions at project sites. Working in the dry using a well-orchestrated de-watering plan including particular attention to safely relocating biota from the work zone prior to implementation preserves existing population status of target species as well as long term biological response to favorable habitat created. Having observed adult salmonid use of freshly disturbed, loose gravels due to implementation disturbance influenced a decision to accept an offer to utilize a free source of surplus round ornamental gravel at one of our restoration sites. Due to favorable biological response in terms of increased spawning activity at locations of artificial spawning gravel incorporation, which triggered biological response in regard to selective spawning sites and increased activity, feasibility, applicable function and aesthetics, the

TFHP used gravel additions at four restoration sites and make an effort to prioritize such an action of conditions are favorable.

Future project focus centers around areas of need towards restoring spring chinook salmon status in reaches identified as beneficial to the species and ranked as they pertain to categorical priority. Rate of projected recovery was noted as underachieving in the Tucannon Basin by BPA entities, therefore adaptive management techniques shared within the TCC, resource management working group is being conducted to bring a point of emphasis on this particular species in regard to restoration actions planned in the Tucannon Basin targeting a 17% improvement within the 2008-2018 timeframe in regard to measurable improvements of physical habitat components relevant to the improved status of fulfilling the needs for spring chinook improvement

Achievement of healthy watershed environments that meet the specific needs of all life stages of ESA-Listed salmonid species will continue to be pursued. Improvements to water quality towards meeting various established criteria by improving overall environmental conditions within the wetted channel associated with optimal fish health within the freshwater ecosystems in which target species inhabit and are theoretically adapted to thrive within though evolutionary processes.

From a project management standpoint, emphasis is placed beyond the project site as focus is enlarged to a magnified watershed-scale while identifying the cause of the issue and the proper remedy to rectify. Using understanding of proper watershed function and associated processes improves the potential for project success. Using this approach, the TFHP has evolved towards a more coarse vision of understanding and application. Increased emphasis of restoring holistic riverine function will guide future restoration actions through the establishment of optimal and efficient interchange between surface and subsurface waterways, particularly in channels that have become perched or isolated due to detrimental land use practices. Seeking to improve the desired ratio between effluent gaining reaches and influent losing reach area to achieve balance within the valley wall framework that become activated as flows spill beyond bank full levels.

From an in-stream aspect, several important changes to protocol and techniques were successfully adopted: philosophical migrations toward softer-approaches such as utilizing LWD and natural materials whenever possible to achieve a more natural aesthetic appearance in performing proper riverine function is an ongoing emphasis. Knowledge of cutting edge techniques is gained and strengthened via. continuing education. Emphasis on techniques to reduce implementation footprints and increased attention to finishing detail improves not only public perception of the work we perform, but accelerated recovery and improved conditions at project sites. Working in the dry using a well-orchestrated de-watering plan including particular attention to safely relocating biota from the work zone prior to implementation preserves existing population status of target species as well as long term biological response to favorable habitat created. Having observed adult salmonid use of freshly disturbed, loose gravels due to implementation disturbance influenced a decision to accept an offer to utilize a free source of surplus round ornamental gravel at one of our restoration sites. Due to favorable biological response in terms of increased spawning activity at locations of artificial spawning gravel incorporation, which triggered biological response in regard to selective spawning sites and increased activity, feasibility, applicable function and aesthetics, the THP used gravel additions at 4 more restoration sites and make an effort to prioritize such an action of conditions are favorable.

Adaptive management from a riparian aspect has resulted in the following use of innovative techniques; added riparian tarps to reduce competitive impacts from noxious weeds on project plantings. Evolution from using plastic tarps to a more natural, biodegradable and aesthetically pleasing coir fabric improved project appearance. Grazing reduction was achieved and higher plant survival attained using organic repellent, and selecting tree species such as Native Water/River Birch and Native Red Alder at sites where beaver were present reduced impacts when compared to sights that had significant losses of willow and cottonwood trees. Use of physical restrictors such as various types of fencing using natural and man-made materials became essential tools after learning lessons in regard to tree loss in previous years. Tall willow whips up to 16' in length were an effective and unique technique that essentially moved plant life out of the animals feeding zone-level and increased immediate tree heights to produce immediate stream shading in an accelerated manner.

Anthropogenic barriers and areas of passage concern to all degrees and life stages will be addressed and brought into compliance with state step height standards when possible, as landowner access can be a restraint. Additionally; velocity barriers, thermal, dry channel, and natural waterfalls in areas such as where exposed bedrock substrate exists shall be considered for rectification based on the unique characteristics associate with each phenomenon. For example an exposed bedrock outcropping substrate currently acting as a passage concern requires detailed inspection in regard if the barrier is indeed naturally occurring or the result of accelerated down cutting resulting from anthropogenic alterations encompassed within; channelization, channel relocation, incisional down cutting etc. Results of determinations shall dictate the platform on which to proceed or not proceed with various forms of rectification if merited.

The CTUIR TFHP hypothesizes that both ecological and physical forces currently limit salmonid production in the Umatilla River Basin and that the relationship between physical habitat conditions, ecological conditions, and salmonid abundance will improve in sites that receive habitat treatments. This is demonstrated by measured improvements in physical habitat conditions, which has resulted in an increased abundance of salmonid populations. Post-treatment monitoring is an important component of the habitat restoration process and is vital towards determining measurable results of restoration actions and identifying trigger-mechanisms responsible for instigating positive change. Project success is ultimately determined by technique applicability, accurate implementation, effective monitoring and timely adaptive management. The CTUIR TFHP is recognized as experts in the discipline of fish habitat restoration in this geographic region and strives to maintain this status.

The CTUIR is emphasizing more attention toward project planning in regard to developing a systematic approach for site selection based on scientific data as well as to increase efforts towards effectiveness monitoring (both have been considered as shortfalls in the past from review committees). The new CTUIR philosophy emphasizes adaptive management as a means of maximizing success at each project site.

Recognition of the unique characteristics of each project site should be considered in conjunction with landowner parameters when selecting the most effective, site-specific habitat restoration plan. A plethora of management strategies have been successfully applied in effort to reestablish the salmonids to self-sustaining levels. We expect exponential response of salmonid populations once habitat deficiencies are addressed and improved. We believe a positive correlation between habitat improvement, salmonid density, and fitness levels will shift the status of ESA-Listed species towards a safer level of sustainability in the Tucannon River Basin. Learning lessons from past experience and applying the lessons to improve project success is a valued skillset and a point of emphasis within the TFHP.

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