COOS BAY • NORTH BEND
WATER BOARD

2305 Ocean Boulevard
P.O. Box 539, Coos Bay, Oregon 97420-0108
Telephone: (541) 267-3128 Fax: (541) 269-5370

Rob K. Schab, General Manager

July 30, 2014

Greg Apke
ODF&W Fish Passage Coordinator
4034 Fairview Industrial Drive, S.E.
Salem, Oregon 97302

RE: Applications for Amendment to Memorandum of Understanding (MOU)
(1) Waiver of Fish Passage at Upper Pony Creek Dam (UPCD); and
(2) Waiver of Fish Passage at Lower Pony Creek (LPCD)

Dear Mr. Apke:

Enclosed is documentation supporting the Coos Bay-North Bend Water Board's (Water Board) request for the following actions:

1. Amendment of existing ODF&W/Water Board MOU regarding the waiver of fish passage at Upper Pony Creek Dam (UPCD)

2. Application for a waiver of fish passage at Lower Pony Creek Dam (LPCD).

Upper Pony Creek Dam was originally constructed in 1951 at river mile 4.5 on Pony Creek. In 2001, a new larger dam was constructed immediately downstream of the existing dam, as part of the Water Board's comprehensive Water Supply Expansion Project. Pursuant to provisions of HB2607, the Water Board was granted a waiver of fish passage for UPCD. The waiver included a suite of mitigation requirements on Pony Creek in lieu of fish passage.

Lower Pony Creek Dam, approximately one mile downstream of UPCD, was constructed in the 1920's. The original dam and a replacement structure built in 1988, immediately upstream of the original structure, did not provide for fish passage. At the time of the 1988 LPCD construction, consultation with ODF&W, ACOE and Oregon Division of State Lands resulted in approval of the construction without fish passage.

As you are aware, shortly after the UPCD was constructed, changes in mitigation rules allow for fish passage mitigation to be pursued beyond the Pony Creek drainage. The Coos Bay-North Bend Water Board has worked collaboratively with ODF&W for over a decade to develop mitigation alternatives which provide greater benefit to Oregon's fish species. We are pleased to submit an alternative mitigation component located on Matson Creek in Coos County. We believe the scope of this mitigation supports an additional modification of the existing UPCD fish passage waiver and a new waiver of fish passage at LPCD. The proposed mitigation provides a net benefit to multiple fish species in the Coos Watershed, well beyond the limited diversity and compromised habitat in Pony Creek.

In addition to greatly improving the net benefit to Oregon's migratory fish species, approval of the proposed actions would result in lengthening the lifespan of the municipal water supply by approximately 4 years, and allow for an additional 55 days of municipal water supply during drought years. The following applications and supporting documentation create benefits to several salmonid species in a habitat of superior quality, while providing the community with a more reliable water supply.

ODF&W's investment of staff time in identifying and reviewing the attributes of this project have been greatly appreciated. If you have any questions, please feel free to contact me or Shannon Souza, the project manager for this effort.

Sincerely,

Rob K. Schab
General Manager

Enclosures

C: Mike Gray, ODF&W, Charleston
Shannon Souza, Sol Coast Consulting & Design, LLC
Jon Souder, CWA

Table of Contents

Section One

Executive Summary

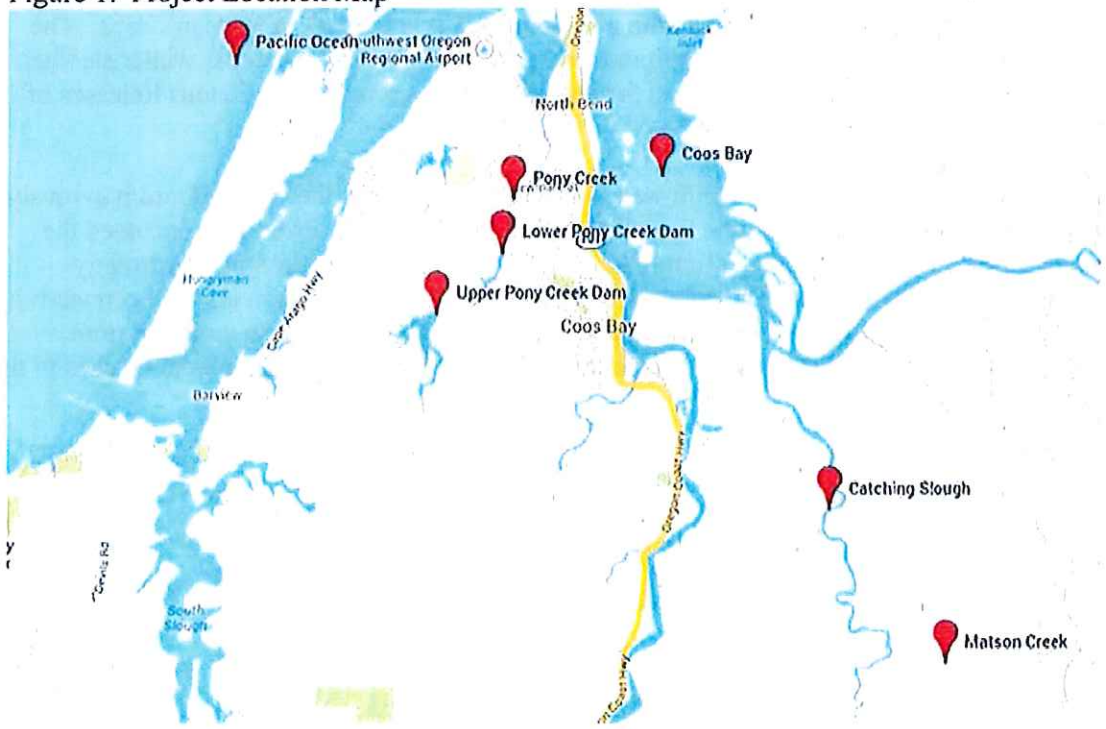
Executive Summary

The Coos Bay North Bend Water Board ("Water Board") operates two dams on Pony Creek in the Coos watershed. In consultation with the Oregon Department of Fish and Wildlife (ODFW), the Water Board has prepared applications pertaining to fish passage on each of the two dams as follows;

- A waiver for fish passage on Lower Pony Creek Dam (LPCD)
- A request for amendment of the Memorandum of Understanding (MOU) addressing the waiver of fish passage on Upper Pony Creek Dam (UPCD)

The applications have been prepared and submitted for ODFW consideration simultaneously in order to allow a comprehensive assessment and review of both the Pony Creek (location of existing mitigation requirements and both Artificial Obstructions) and the Matson Creek (location of both proposed mitigations) systems (Figure 1). Pony Creek is a 303d listed stream in an urban setting in which recent surveys have observed only cutthroat trout. The MOU mitigation elements in Pony Creek were designed to "protect a minimal population of cutthroat trout". By comparison, the proposed actions at Matson Creek would occur in open pasture lands amidst a wide, active floodplain and adjacent forested uplands which feed into the main stem of Matson Creek and Catching Slough in which coho, chinook, winter steelhead, chum and sea-run cutthroat have been observed. Additionally, both the proposed stream restoration and previously completed wetland restoration and removal of barriers to fish passage at the mouth of Matson Creek reside on lands protected by a conservation easement and under the active ownership of the Wetland Conservancy.

Figure 1: Project Location Map



Merritt Lake Dam, also known as Lower Pony Creek Dam (LPCD), was originally constructed during the 1920's on Pony Creek near River Mile 3.2. Since that time it has blocked passage to the upper portions of Pony Creek. The LPCD was reconstructed in 1988, at which time consultation with USACE, Oregon DSL, and ODFW resulted in approval of the project without fish passage. The application for a waiver of fish passage at LPCD proposes mitigation through the restoration of the north fork of Matson Creek. As described in the application, this mitigation would provide the target species (cutthroat trout) as well as additional salmonid species (coho, chinook, winter steelhead, chum and sea-run cutthroat) with year round rearing habitat within a protected valley previously restored for wetland mitigation.

Fish passage at UPCD was addressed by the existing MOU between the Water Board and ODFW. In addition to physical habitat mitigation measures previously completed within the Pony and Willanch Creek drainages, the MOU (2004 amendment) includes requirements for releases of water from LPCD as follows:

- Continuous Releases, year round, in the amount of 1 c.f.s.
- Supplemental Releases in the amounts of; 1 c.f.s. in November, 2 c.f.s. in December, 3 c.f.s. in January, 3 c.f.s. in February, 2 c.f.s. in March, 2 c.f.s in April and 1 c.f.s in May.

These Supplemental Releases are to be enabled by waters stored by the Water Board in Upper Pony Creek Reservoir under a storage water right to be secured by ODFW for fisheries enhancement and supplied through natural flows of Pony Creek and pumped flows from the adjoining Joe Ney watershed. The Supplemental flows are to "be maintained annually to protect a minimal resident population of cutthroat trout."(ODFW/CBNBWB, 2004) This request for amendment to the MOU presents the replacement of the Supplemental Releases, and related ODFW water right application, with alternate mitigation in the form of stream restoration in the South Arm of Matson Creek Valley on the mainstem and Tributary #3 of Matson Creek. The restoration is designed to provide year round rearing habitat for coho, chinook, winter steelhead, chum and sea-run cutthroat. The request for amendment supports the Continuous Releases of 1 c.f.s.

Although no fisheries mitigation credit was assigned to the project, the Water Board previously completed wetland mitigation in the lower section of Matson Creek. Prior work included the removal of barriers to fish passage from Catching Slough and returning natural hydrology patterns and flow conditions. The combination of the proposed improvements with connectivity to downstream and adjacent off stream habitats will result in net benefits to cutthroat trout, steelhead trout and coho salmon, while extending habitat improvements from tidal reaches to the headwaters, (Figure 2).

Figure 2: Matson Creek Valley

To facilitate ODFW net benefit analysis, the Water Board is including data from Aquatic Habitat Inventory (AHI) surveys conducted in both Pony and Matson creeks. In order to complete a preliminary assessment, the Water Board contracted with Coos Watershed Association (CWA) to evaluate the existing and proposed mitigations utilizing the Willamette Partnerships Salmon Credit Calculator. While limitations to this approach have been acknowledged, the results of the application provide some measure of quantitative comparison of habitat and mitigation values from which to inform the proposed mitigation design. Site Functional Performance scores of existing mitigation stream segments was slightly higher 64% (Pony), than proposed mitigation locations 60% and 54% (South Fork Matson) and 55% (North Fork Matson). The design of proposed mitigation on the forks of Matson Creek is intended to bring functionality of those streams up to 100% functionality. By contrast, the Water Board and ODFW have exhausted efforts to identify additional mitigation measures on Pony Creek that would result in improvements to that streams functionality. Both the raw survey data sets and the salmon credit calculators conducted by CWA have been included for use or reference by ODFW staff.

References

Oregon Department of Fish and Wildlife (ODFW), 2000. Aquatic Inventory Survey for Lower Pony Creek Watershed. Corvallis.

Oregon Department of Fish and Wildlife (ODFW), 2011. Mart Davis Proposal – Analysis of Benefits. Coos Bay.

U.S. Army Corps of Engineers (USACE), 1998. Biological Assessment: Coos Bay-North Bend Water Board Water Supply Expansion Project. Action I.D. 94-010. Portland District.

Lower Pony Creek Watershed Committee (LPCWC), 2001. Lower Pony Creek Watershed Assessment and Potential Action Plan. Prepared for LPCOC by Satre Assoc. PC, Eugene; Earth Designs Consultants, Inc., Corvallis; and Hart Crowser, Lake Oswego, OR.

Coos Watershed Association (CWA), 2009. Catching Slough, Daniel's Creek and Heads of Tide Sub-basin Assessment and Restoration Opportunities. Charleston OR.

Coos Watershed Association (CWA), 2013. Analysis of Mitigation Needs for the Elimination of Instream Flow Requirements in Pony Creek and Design of Proposed Compensatory Stream Features at the Matson Creek Wetland Preserve, Task 1 Summary Report. Charleston OR

Coos Watershed Association (CWA), 2014. Summary Report: Task2, "Determine the Benefits from Existing In-stream Flows. Charleston OR

Oregon Department of Fish and Wildlife (ODFW) & Coos Bay-North Bend Water Board, 2004. Memorandum of Understanding (MOU) Waiver to Fish Passage Amended: July 8, 2004. Salem Oregon

Section Two

Fish Passage Waiver Application
Lower Pony Creek Dam

OREGON DEPARTMENT OF FISH AND WILDLIFE

Fish Passage WAIVER Application

APPLICANT INFORMATION

ORGANIZATION/APPLICANT: Coos Bay North Bend Water Board
CONTACT: Rob Schab **TITLE:** General Manager
ADDRESS: 2305 Ocean Blvd
CITY: Coos Bay **STATE:** OR **ZIP:** 97420
PHONE: 541.267.3128
E-MAIL ADDRESS: rob_schab@cbnbh2o.com

SIGNATURE: _____ **DATE:** 7-30-14

OWNER (*if different than Applicant*): Applicant

APPLICATION COMPLETED BY (*if different than Applicant*): Shannon Souza, PE
TITLE: Principal
ORGANIZATION: Sol Coast Consulting & Design, LLC
ADDRESS: 299 S Bayshore Drive
CITY: Coos Bay **STATE:** OR **ZIP:** 97420
PHONE: 541.266.0877
E-MAIL ADDRESS: Shannon@solcoast.com

SIGNATURE: _____ **DATE:** _____

To Be Completed by ODFW Fish Passage Coordinator

APPLICATION #: **DATE RECEIVED:**

FILE NAME:

APPROVED ☐ **SIGNATURE:** _____ **DATE:** _____
DENIED ☐ **TITLE:**

ARTIFICIAL OBSTRUCTION (*for which a Waiver is being requested*)

1. TYPE OF ARTIFICIAL OBSTRUCTION:

- ☒ Dam
- ☐ Culvert/Bridge
- ☐ Tidegate
- ☐ Other (describe):

New ☐ Existing ☒

2. PLEASE PROVIDE A BACKGROUND AND DESCRIPTION OF THE PROPOSED ACTION TRIGGERING THE NEED TO ADDRESS FISH PASSAGE: Merritt Lake Dam, also known as Lower Pony Creek Dam (LPCD), was originally constructed during the 1920's on Pony Creek near River Mile 3.2. (Figure 1) Since that time it has blocked passage to the upper portions of Pony Creek. A new LPCD was constructed in 1988, at which time consultation with USACE, Oregon DSL, and ODFW resulted in approval of the project without fish passage (Atiyeh, 1986).

The Obstruction is an existing dam constructed in a hazardous seismic zone. LPCD is an integral element of the municipal water supply as well as a potential threat to public safety in the event of a failure. The applicant is scheduled to solicit proposals for an evaluation of the dam in 2015 during which the additional spillway

adequacy will be evaluated. Accordingly, the applicant anticipates the likelihood of strengthening retrofit construction activities in order to bring the dam up to present day Seismic Design Standards.

Figure 1: Project Location Map

3. PASSAGE WILL NOT BE PROVIDED FOR THE FOLLOWING REASON(S): Fish passage has been obstructed since the original dam construction in the 1920's. No fish passage was provided for in the LPCD construction design as passage was not required at the time of the Artificial Obstruction construction (1988). A copy of the letter authorizing construction is attached.

4. DATE THE TRIGGER ACTION IS SCHEDULED TO BEGIN): While not scheduled, this triggering event may occur by 2021.

5. LOCATION

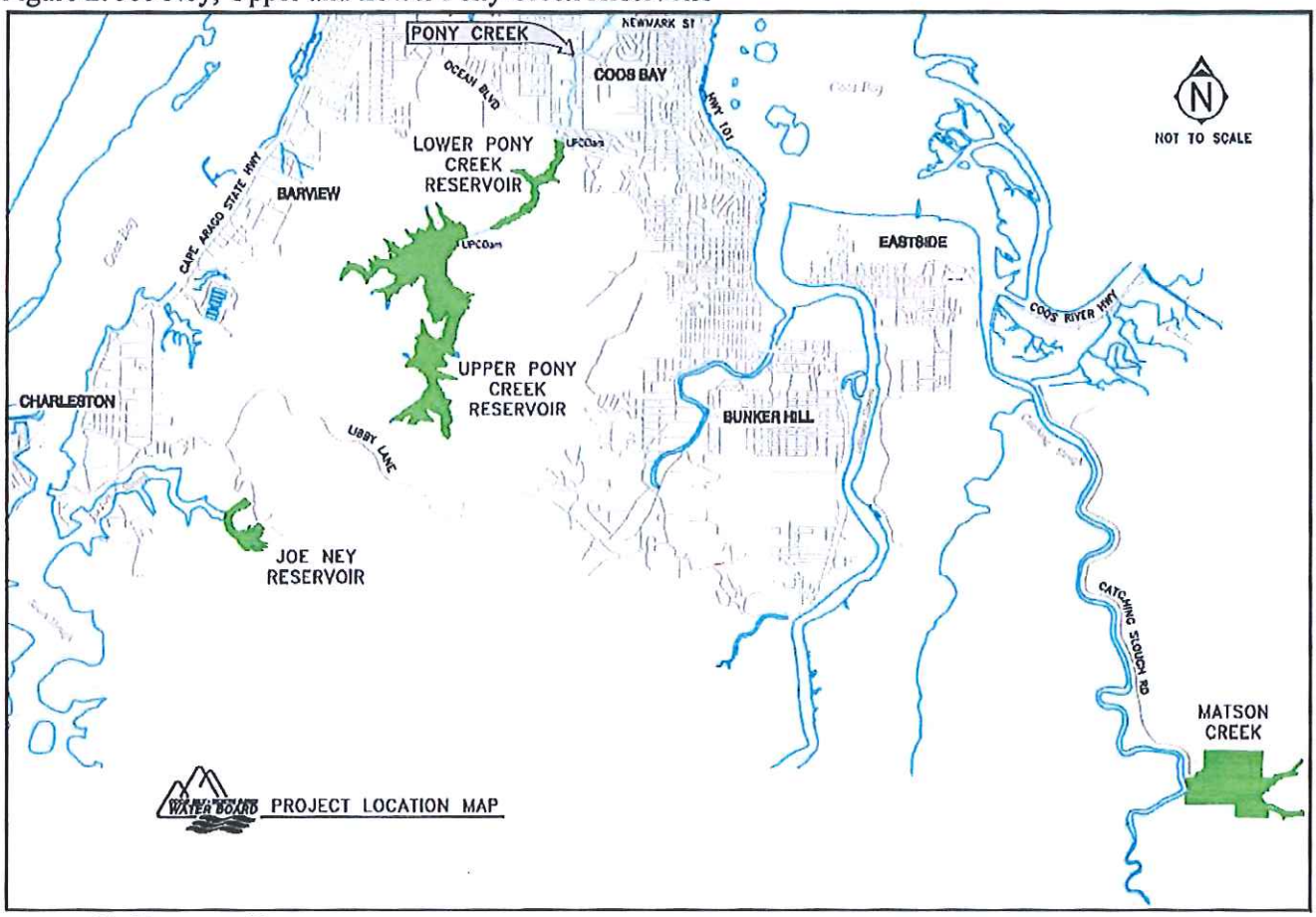
COUNTY:	Coos	
ROAD CROSSING:	NA	
RIVER/STREAM:	Pony Creek	
TRIBUTARY OF:	Coos Bay	
BASIN:	South Coast	
COORDINATES[a]:	Longitude: 43.379868, °W	Latitude: -124.241687°N

6. STREAM DESCRIPTION

Pony Creek, below LPCD, is a highly urbanized stream in which collaborative habitat restoration efforts (between the Water Board and ODFW) have been exhausted. Pony Creek is subject to limitations on the life supporting functionality beyond the impacts of the LPCD barrier, namely; urban encroachment, high temperatures and poor water quality. Pony Creek is a 303d listed stream for Temperature, Fecal Coliform, and E. Coli.

LPCD prohibits fish passage to Lower Pony Creek Reservoir (located between Lower and Upper Pony Creek Dams) and its tributaries. (Figure 2) Merritt Reservoir has four tributaries, including Pony Creek. Upper Pony and Merritt Reservoirs inundate most of the spawning habitat historically available to coho salmon. Surveys in 1999 identified a limited amount of very low suitability spawning habitat in one tributary of Merritt Reservoir. The survey also observed an abundance of suitable rearing habitat for coho salmon, steelhead and sea-run cutthroat trout above LPCD in both reservoirs and in the tributaries. (CH2MHill, FEIS, 1999)

Figure 2: Joe Ney, Upper and Lower Pony Creek Reservoirs



6A. BARRIER TABLE

	DOWNSTREAM					UPSTREAM			
Locations	3	C/N	2	1	AO	1	2	E	*example*
Type					D	D	C		C
Length					35 ft				80 ft
Distance		300 ft				6,500 ft	12,500 ft	18,000 ft	1,200 ft
Level					5	5			5

Type = C (culvert/bridge), D (dam), T (tide gate), N (natural; *describe below*), O (other; *describe below*)
Length = length of the barrier in the stream (e.g., culvert's length, dam's width/footprint)
Distance = distance from the Artificial Obstruction (to closest point of other barriers)
Level = amount of passage at the barrier using the following codes:

PLEASE PROVIDE ADDITIONAL DESCRIPTIONS FOR THOSE BARRIERS INCLUDED IN THE BARRIER TABLE OR FOR OTHER BARRIERS AFFECTING NATIVE MIGRATORY FISH MOVEMENT TO OR FROM THE ARTIFICIAL OBSTRUCTION: The existing Artificial Obstruction, Lower Pony Creek Dam is an earthen impoundment (Photos 1-3) at the base of LPC or Merritt Lake Reservoir located on Pony Creek approximately 300 feet upstream of the confluence with the AAA Fork.

Photo 1: Lower Pony Creek Dam ("LPCD")

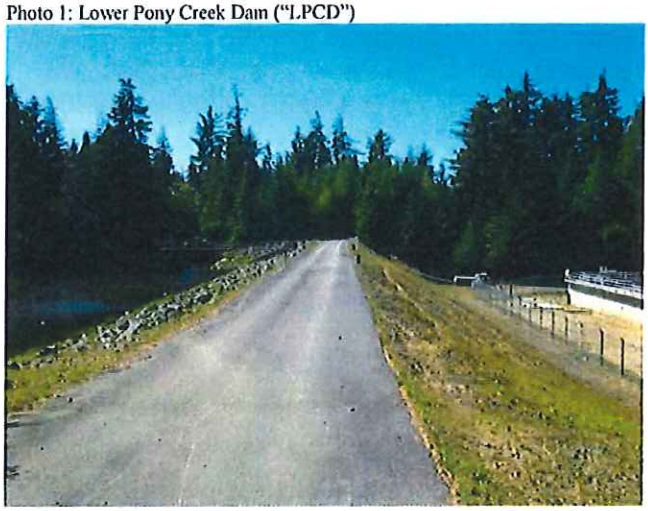


Photo 2: LPC Reservoir Intake from top of LPCD

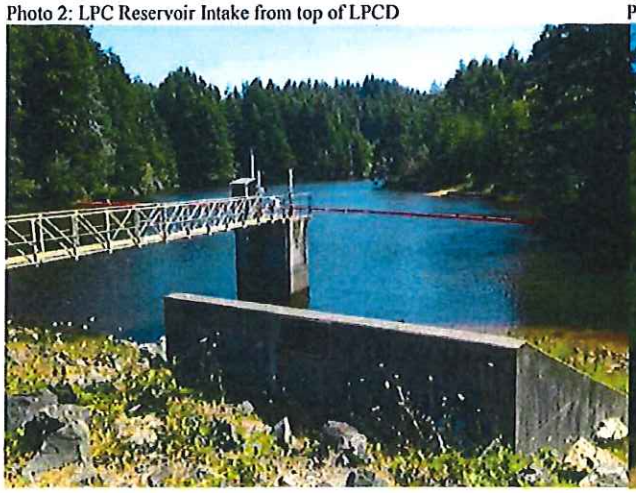
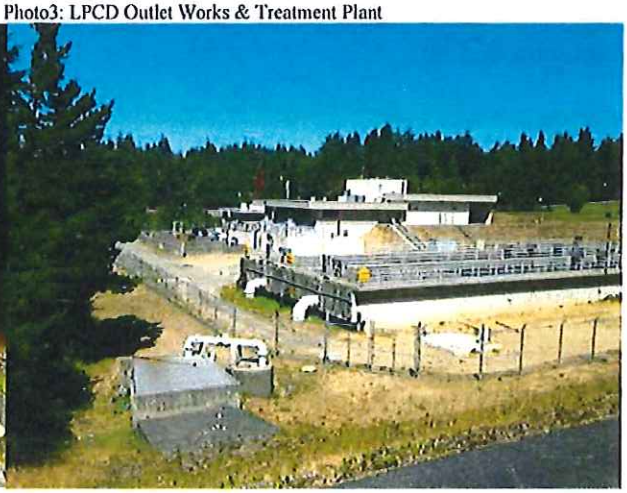


Photo3: LPCD Outlet Works & Treatment Plant



6B. SUMMARY TABLE (*please provide the following information relative to the Artificial Obstruction, which will help determine the benefit of providing passage at it*):

	DOWNSTREAM	UPSTREAM
NMF Species Present Currently	Cutthroat Trout	Cutthroat Trout
NMF Species Present Historically	Coho, Steelhead, Sea-run Cutthroat	Coho, Steelhead, Sea-run Cutthroat
Habitat Quality	poor	Usable rearing
Flows	1-31 cfs	10 cfs
Water Quality	poor	good, seasonal stratification
Water Right Availability	na	limited
Land Use/Zoning	urban and residential	commercial forest
NMF = native migratory fish		

PLEASE PROVIDE ADDITIONAL DETAILS REGARDING THE INFORMATION PROVIDED IN THE SUMMARY TABLE (*such as species listed under the state or federal ESA and descriptions of the stream channel and riparian habitat*): Recent surveys have observed Cutthroat Trout as the only salmonid species in the freshwater portion of the Pony Creek Watershed. A resident population of Cutthroat exists in the watershed above Merritt (Lower Pony) and Upper Pony dams; the sea-run life cycle of Cutthroat can be expressed in the watershed below the dams. Habitat potential exists in the Pony Creek Watershed below the dams for nongame fish species including Cottids (Sculpins), Three-spine Stickleback, and Lampreys (Pacific and Western Brook). No recent evidence of anadromous salmonid presence exists, although it is likely that Coho and Steelhead inhabited the basin before significant urban development and the dams existed. Attempts to colonize the Pony Creek Watershed with Coho and Steelhead through the STEP Program were unsuccessful, likely due to a lack of suitable spawning habitat. (Gray,ODFW, 2011)

6C. PROVIDE THE SOURCE FOR INFORMATION CONTAINED IN THE BARRIER AND SUMMARY TABLES: Barriers – Coos Bay North Bend Water Board engineering records for dam and culvert construction. Summary – Final Environmental Impact Statement Coos Bay-North Bend Water Board Water Supply Expansion Project US Army Corps of Engineers (CH2MHill authorship), 1999. Mike Gray, ODFW

MITIGATION

1. DESCRIBE THE MITIGATION TO BE PROVIDED: Restoration of rearing habitat on North Matson Creek Tributary. Specifically, the mitigation is designed to restore full salmon rearing habitat functionality to 3,992 ft of a tributary to Matson Creek by re-meandering for natural sinuosity, placing Large Woody Debris (LWD) in and along the restored tributary bank, encouraging pool development and re-establishing native riparian zone plant communities.

2. DISTANCE BETWEEN MITIGATION SITE(S) AND ARTIFICIAL OBSTRUCTION: 7 miles

3. OWNER (*if different than Applicant*): The Wetland Conservancy

CONTACT:	Ester Lev	TITLE:	Executive Director
ADDRESS:	4640 SW Macadam #50		
CITY:	Portland	STATE: OR	ZIP: 97239
PHONE:	503.227.0778	EMAIL:	estherlev@wetlandsconservancy.org

4. DATE THE MITIGATION IS SCHEDULED TO BE COMPLETED: October, 2015

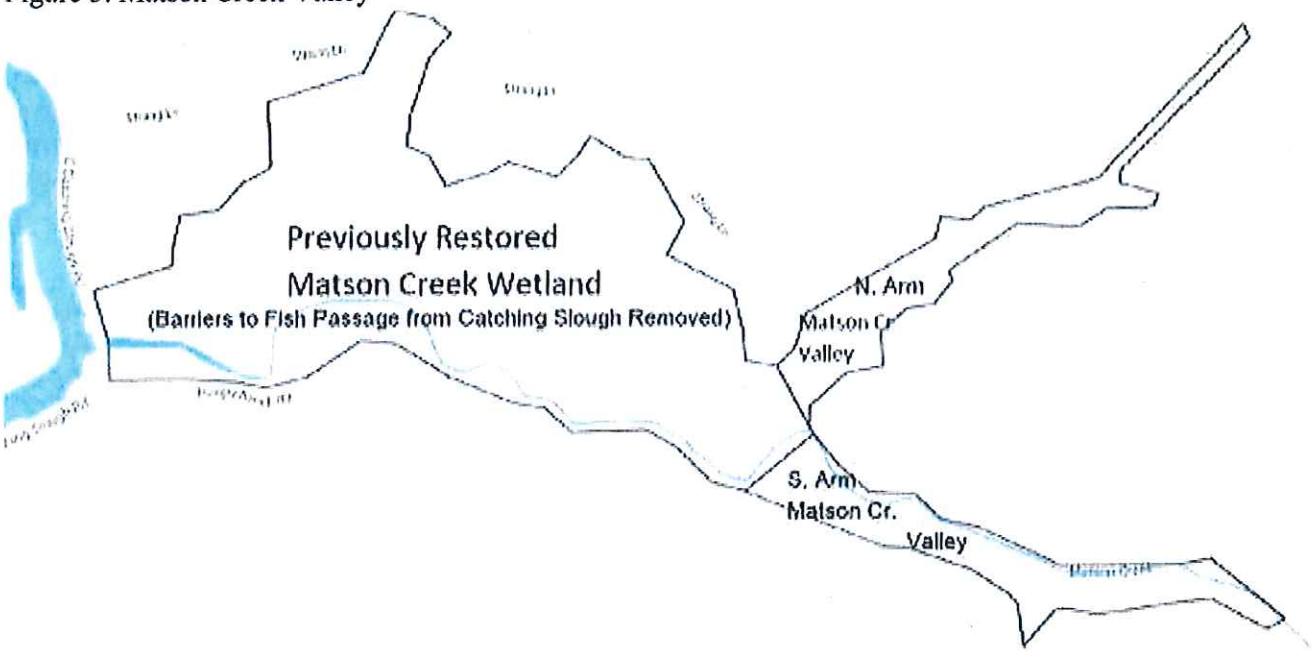
5. LOCATION

COUNTY:	Coos	
ROAD CROSSING (if applicable):	NA	
RIVER/STREAM:	Matson Creek	
TRIBUTARY OF:	Catching Slough Sub-Basin	
BASIN:	South Coast	
COORDINATES[a]:	Longitude: 43.306518, °W	Latitude: -124.130759°N

6. STREAM DESCRIPTION

The mitigation site is located in the Catching Slough Sub-Basin, approximately 7 miles south east of the AO. (Figure 3) The Catching Slough Sub-Basin is a stream and slough system that was historically "sinuous and marshy and provided highly productive rearing areas for juvenile salmon including coho." (CWA, 2009) The North Fork Matson Creek runs through open pasture lands amidst a wide, active floodplain and adjacent to forest uplands. The North Fork has been channelized and moved to the south side of the valley which has created conditions for pasture grass versus wet meadow species. Riparian vegetation includes either salmon berry and alders or sedges, perennial grasses and ferns depending on the reach.

Figure 3: Matson Creek Valley



6A. BARRIER TABLE (*please provide the following information for barriers, which will help determine the benefit of the Mitigation site; indicate measurement units if applicable*):

	NORTH ARM MATSON CREEK			
Locations	3	C/N	2	1
Type				
Length				
Distance		3,992 ft		
Level				

PLEASE PROVIDE ADDITIONAL DESCRIPTIONS FOR THOSE BARRIERS INCLUDED IN THE BARRIER TABLE OR FOR OTHER BARRIERS AFFECTING NATIVE MIGRATORY FISH MOVEMENT TO OR FROM THE MITIGATION: The applicant removed previously present barriers to fish passage in an earlier wetland mitigation project at this location through the replacement of undersized culverts and a tide gate with a bridge, thus simultaneously reintroducing natural tidal function to the valley. No fish passage credits were attributed to this action.

6B. SUMMARY TABLE (*please provide the following information relative to the Mitigation, which will help determine its benefit*):

	NORTH ARM MATSON CREEK
NMF Species Present Currently	Unidentified Salmonid Fry
NMF Species Present Historically	Coho, Chinook, Winter Steelhead, Chum and Sea-Run Cutthroat
Habitat Quality	Poor
Flows	1,470 cfs (2 year storm)
Water Quality	Good
Water Right Availability	no
Land Use/Zoning	Conservation easement (Matson Creek Valley) and Forestry (Adjacent Uplands)

PLEASE PROVIDE ADDITIONAL DETAILS REGARDING THE INFORMATION PROVIDED IN THE SUMMARY TABLE (*such as species listed under the state or federal ESA and descriptions of the stream channel and riparian habitat*): The proposed Matson Creek mitigation actions would take place in the Catching Slough sub-basin in which Coho, Chinook and Winter Steelhead have been documented in addition to Chum Salmon and Sea-run Cutthroat. Coho and

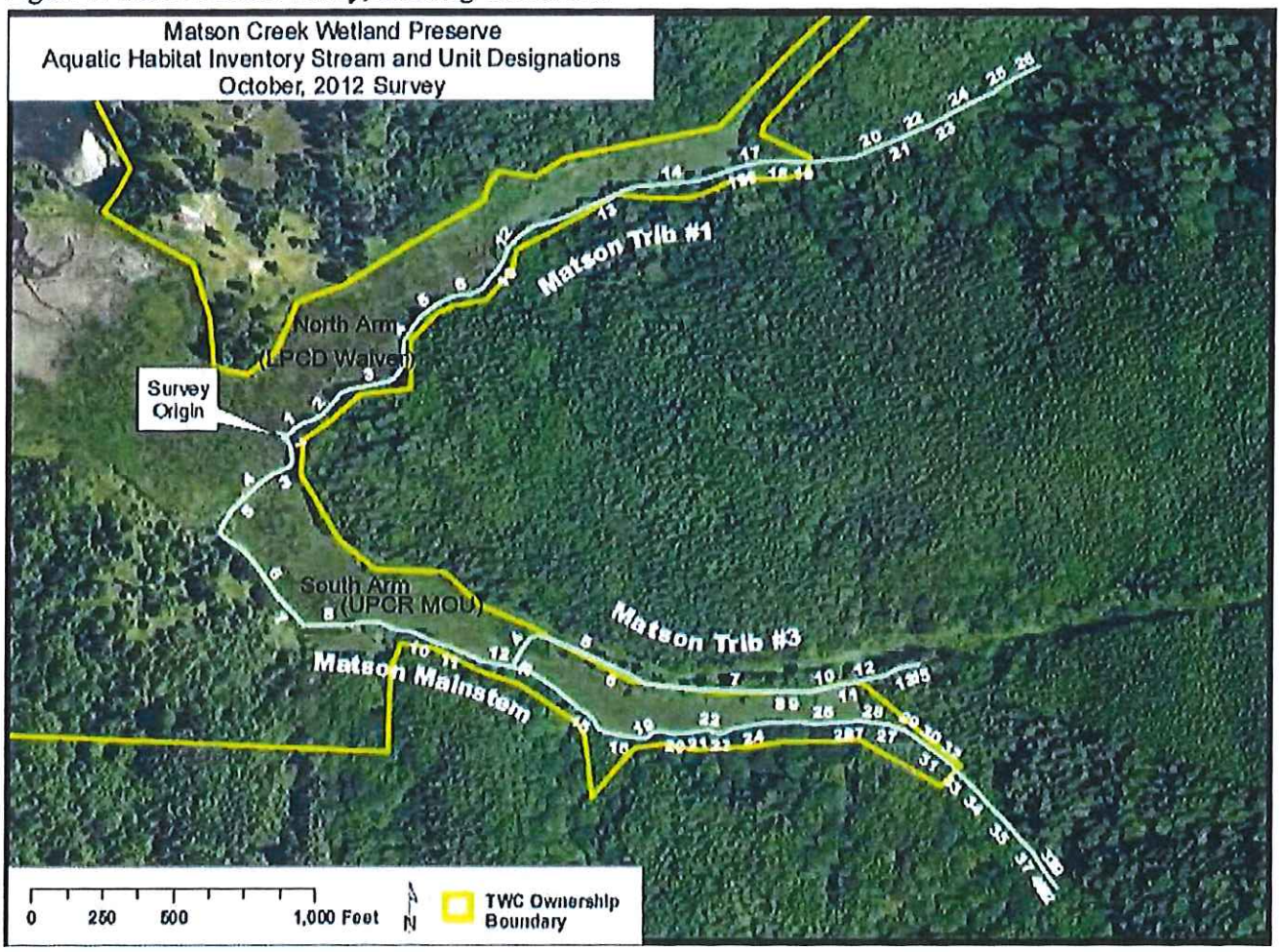
Steelhead have each been observed in Matson Creek. "Anadromous fish are distributed widely throughout the sub-basin due to the highly complex, low-gradient stream systems." A wide variety of amphibian and non-salmonid fish species are also observed in the Catching Slough subbasin. These species include, but are not limited to cottids, brook lamprey, Pacific lamprey, stickleback, Pacific giant salamander, Dunn's salamander, roughskin newt, tailed frogs, red-legged frog, Pacific treefrog, and foothill yellow-legged frog. There are over 58.64 kilometers of summer and winter rearing habitat throughout the sub-basin, with almost 29 kilometers of that area used for spawning during the winter months in mainstem reaches and adjacent tributaries. Fish use of the named tributaries end at high gradient segments where both boulders and or bedrock are present. (CWA, 2009)

Winter habitat remains the most limiting habitat type in the Catching Slough sub-basin. Winter coho habitat is most commonly characterized by pools that provide refuge from high winter flows - especially secondary, off-channel and beaver pools. The proposed length of North Arm Matson Creek runs through open pasture lands amidst a wide, active floodplain and adjacent to forest uplands. Limiting factors for coho were identified by CWA in their 2009 assessment of the sub-basin as shade deficits, lack of large woody debris, undesirable pool depth and frequency. The publication further states that; "These unconstrained single channels would have the potential to improve coho rearing habitat if allowed to meander across the relatively wide valley floors and improving channel-floodplain connectivity." (CWA, 2009)

Photo 4: Looking NE up the North Arm Matson Valley

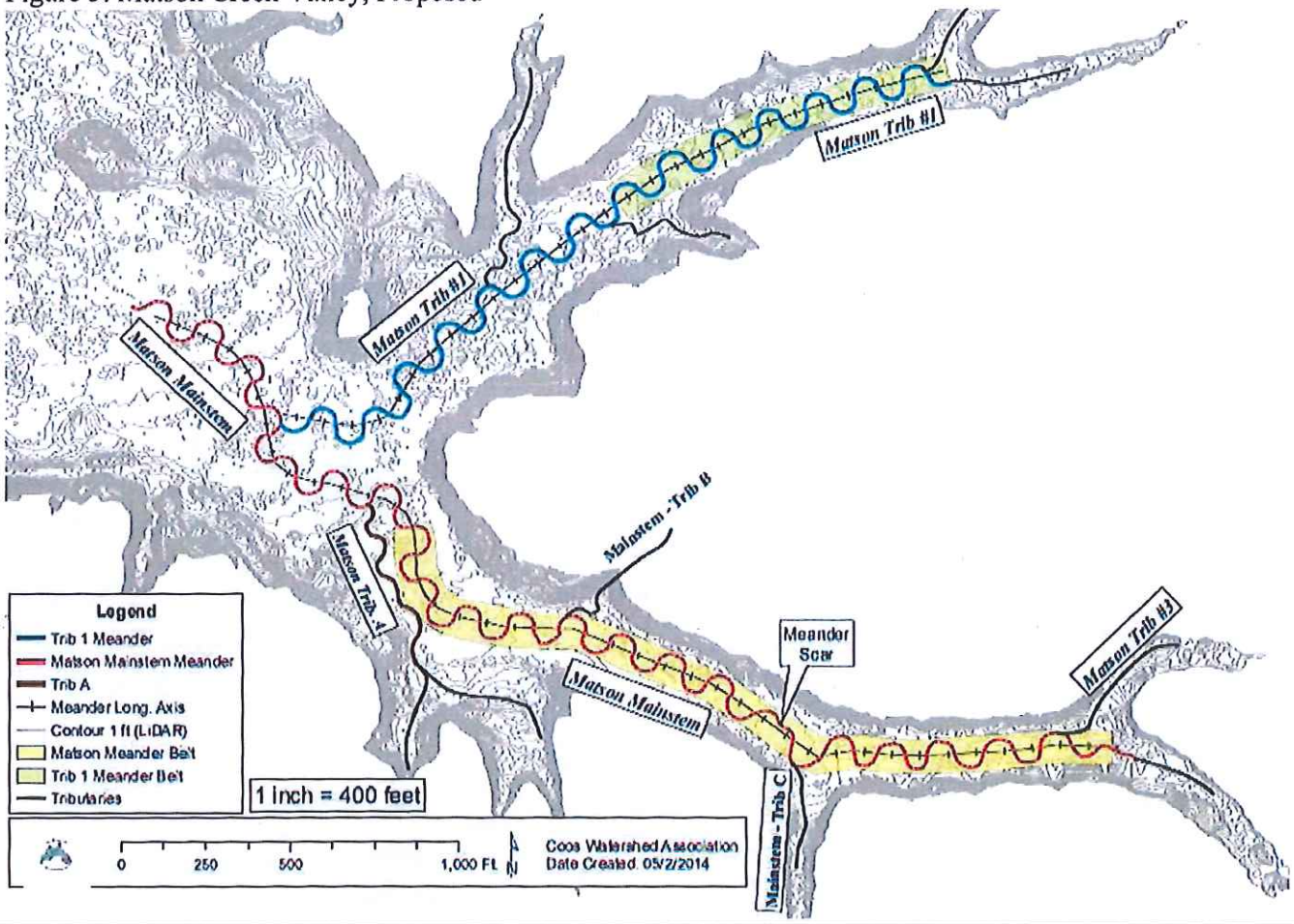
The proposed mitigation site for waiver of fish passage at LPCD would occur on Matson Tributary #1, located in the North Fork Matson Creek valley which encompasses approximately 9 acres of wetland and pasture. (Figure 4, Photo 4) The wetland area can be found near the confluence of the North and South Forks of Matson Creek. Vegetation here consists of obligate wetland species including cattail, slough sedge, small-fruited bulrush, and burreed. The upper valley consists of the typical agriculturally modified riparian area. The North Fork has been channelized and moved to the south side of the valley which has created conditions for pasture grass versus wet meadow species. Vegetation on the valley side of the riparian buffer has been cleared while vegetation on the upland side of the creek consists of red alder, salmonberry, red elderberry, big leaf maple, Sitka spruce, and myrtlewood. The forested northern edge of the valley consists of mixed conifers species (Douglas fir, Sitka spruce, Western red cedar, Western hemlock) interspersed with myrtlewood, big leaf maple, and madrone. The main threats to native plants in this valley are from encroaching blackberry and competition with the established prairie grass. Fortunately, reed canary grass, a highly invasive grass, is found in limited quantities in this valley. Active establishment of native riparian and wetland vegetation is necessary for the development of a diverse plant community to outcompete invasive species. (CWA, 2014)

Figure 4: Matson Creek Valley, Existing Conditions



The proposed restoration activities on the North Fork of Matson Creek address winter habitat limiting factors as well as summer shading potential. This will be accomplished through remeandering of the channelized creek bed, placement of large woody debris and a vegetation planting plan in the riparian zone. 30% design documents are included as an attachment to this application. (Figure 5)

Figure 5: Matson Creek Valley, Proposed



6C. PROVIDE THE SOURCE FOR INFORMATION CONTAINED IN THE BARRIER AND SUMMARY TABLES: ODFW Protocol Aquatic Habitat Inventory surveys were completed by CWA crews trained in the protocol by ODFW, (CWA,2013) (attached), Surface water availability reporting, Oregon Department of Water Resources, Mitigation Design, Coos Watershed Association (attached), Catching Slough, Daniel's Creek and Heads of Tide Sub-basin Assessment and Restoration Opportunities (CWA, 2009)

7. DESCRIBE HOW THE MITIGATION RELATES TO ANY EXISTING FISH MANAGEMENT PLANS, INCLUDING THE OREGON PLAN: The mitigation supports the continued recovery of five of our native anadromous fish populations through the restoration of salmonid rearing habitat recently made accessible by the applicant through the removal of barriers to fish passage. This result is consistent with the mission of the Oregon Plan for Salmon and Watersheds. The mitigation was developed in collaboration with Coos Watershed Association and is in alignment with their findings documented in the 2008 publication "Catching Slough, Daniels Creek and Heads of Tide Sub-basin Assessment and Restoration Opportunities". The mitigation is designed to restore winter habitat and improve summer shading capacity in the North Fork Matson Creek valley. A separate, related, application for amendment to an existing MOU of FPW for UPCD has been simultaneously submitted

proposing mitigation in the South Fork Matson Creek Valley as replacement for Supplemental Releases currently being discharged into Pony Creek.

8. DESCRIBE ANY KNOWN RESTORATION OR LAND USE PLANS WHICH MIGHT HAVE AN IMPACT ON THE MITIGATION *(e.g., is the watershed included within an expanded Urban Growth Boundary or does a Local Comprehensive Plan limit future development in the watershed)*:

The location of the proposed replacement measure is in a rural setting within the Coos watershed and on the upper reaches of Matson Creek. Matson Creek was recently the subject of successful wetland mitigation actions accomplished by the Water Board that also resulted in measurable improvements to the functionality of that stream system through the replacement of collapsed and undersized culverts with a bridge, the release of natural tidal influences to the restored estuarine/palustrine wetlands, and the naturalization of the stream channel to approximate and encourage organic hydrology. While the applicants' actions were driven by wetland mitigation goals and no fish passage credits were associated with the project, the removal of barriers to fish passage across East Catching Slough Road has resulted in year round access to the 97 acre valley for Coho, Chinook, Winter Steelhead, Chum Salmon and Sea-run Cutthroat documented in Catching Slough.

Commensurate with this application for waiver of fish passage is a complimentary application for amendment of the existing MOU for UPCD to allow for the replacement of Supplemental Releases in Pony Creek with restoration of the South Fork Matson Creek. Additionally, the applicant and CWA are working with Oregon Department of State Lands (DSL) on the restoration of the wetlands through which each, the North and South Matson Creek tributaries, will meander. The resulting interplay of these three distinct restoration actions with those recently accomplished in Lower Matson Creek presents the opportunity for synergistic improvements to habitat for a wide diversity of species in a rich ecosystem.

The land is owned by the Wetland Conservancy and adjoined by forestry, agriculture and residential properties. The mitigation project is secure through a perpetual conservation easement.

9. IF THE MITIGATION ENTAILS PROVIDING PASSAGE AT AN EXISTING ARTIFICIAL BARRIER, WHAT IS THE EXPECTED DATE OF REPLACEMENT OR MAJOR REPAIR FOR THE STRUCTURE IF IT WERE NOT USED AS MITIGATION: na

10. DOES THE MITIGATION INCLUDE ANY ACTIVITY THAT IS A REQUIREMENT OR CONDITION OF ANY OTHER AGREEMENT, LAW, PERMIT, OR AUTHORIZATION *(if "Yes", describe)*: no

11. DESCRIBE HOW THE MITIGATION WILL BE FUNDED *(include a cost estimate, funding sources, and whether funds are currently secured)*: The project constructed cost estimate is $136,000 of which full funding was approved by the applicant Board of Directors.

12. DESCRIBE HOW THE MITIGATION WILL BE EVALUATED, MONITORED, AND MAINTAINED: Once completed, the mitigation will be subjected to an "as built" survey to document and verify resulting stream length, placement and volumes of LWD, frequency and depth of pools and the viability of reintroduced native plantings. Success criteria will be based on the completion of prescribed restoration measures. Biological monitoring for salmonid presence will be completed at years three, six and nine. The mitigation is designed as a re-naturalization and will not require physical maintenance. The land is held by the Wetland Conservancy and a conservation easement is on file to maintain the use of the site into perpetuity.

MAP(S)

- *Please attach one or more maps indicating the Artificial Obstruction, Mitigation, the streams on which they are located, and other barriers in those streams. A 7.5 minute USGS quad map is sufficient.*

☒ -- Map(s) included

PHOTOS

- *Please include photographs of the following (.JPG files are preferred):*

☒ -- Artificial Obstruction
☒ -- Mitigation Site(s)
☒ -- up- and downstream habitat at the Artificial Obstruction and Mitigation Site(s)
☒ -- other barriers up- and downstream of the Artificial Obstruction and Mitigation Site(s)

References

Oregon Department of Fish and Wildlife (ODFW), 2000. Aquatic Inventory Survey for Lower Pony Creek Watershed. Corvallis.

Oregon Department of Fish and Wildlife (ODFW), 2011. Mart Davis Proposal – Analysis of Benefits. Coos Bay.

U.S. Army Corps of Engineers (USACE), 1998. Biological Assessment: Coos Bay-North Bend Water Board Water Supply Expansion Project. Action I.D. 94-010. Portland District.

Lower Pony Creek Watershed Committee (LPCWC), 2001. Lower Pony Creek Watershed Assessment and Potential Action Plan. Prepared for LPCOC by Satre Assoc. PC, Eugene; Earth Designs Consultants, Inc., Corvallis; and Hart Crowser, Lake Oswego, OR.

Coos Watershed Association (CWA), 2009. Catching Slough, Daniel's Creek and Heads of Tide Sub-basin Assessment and Restoration Opportunities. Charleston OR.

Coos Watershed Association (CWA), 2013. Analysis of Mitigation Needs for the Elimination of Instream Flow Requirements in POiny Creek and Design of Proposed Compensatory Stream Features at the Matson Creek Wetland Preserve, Task 1 Summary Report. Charleston OR

Coos Watershed Association (CWA), 2014. Summary Report: Task2, "Determine the Benefits from Existing In-stream Flows. Charleston OR

Governor Atiyeh, 1986. Letter of approval for Lower Pony Creek Dam without fish passage. Salem OR

Section Three

Request for Amendment of MOU for Waiver of Fish Passage Upper Pony Creek Dam

REQUEST FOR AMENDMENT OF MOU FOR FISH PASSAGE AT UPCR

ORGANIZATION/APPLICANT: Coos Bay North Bend Water Board
CONTACT: Rob Schab TITLE: General Manager
ADDRESS: 2305 Ocean Blvd
CITY: Coos Bay STATE: OR ZIP: 97420
PHONE: 541.267.3128
E-MAIL ADDRESS: rob_schab@cbnbh2o.com

SIGNATURE: _____ DATE: 7-30-14

OWNER (*if different than Applicant*): Applicant

APPLICATION COMPLETED BY (*if different than Applicant*): Shannon Souza, PE
TITLE: Principal
ORGANIZATION: Sol Coast Consulting & Design, LLC
ADDRESS: 299 S Bayshore Drive
CITY: Coos Bay STATE: OR ZIP: 97420
PHONE: 541.266.0877
E-MAIL ADDRESS: Shannon@solcoast.com

SIGNATURE: _____ DATE: _____

Executive Summary

The Coos Bay North Bend Water Board ("Water Board") is currently engaged in a Memorandum of Understanding (MOU) with the Oregon Department of Fish and Wildlife (ODFW) requiring, as partial mitigation for fish passage at Upper Pony Creek Dam (UPCD), flow releases into Pony Creek as follows:

- Continuous Releases, year round, in the amount of 1 c.f.s.
- Supplemental Releases in the amounts of; 1 c.f.s. in November, 2 c.f.s. in December, 3 c.f.s. in January, 3 c.f.s. in February, 2 c.f.s. in March, 2 c.f.s in April and 1 c.f.s in May.

As described in the MOU, these Supplemental Releases are to be enabled by waters stored by the Water Board in Upper Pony Creek Reservoir (UPCR) under a storage water right secured by ODFW for fisheries enhancement. The Supplemental flows are to "be maintained annually to protect a minimal resident population of cutthroat trout."(ODFW/CBNBWB, 2004)

Changes in governing law, since the MOU was entered into in 1999, allow for the consideration of mitigation opportunities beyond the Pony Creek drainage. (Figure 1) The Water Board has established a value of the waters captured and conveyed through the UPCR and LPCR and then released in the form of Supplemental Releases to be equal to the annual storage of an additional 270 million gallons of water, which reduces the projected life of the reservoir by approximately 4 years. More importantly, this stored water is currently not available for municipal consumption during drought years. The additional stored water would extend community use by approximately 55 days without pumping water from the Joe Ney Reservoir. The Water Board and district ODFW staff have also identified the potential for a greater benefit to the targeted, and additional, NMF species through habitat restoration at Matson Creek.

The Water Board is hereby proposing:

1. Replacement of the Supplemental Releases component with an alternate mitigation plan located on the South Fork Matson Creek.
2. The elimination of the Supplemental Releases would additionally result in the abandonment of the ODFW application for storage water rights on UPCR intended to meet those release requirements and the potential for additional waters to be pumped from the Joe Ney Reservoir to fulfill that storage right.
3. Relinquishing the contribution of tributary confluence flows (namely from AAA fork), currently allowed by the MOU, to meet the Continuous Release by relocating the flow monitoring up stream to the Lower Pony Creek Dam (LPCD).

The request for amendment supports the Continuous Releases of 1 cfs.

LOCATION OF EXISTING ARTIFICIAL OBSTRUCTION

COUNTY:	Coos	
ROAD CROSSING (if applicable):	NA	
RIVER/STREAM:	Pony Creek	
TRIBUTARY OF:	Coos Bay	
BASIN:	South Coast	
COORDINATES:	Longitude: 43.379868, °W	Latitude: -124.241687°N

Figure 1: Project Location Map

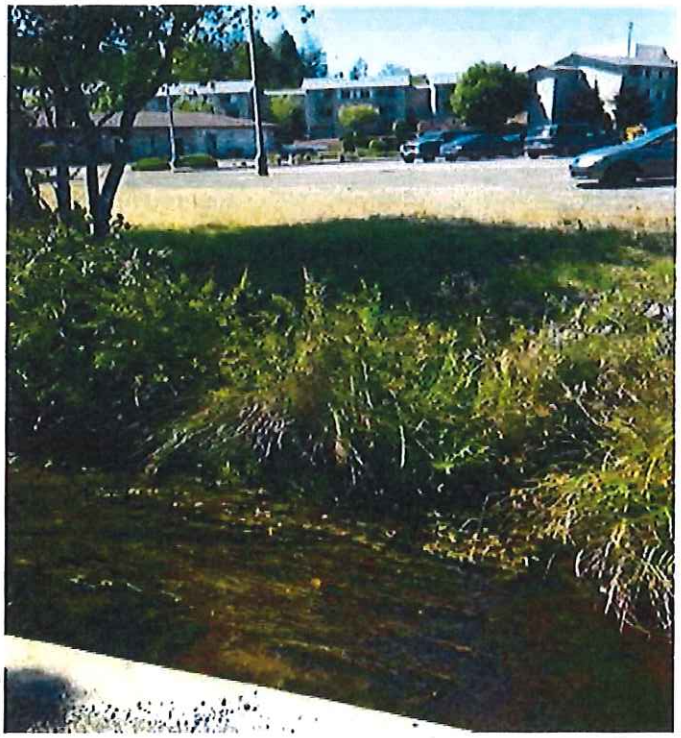
STREAM DESCRIPTION

Pony Creek, below Lower Pony Creek Dam (LPCD), is a highly urbanized stream in which collaborative habitat restoration efforts (between the Water Board and ODFW) have been exhausted. Pony Creek is subject to limitations on the life supporting functionality beyond the impacts of the LPCD barrier, namely; urban encroachment, high temperatures and poor water quality.

The reach of lower Pony Creek affected by this proposal extends from LPCD to Newmark Avenue and is approximately 0.7 miles (3,696 ft.) long. Below Newmark Avenue, the basin is tidally influenced with occasional tidal/storm surge events extending above Newmark. The reach runs through a combination of residential and urban/commercial landscapes with significant development of buildings and impermeable surfaces built to the stream's edge in many areas (Photos 1-2, Figure 2).

Photo 1: Flow Monitoring Station on Lower Pony Creek near Ocean Blvd.

Photo 2: Lower Pony Creek near Newmark Ave.



"The stream substrate is dominated (77 to 90%+) by silt, organics, and sand (ODFW Aquatic Inventory Survey, 2000), with extremely limited areas of sandstone-based gravels. Gravel composition and size in lower Pony Creek is typical of many near-coast tributaries in Coos County, having limited use of larger (non-cutthroat) anadromous salmonids (ODFW 2000; USACE 1998) The only area noted with gravels suitable for anadromous fish were those gravels placed by the Water Board for mitigation. Riparian vegetation was primarily perennials and shrubs below the K-Mart Fork, with small conifers and hardwoods upstream of this point. Wood volume was low, in the range of 0.2 to 2.2 m^3 per 100 m of stream. The Water Board placed LWD for mitigation in the basin, most of which remain. Three LWD placements in the "AAA Fork" had to be removed due to a change of mind by the cooperating landowner."

The existence of the dams upstream precludes the recruitment of gravel to lower Pony Creek. An assessment and action plan for the lower Pony Creek watershed identified the geology of this basin as primarily sandy loams and clay formed by sedimentary marine terraces (LPCWC, 2001). The assessment also identified summer water temperatures "stressful" to fish and aquatic life. The Aquatic Inventory Survey (ODFW 2000) identified areas of "orange slime", "oil in the water, and "petrol odors", likely associated with residential and commercial development, and collection/transport from impermeable surfaces such as roads, parking lots, and building roofs." (ODFW, 2011)

Figure 2: Lower Pony Creek

SUMMARY OF REACHES AFFECTED BY EXISTING MITIGATION:

	PONY CREEK
NMF Species Present Currently	Cutthroat Trout
NMF Species Present Historically	Coho, Steelhead, Sea-run Cutthroat
Habitat Quality	poor
Flows	1-31 cfs
Water Quality	poor
Water Right Availability	na
Land Use/Zoning	urban and residential

Recent surveys have observed Cutthroat Trout as the only salmonid species in the freshwater portion of the Pony Creek Watershed. A resident population of cutthroat exists in the watershed above Merritt (Lower Pony) and Upper Pony dams; the sea-run life cycle of cutthroat can be expressed in the watershed below the dams. Habitat potential exists in the Pony Creek Watershed below the dams for nongame fish species including Cottids (Sculpins), Three-spine Stickleback, and Lampreys (Pacific and Western Brook).

No recent evidence of anadromous salmonid presence exists, although it is likely that Coho and Steelhead inhabited the basin before significant urban development and the dams existed. Attempts to colonize the Pony Creek Watershed with Coho and Steelhead through the STEP Program were unsuccessful, likely due to a lack of suitable spawning habitat. (Gray, ODFW, 2011) (Photos 1-2)

DESCRIPTION OF THE MITIGATION TO BE PROVIDED

The proposed mitigation calls for the restoration of rearing and wintering habitat on mainstem and Tributary #3 located in the South Arm of Matson Creek Valley. Specifically, the mitigation is designed to restore full salmon rearing habitat functionality to 6,318 ft of channelized ditch by remeandering for natural sinuosity, placing Large Woody Debris (LWD) in and along the restored tributary bank, encouraging pool development and re-establishing native riparian zone plant communities.

The mitigation site is located approximately 7.5 miles southeast of the UPCD and is a tributary to Catching Slough and Coos Bay.

OWNER:	The Wetland Conservancy		
CONTACT:	Ester Lev	TITLE:	Executive Director
ADDRESS:	4640 SW Macadam #50		
CITY:	Portland	STATE: OR	ZIP: 97239
PHONE:	503.227.0778	EMAIL:	estherlev@wetlandsconservancy.org

DATE THE MITIGATION IS SCHEDULED TO BE COMPLETED: October, 2015

LOCATION

COUNTY:	Coos	
ROAD CROSSING:	NA	
RIVER/STREAM:	Matson Creek	
TRIBUTARY OF:	Catching Slough Sub-Basin	
BASIN:	South Coast	
COORDINATES[a]:	Longitude: 43.306518, °W	Latitude: -124.130759°N

STREAM DESCRIPTION

The mitigation site is located in the Catching Slough Sub-Basin, approximately 7 miles south east of the AO. (Figure 1) The Catching Slough Sub-Basin is a stream and slough system that was historically "sinuous and marshy and provided highly productive rearing areas for juvenile

salmon including coho." (CWA, 2009) The South Arm Matson Creek Valley is typical of agriculturally modified stream-wet meadow systems in coastal Oregon. The stream was historically filled and flows redirected to channelized ditches located on either side of the valley in order to accommodate agricultural pasture lands. As such, the resulting channels have limited riparian vegetation.

The proposed mitigation site resides within the Matson Creek valley and is contiguous to Mainstem Matson Creek to which full natural tidal hydrology was restored by the Water Board pursuant of wetland mitigation credits. A simultaneous application for Waiver of Fish Passage at LPCD has been submitted for department review proposing a complimentary mitigation of the North Fork Matson Creek (Figure 3).

Figure 3: Proposed Mitigation Location

BARRIER TABLE

	DOWNSTREAM					UPSTREAM			
Locations	3	C/N	2	1	M	1	2	E	*example*
Type									D
Length									8 ft
Distance		6,318 ft							1,700 ft
Level									1

LOCATIONS: M = the Mitigation site

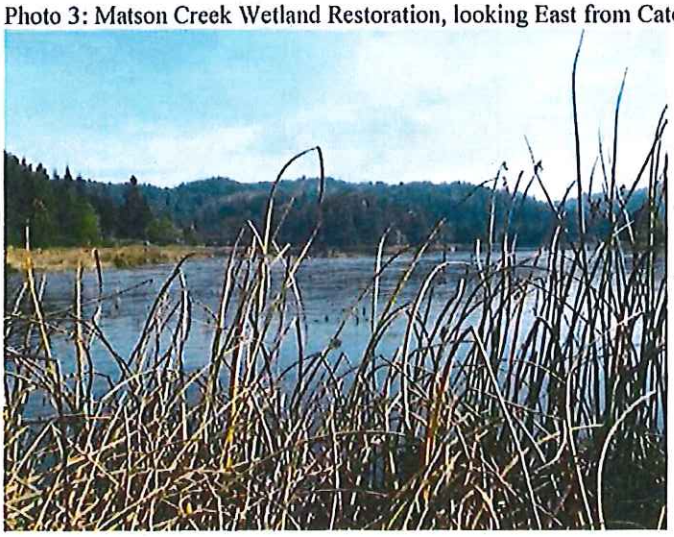
ADDITIONAL DESCRIPTIONS FOR THOSE BARRIERS INCLUDED IN THE BARRIER TABLE OR FOR OTHER BARRIERS AFFECTING NATIVE MIGRATORY FISH MOVEMENT TO OR FROM THE MITIGATION: The applicant removed previously present barriers to fish passage in an earlier wetland mitigation project at this location through the replacement of undersized culverts with a bridge. No fish passage credits were attributed to this action.

SUMMARY TABLE:

	SOUTH FORK MATSON TRIBUTARIES
NMF Species Present Currently	Unidentified Salmonid Fry
NMF Species Present Historically	Coho, Chinook, Winter Steelhead, Chum and Sea-Run Cutthroat
Habitat Quality	Poor
Flows	1,470 cfs (2 year storm)
Water Quality	Good
Water Right Availability	no
Land Use/Zoning	Conservation easement (Matson Creek) and Forestry (adjacent uplands)

PLEASE PROVIDE ADDITIONAL DETAILS REGARDING THE INFORMATION PROVIDED IN THE SUMMARY TABLE (*such as species listed under the state or federal ESA and descriptions of the stream channel and riparian habitat*): The proposed Matson Creek mitigation actions would take place in the Catching Slough sub-basin in which Coho, chinook and winter steelhead have been documented in addition to Chum salmon and Sea-run Cutthroat. Coho and Steelhead have each been observed in Matson Creek. "Anadromous fish are distributed widely throughout the sub-basin due to the highly complex, low-gradient stream systems." A wide variety of amphibian and non-salmonid fish species are also observed in the Catching Slough subbasin. These species include, but are not limited to Cottids, Brook Lamprey, Pacific Lamprey, Stickleback, Pacific giant salamander, Dunn's salamander, roughskin newt, tailed frogs, red-legged frog, Pacific treefrog, and foothill yellow-legged frog. There are over 58.64 kilometers of summer and winter rearing habitat throughout the sub-basin, with almost 29 kilometers of that area used for spawning during the winter months in mainstem reaches and adjacent tributaries. Fish use of the named tributaries end at high gradient segments where both boulders and or bedrock are present. (CWA, 2009)

Photo 3: Matson Creek Wetland Restoration, looking East from Catching Slough



Winter habitat remains the most limiting habitat type in the Catching Slough sub-basin. Winter coho habitat is most commonly characterized by pools that provide refuge from high winter flows - especially secondary, off-channel and beaver pools. The proposed length of South Fork Matson Creek runs through open pasture lands amidst a wide, active floodplain and adjacent to forest uplands. Limiting factors for Coho were identified by CWA in their 2008 assessment of the sub-basin as shade deficits, lack of large woody debris, undesirable pool depth and frequency. The publication further states that; "These unconstrained single channels would have the potential to improve Coho rearing habitat if allowed to meander across the relatively wide valley floors and improving channel-floodplain connectivity." (CWA, 2009)

Photo 4: South Arm Matson Creek Valley, looking NW

This 16 acre valley, containing the South Fork Matson Creek Tributaries (Figure 4), consists mainly of pasture grasses and non-native herbaceous species (e.g., creeping buttercup,birdsfoot trefoil), which have flourished with a lower water table due to channelization of the stream. Some large patches of native small-fruited bulrush (an obligate wetland species) can be found along the northern edges of the valley, but this is the majority of native species found throughout this valley. Along the creek, on the valley side of the riparian edge, little to no vegetation exists aside from pasture grass. Vegetation on the upland side of the creek consists of red alder, salmonberry, red elderberry, big leaf maple, Sitka spruce, and myrtlewood – typical riparian vegetation found in the Coos watershed. This vegetation will remain undisturbed during restoration implementation and will provide a seed source for recruitment of these species. The

forested northern edge of the valley consists of mixed conifer species (Douglas fir, Sitka spruce, Western red cedar, Western hemlock) interspersed with myrtlewood, big leaf maple, and madrone. The main threats to native plants in this valley are from encroaching blackberry and competition with the established prairie grass. Fortunately, reed canary grass, a highly invasive grass, is found in limited quantities in this valley. Active establishment of native riparian and wetland vegetation is necessary for the development of a diverse plant community to outcompete invasive species. (CWA, 2014)

Figure 4: Existing Conditions at Matson Creek Valley

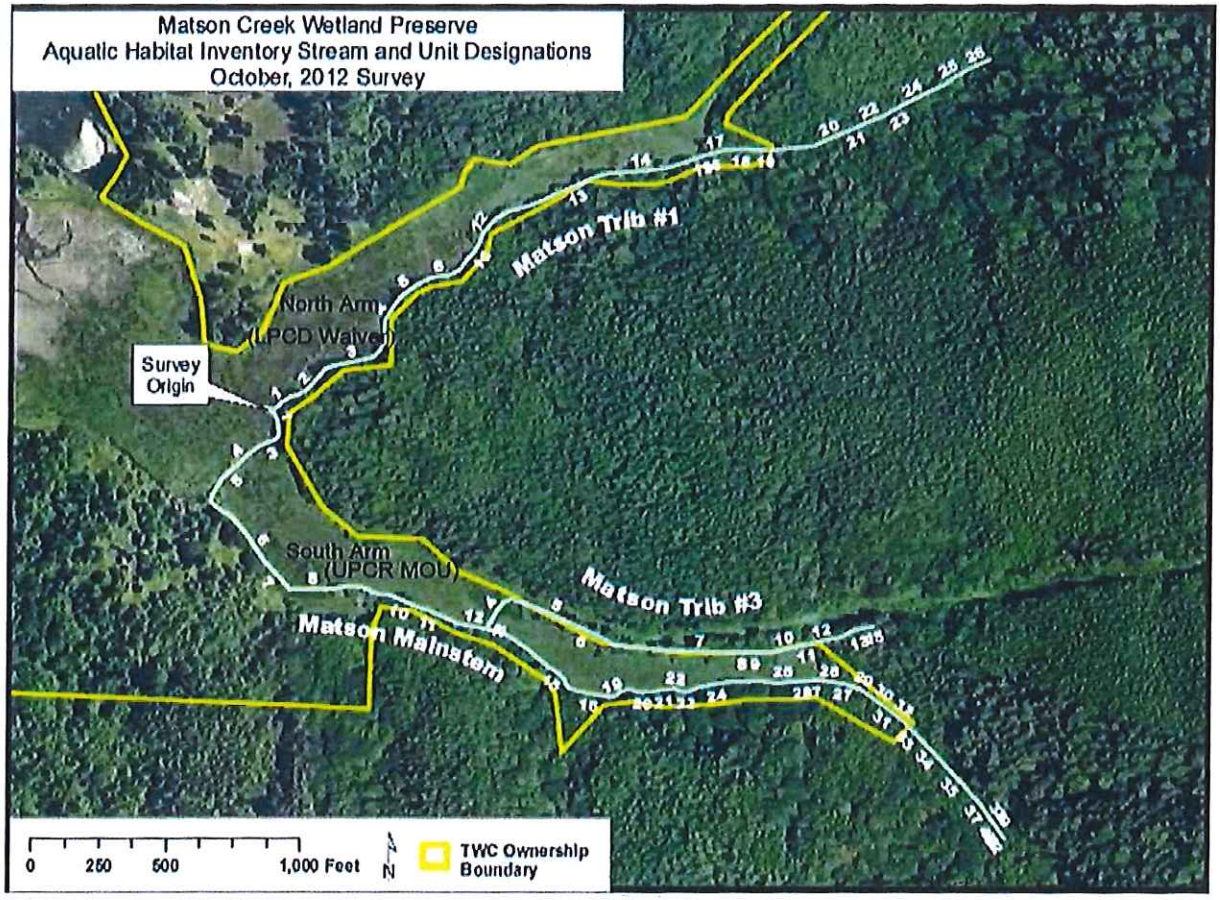
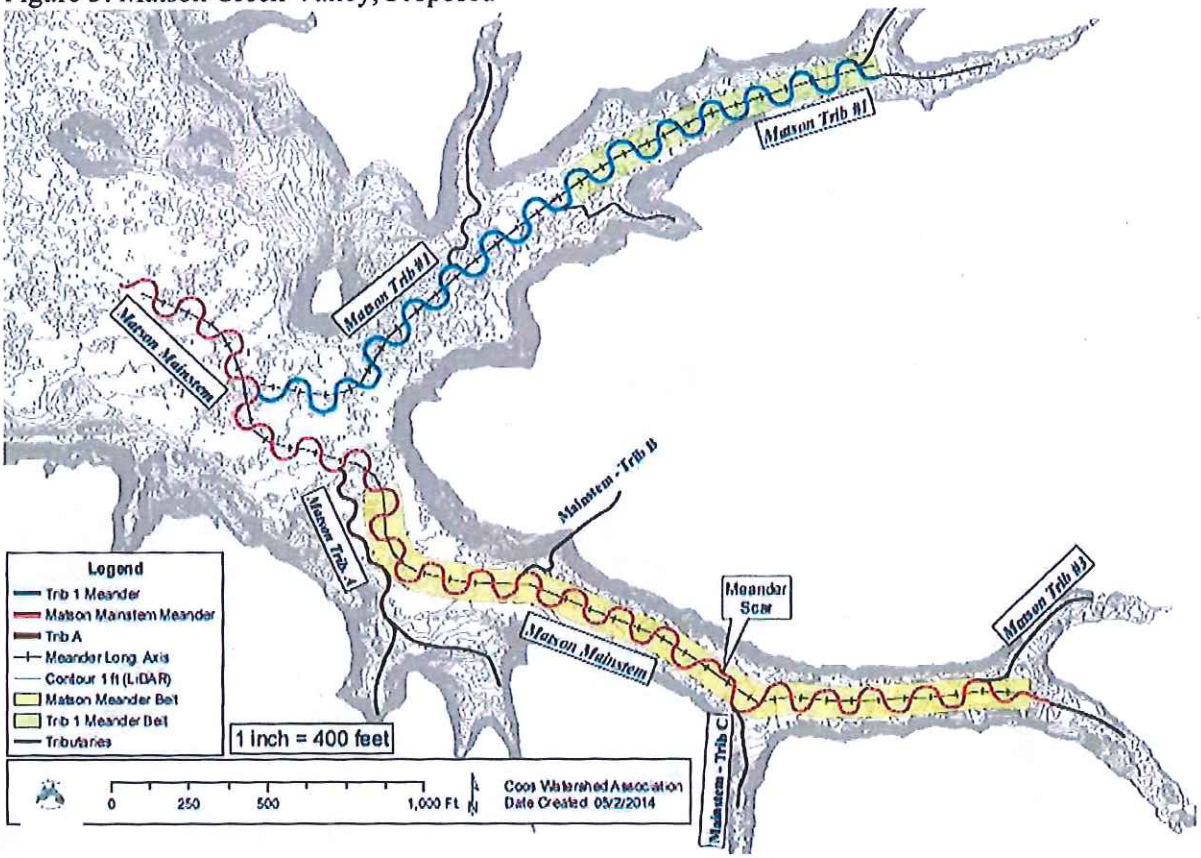


Figure 5: Matson Creek Valley, Proposed



The proposed restoration activities on the South Fork of Matson Creek address winter habitat limiting factors as well as summer shading potential. This will be accomplished through remeandering of the channelized creek bed, placement of large woody debris and a vegetation planting plan in the riparian zone. 30% design documents are included as an attachment to this application. (Figure 5)

RELATES OF ALTERNATE MITIGATION TO ANY EXISTING FISH MANAGEMENT PLANS, INCLUDING THE OREGON PLAN: The mitigation supports the continued recovery of five of our native anadromous fish populations through the restoration of salmonid rearing habitat recently made accessible by the applicant through the removal of barriers to fish passage. This result is consistent with the mission of the Oregon Plan for Salmon and Watersheds. The mitigation was developed in collaboration with Coos Watershed Association and is in alignment with their findings documented in the 2008 publication "Catching Slough, Daniel's Creek and Heads of Tide Sub-basin Assessment and Restoration Opportunities". The mitigation is designed to restore winter habitat and improve summer shading capacity in the South Fork Matson Creek valley.

KNOWN RESTORATION OR LAND USE PLANS WHICH MIGHT HAVE AN IMPACT ON THE MITIGATION: The location of the proposed replacement measure is in a rural setting within the Coos watershed and on the upper reaches of Matson Creek. Matson Creek was recently the subject of successful

wetland mitigation actions accomplished by the Water Board that also resulted in measurable improvements to the functionality of that stream system through the replacement of collapsed and undersized culverts with a bridge, the release of natural tidal influences to the restored estuarine/palustrine wetlands, and the naturalization of the stream channel to approximate and encourage organic hydrology. While the applicants actions were driven by wetland mitigation goals and no fish passage credits were associated with the project, the removal of barriers to fish passage across East Catching Slough Road has resulted in year round access to the 97 acre valley for Coho, Chinook, Winter Steelhead, Chum Salmon and Sea-run Cutthroat.

Commensurate with this request for amendment of the existing MOU for UPCR to allow for the replacement of Supplemental Releases in Pony Creek with restoration of the South Fork Matson Creek is a complimentary application for waiver of fish passage at Lower Pony Creek Dam. Additionally, the applicant and CWA are working with Oregon Department of State Lands (DSL) on the restoration of the wetlands through which each, the North and South Matson Creek tributaries, will meander. The resulting interplay of these three distinct restoration actions with those recently accomplished in Lower Matson Creek presents the opportunity for synergistic improvements to habitat for a wide diversity of species in a rich ecosystem.

As opposed to the urban/residential nature of Lower Pony Creek and the associated impacts to its stream functions and uncertain development future, the land is owned by The Wetland Conservancy (TWC) and adjoined by forestry, agriculture and residential properties. The mitigation project is supported by TWC and concurrent with and secured through a perpetual conservation easement.

MITIGATION FUNDING: The project constructed cost estimate is $204,000 of which full funding was approved by the applicant Board of Directors.

12. DESCRIBE HOW THE MITIGATION WILL BE EVALUATED, MONITORED, AND MAINTAINED: Once completed, the mitigation will be subjected to an "as built" survey to document and verify resulting stream length, placement and volumes of LWD, frequency and depth of pools and the viability of reintroduced native plantings. Success criteria will be based on the completion of prescribed restoration measures. Biological monitoring for salmonid presence will be completed at years three, six and nine. The mitigation is designed as a re-naturalization and will not require physical maintenance. The land is held by the Wetland Conservancy and a conservation easement is on file to maintain the use of the site into perpetuity.

Oregon Department of Fish and Wildlife (ODFW), 2000. Aquatic Inventory Survey for Lower Pony Creek Watershed. Corvallis.

Oregon Department of Fish and Wildlife (ODFW), 2011. Mart Davis Proposal – Analysis of Benefits. Coos Bay.

U.S. Army Corps of Engineers (USACE), 1998. Biological Assessment: Coos Bay-North Bend Water Board Water Supply Expansion Project. Action I.D. 94-010. Portland District.

Lower Pony Creek Watershed Committee (LPCWC), 2001. Lower Pony Creek Watershed Assessment and Potential Action Plan. Prepared for LPCOC by Satre Assoc. PC, Eugene; Earth Designs Consultants, Inc., Corvallis; and Hart Crowser, Lake Oswego, OR.

Coos Watershed Association (CWA), 2009. Catching Slough, Daniel's Creek and Heads of Tide Sub-basin Assessment and Restoration Opportunities. Charleston OR.

Coos Watershed Association (CWA), 2013. Analysis of Mitigation Needs for the Elimination of Instream Flow Requirements in POiny Creek and Design of Proposed Compensatory Stream Features at the Matson Creek Wetland Preserve, Task I Summary Report. Charleston OR

Coos Watershed Association (CWA), 2014. Summary Report: Task2, "Determine the Benefits from Existing In-stream Flows. Charleston OR

Section Four

Proposed Mitigation at Matson Creek
30% Design

Coos Watershed Association
P.O. Box 5860
Charleston, OR 97420
(541) 888-5922
(Fax) 888-6111
E-mail: jsouder@cooswatershed.org

TO: Rob Schab, Executive Director, Coos Bay/North Bend Water Board

FROM: Jon Souder, Executive Director, Coos Watershed Association

SUBJECT: Pony Creek In-stream Flow Mitigation at Matson Creek – 30% Designs

Background. The Coos Bay/North Bend Water Board (Water Board) has Oregon Department of Fish & Wildlife (ODFW) fish passage mitigation requirements resulting from its Pony Creek reservoir projects. One element of the mitigation package is to provide minimum in-stream flows from reservoir releases year round, with additional releases required during the non-summer months in Pony Creek. The Water Board proposes to replace portions of the required releases in Pony Creek with stream habitat improvements on Matson Creek in the vicinity of Sumner, Oregon. The Water Board has contracted with the Coos Watershed Association (CoosWA) to conduct analyses needed to quantify the replacement values and to design a mitigation plan to provide these values at the Matson Creek Wetland Preserve.

The Matson Creek streams include the mainstem in the South Arm of the valley, a short tributary to this stream (called Tributary #3) that drains an adjacent valley, and Tributary #1 that flows through the North Arm of the valley. For the proposed re-meandering, the Matson Creek mainstem and Tributary #3 are combined into a single channel at the upper end (see Figure 1). There were ODFW-protocol aquatic habitat inventories conducted to determine the existing conditions in these streams; this data was provided to the Water Board in previous reports. This report provides preliminary designs for the re-meandering of the two Matson Creek channels, approximating 30% of what is needed for final construction drawings. These 30% designs are intended to allow the Water Board and ODFW to agree upon a mitigation approach and determine the degree of equivalency between mitigation needs and Matson Creek mitigation benefits.

Proposed Mitigation. The proposed mitigation at Matson Creek will re-meander the existing incised channels to increase their length, decrease their gradient, and improve wood loading. The re-meandered channel will be within a broader meander belt in the upper reaches to better reconnect with its floodplain and allow for the establishment of wetland vegetation (see Figure 1). In the lower areas that are flatter and already have wetland vegetation, the channel will only be re-meandered. Summary characteristics for these new channels are shown in Table 1, with both English and metric units provided. Figure 2 shows a representative cross-section of the proposed channel.

A significant component of the mitigation will be placement of large wood and installation of logjam structures within the re-meandered stream and the adjacent floodplain (see Figure 3). Individual pieces will be placed in the re-meandered stream as either sill logs (embedded in the substrate) or underscour logs (placed in the bank to intercept high flows)(see Figure 4). The purpose of the sill

Table 1. Channel characteristics for the re-meandered Matson streams.

Attribute	English	Metric
Active Channel		
Matson Mainstem		
Average Width (ft./m)	13	4.0
Average Height (ft./m)	2.1	0.6
Channel Length (ft./m)	5,708	1,740
Channel Area (ac./ha.)	1.70	0.69
Axis Length (ft./m)	3,473	1,059
Sinuosity Ratio	1.64	1.64
Tributary #1		
Average Width (ft./m)	11	3.4
Average Height (ft./m)	1.75	0.5
Channel Length (ft./m)	3,706	1130
Channel Area (ac./ha.)	0.94	0.38
Axis Length (ft./m)	2,317	706
Sinuosity Ratio	1.60	1.60
Meander Belt (Floodprone)		
Matson Mainstem		
Average Width (ft./m)	109.5	33.4
Axis Length (ft./m)	2,369	722
Belt Area (ac./ha.)	5.96	2.41
Channel Length (ft./m)	3,894	1,187
Tributary #1		
Average Width (ft./m)	103.7	31.6
Axis Length (ft./m)	1,068	325.5
Belt Area (ac./ha.)	2.54	0.74
Channel Length (ft./m)	1,708	521

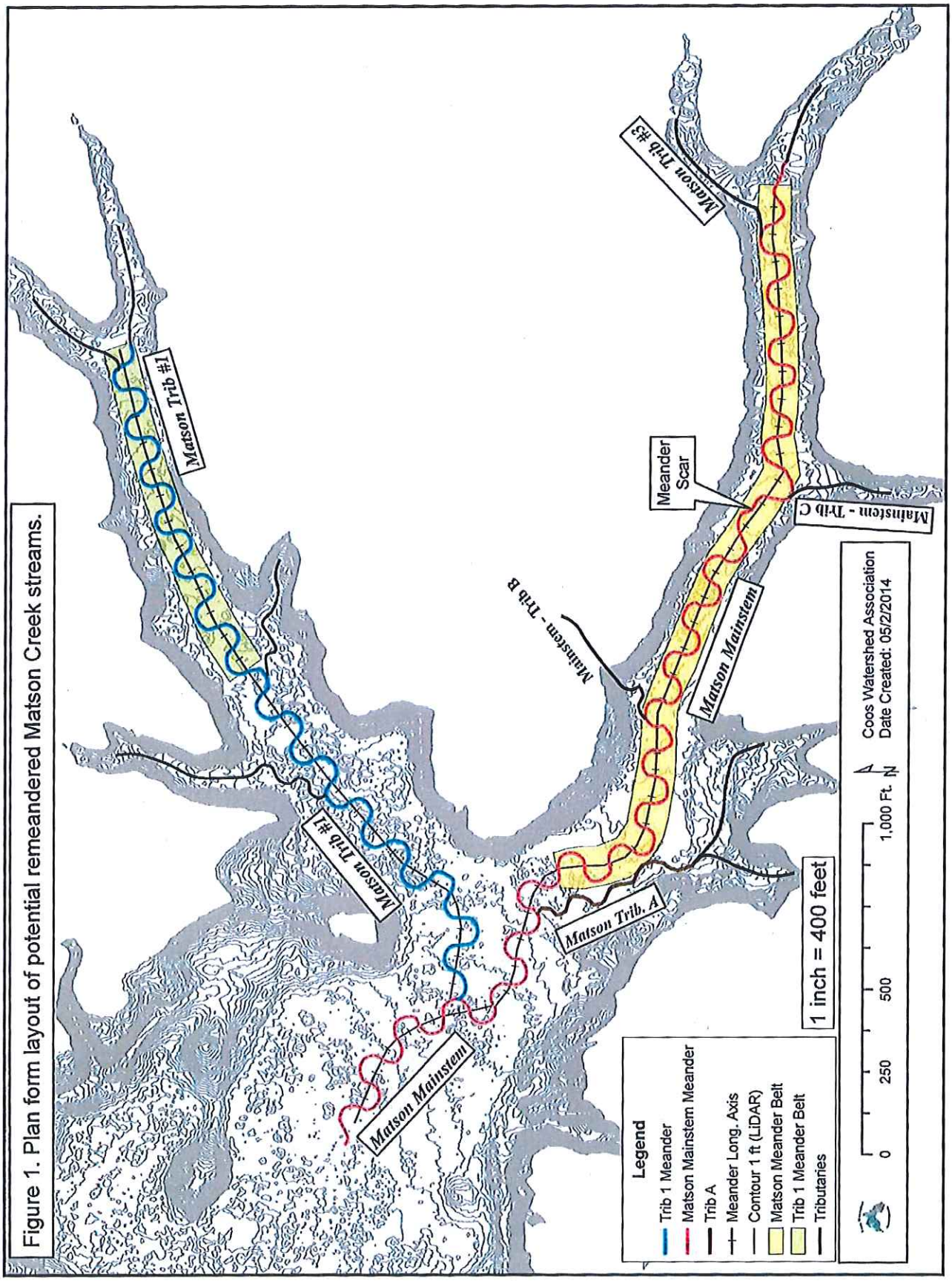


Figure 1. Plan form layout of potential remeandered Matson Creek streams.

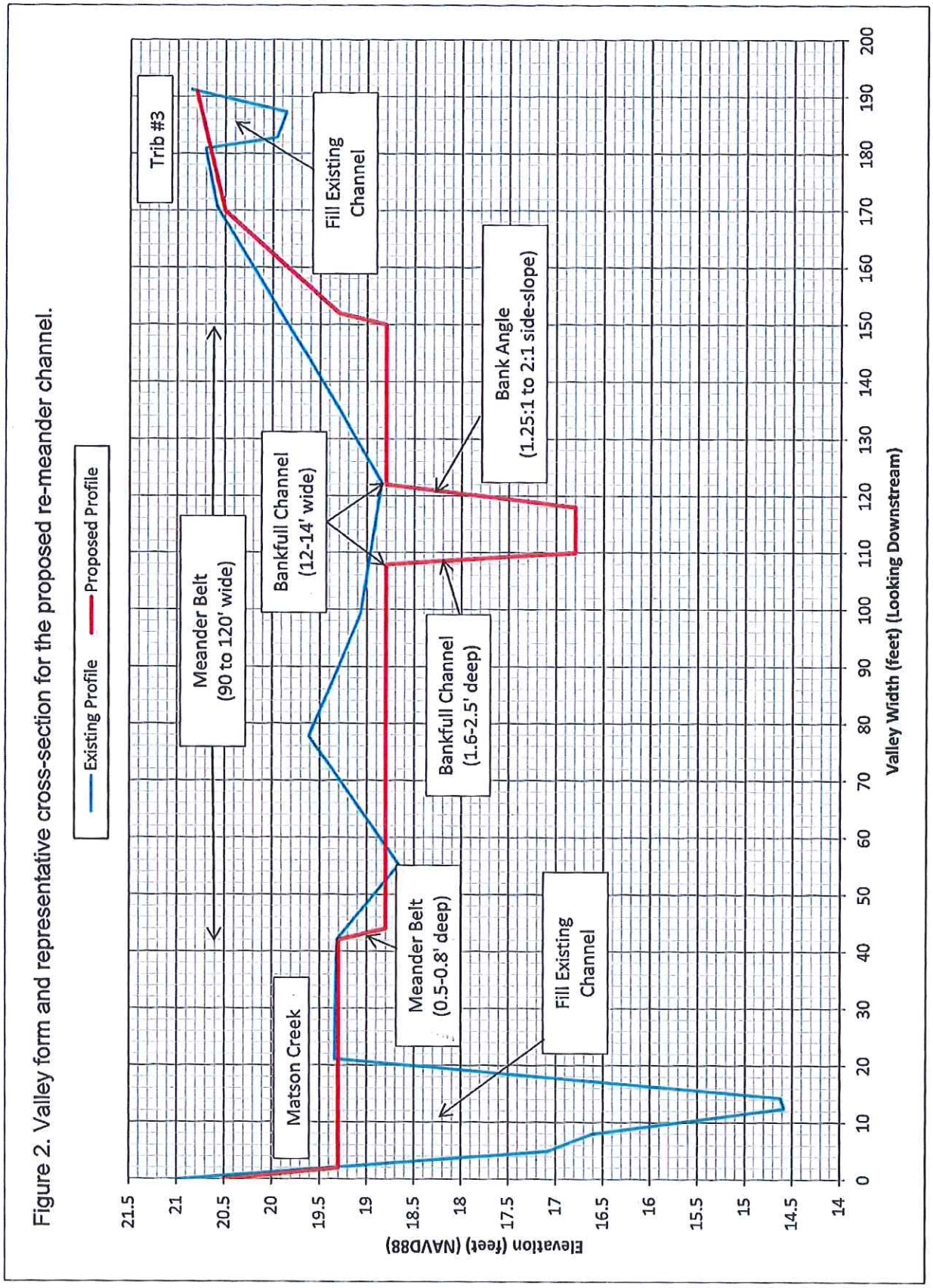


Figure 2. Valley form and representative cross-section for the proposed re-meander channel.

Logjam structures are designed to assist in maintaining the meander bends; provide high flow refugia and cover for, respectively, for winter and summer rearing habitat; increase the diversity and complexity of stream habitats through deposition and scour; and provide a mechanism to reconnect the channel and its floodplain. Table 2 provides estimated quantities of large wood, while Figure 2 provides our anticipated installation designs. We assume that there will be two key pieces in every in-stream wood structure, and that all single underscour and sill logs will meet the key piece criteria. The in-stream wood will be place solely within the meander belt zones on both streams.

Table 2. Large wood loading for the proposed Matson mitigation.

Site & Component	Number	Pieces	English (ft^3)	Metric (m^3)
Matson Mainstem (South Arm)				
Constructed Logjams				
2 Log Structures	2	4	322	9
3 Log Structures	13	39	3,140	89
4 Log Structures	11	44	3,542	100
5 Log Structures	2	10	805	23
Single Underscour & Sill Logs	22	22	1,467	42
Total in Active Channel		119	9,580	271
Pieces/100m & Volume/100m		10.0	807	22.8
Key Pieces (> 60cm dbh)		78		
Key Pieces/100m		6.6		
Floodplain Logs				
Single Pieces	16	16	1288	36
2 Log Structures	7	14	1127	32
3 Log Structures	3	9	724.5	21
Total Amount in Floodplain		39	3,140	89
Pieces/100m & Volume/100m		2.2	180	5.1
Tributary #1 (North Arm)				
Constructed Logjams				
2 Log Structures	1	2	161	5
3 Log Structures	6	18	1,449	41
4 Log Structures	5	20	1,610	46
5 Log Structures	1	5	403	11
Single Underscour & Sill Logs	10	10	667	19
Total in Active Channel		55	4,428	125
Pieces/100m & Volume/100m		10.6	850	24.1
Key Pieces (> 60cm dbh)		36		
Key Pieces/100m		3.2		
Floodplain Logs				
Single Pieces	10	10	805	23
2 Log Structures	4	8	644	18
3 Log Structures	2	6	483	14
Total Amount in Floodplain		24	1,932	55
Pieces/100m & Volume/100m		2.1	171	4.8

The stability of the logjam structures will be insured by embedding them in the floodplain and weighting them with boulders (see diagram). An initial stability analysis for a single log embedded in the bank was conducted, and the results are reported. Once the 30% design approach is approved, additional analyses will be used to determine the amount of boulders needed for the larger structures. As shown in the drawings, all the boulders will be outside the active channel width, and most will be buried in the floodplain.

Additional wood will be placed in the floodplain to serve as amphibian habitat and to act as "nurse logs" for terrestrial vegetation (especially spruce and cedar plantings). These pieces and structures will be placed along the entire stream reach, not just within the meander belt. This wood will not be anchored or embedded, allowing it to potentially redistribute during flow events greater than bankfull.

Table 3. Native plant establishment summary.

Plants by Zone	Length	Width	# Pieces	Area (ac.)
Matson Mainstem (South Arm)				
Streambank Cuttings	5,708	8	38,406	1.38
Wetland Zone	2,369	60	2,434	2.01
Riparian Buffer Zone	2,369	24		1.31
Deciduous Trees			592	0.87
Shrubs			4,211	0.87
Conifer Recruitment Zone	2,369	24	889	1.31
South Arm Total			46,532	7.74
Estimated Stream Shade			100%	
Tributary #1 (North Arm)				
Streambank Cuttings	3,706	8	21,657	1.05
Wetland Zone	1,068	60	1,137	0.94
Riparian Buffer Zone	1,068	16		0.39
Trees			179	0.26
Shrubs			1,272	0.26
Conifer Recruitment Zone	1,068	16	267	0.39
North Arm Total			24,512	3.30
Estimated Stream Shade			100%	

The present pasture surface will be re-vegetated to establish wetland and riparian plants within the meander belt, in the current wetlands adjacent to the remeandered stream below the meander belt, and along the edges of the remainder of the valley floor. A detailed planting plan is included. Table 3 shows a summary of the number of plants by planting zone. Willow and dogwood cuttings will be on a 1' x 1' spacing, 4' wide on each side of the channel in the meander belt, and a 2' x 2' spacing, 8' wide on each

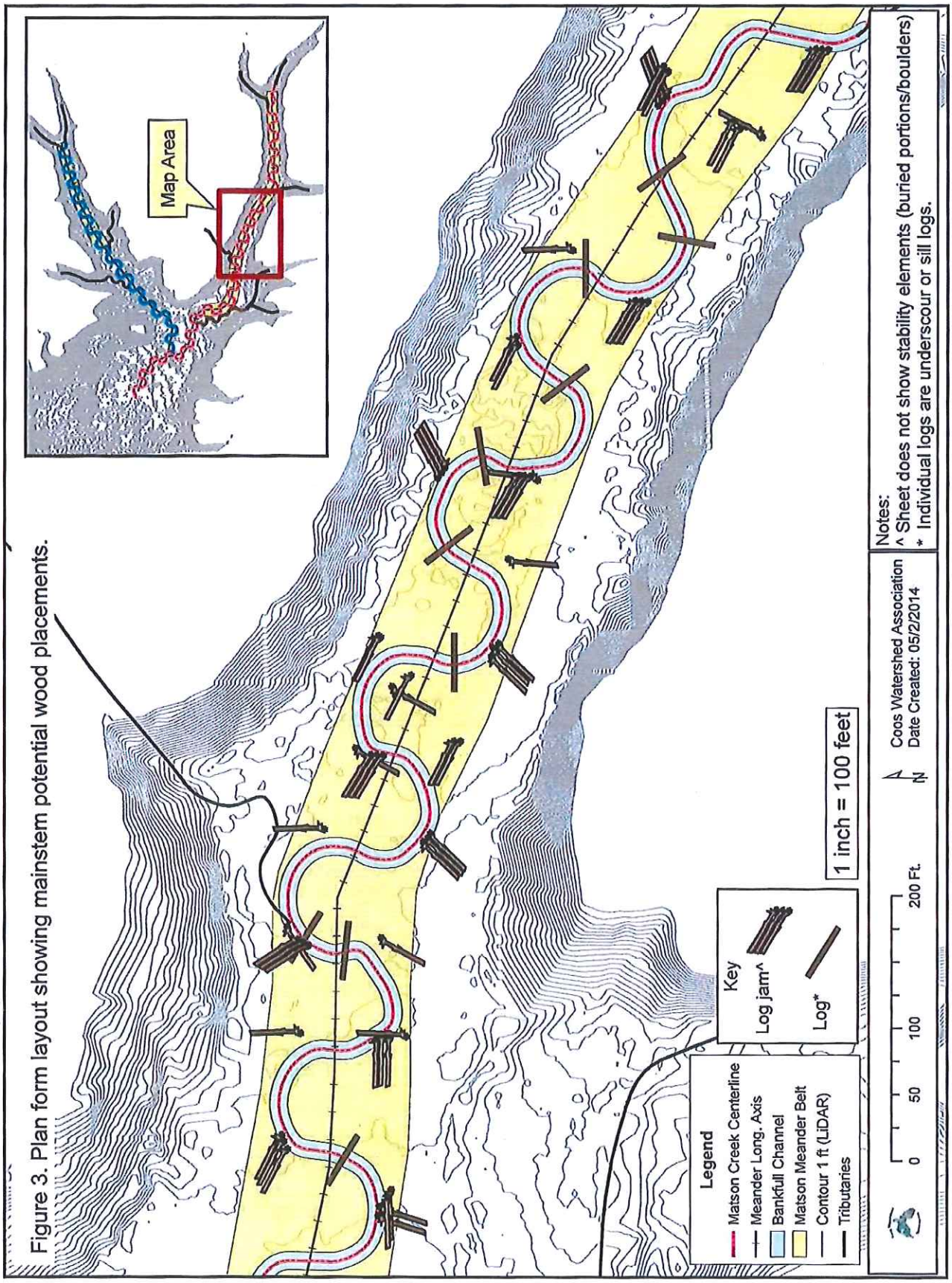
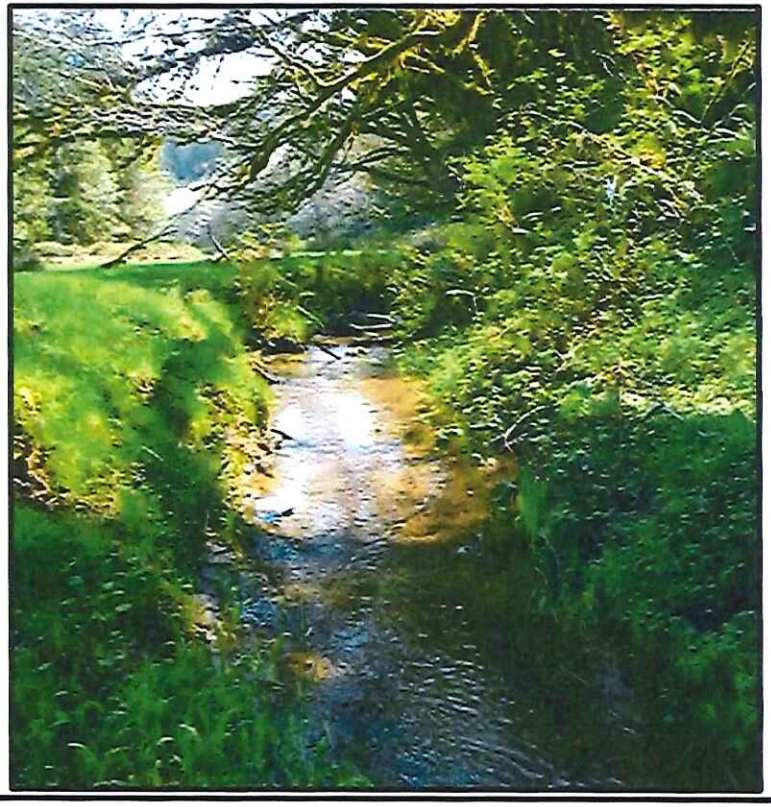
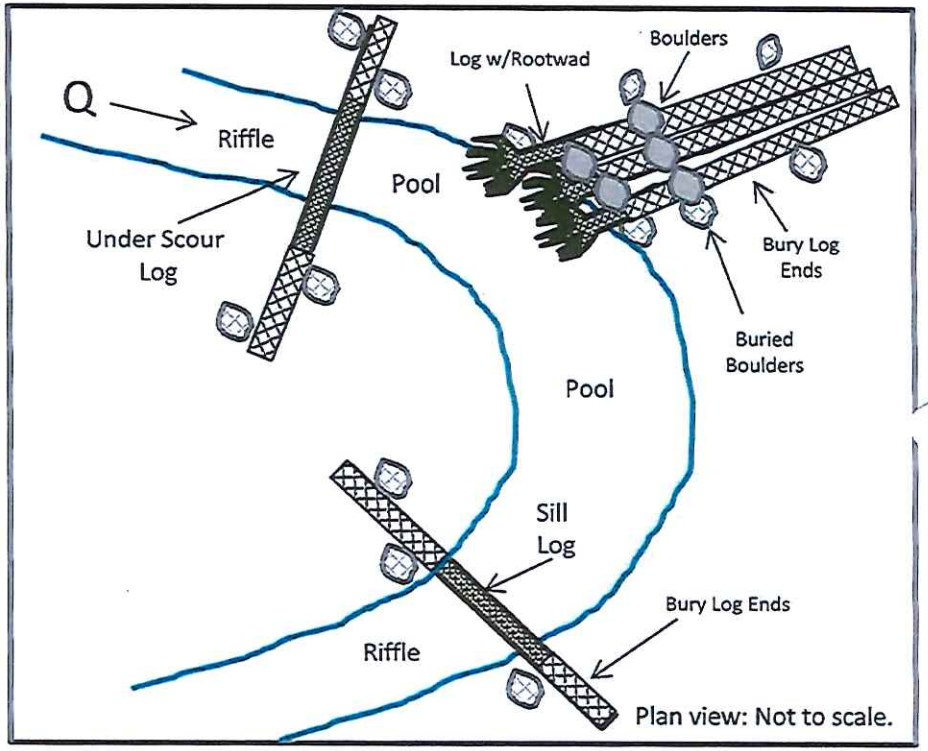


Figure 3. Plan form layout showing mainstem potential wood placements.

Figure 4. Large wood structure 30% design configuration.

Project:	**Matson Creek Stream Restoration**
Project Lead:	Coos Watershed Association
Landowner:	Wetlands Conservancy
Designs By:	Coos Watershed Association PO Box 5860 Charleston, Oregon
Site Number:	Example drawing
Sheet:	1 of 1





Construction Notes

- Construction shall only occur during in-water work period, unless extension has been granted by appropriate permitting agencies.
- Access routes will be minimized to that which is required. Removal of standing live or dead trees is not acceptable.
- Whenever possible, bury boulders to at least 90% of height.
- Stack key pieces when possible to reduce mobility.
- Secure rootwads between logs and bank on upstream side of structure.
- Place rootwads in channel whenever possible.
- Final location of wood TBD in field by CoosWA Project Manager.
- Re-vegetate all disturbed ground.
- See contract agreement for additional work details.

Materials Description

Item	Quantity	Diameter	LENGTH (Ft)	Species	Wood Source
Rootwad Logs	3-6	16-24" DBH	40-60	Douglas Fir	TBD
Logs	1-2	16-22" DBH	40	Douglas Fir	TBD

side of the channel below the meander belt. The wetland planting zone will be about 30' wide extending from the shream channels on the inside meander bends, with plugs planted on a 6' x 6' spacing. The riparian buffer will be in a belt approximately 8' wide on the interior of the meander belt boundary, including the outside of the meander bends. In this zone, trees (ash and spruce) will be planted on an 8' x 8' spacing, with shrubs planted on a 3' by 3' spacing. While the shrub and tree zones within the riparian buffer will comprise about 50% of the area for each, there will be an overlap between the two zones of about one-third. Finally, the conifer recruitment zone will fill the remainder of the valley floor outside the meander belt. Trees (cedar, hemlock, spruce) in this zone will be planted on an 8' by 8' spacing.

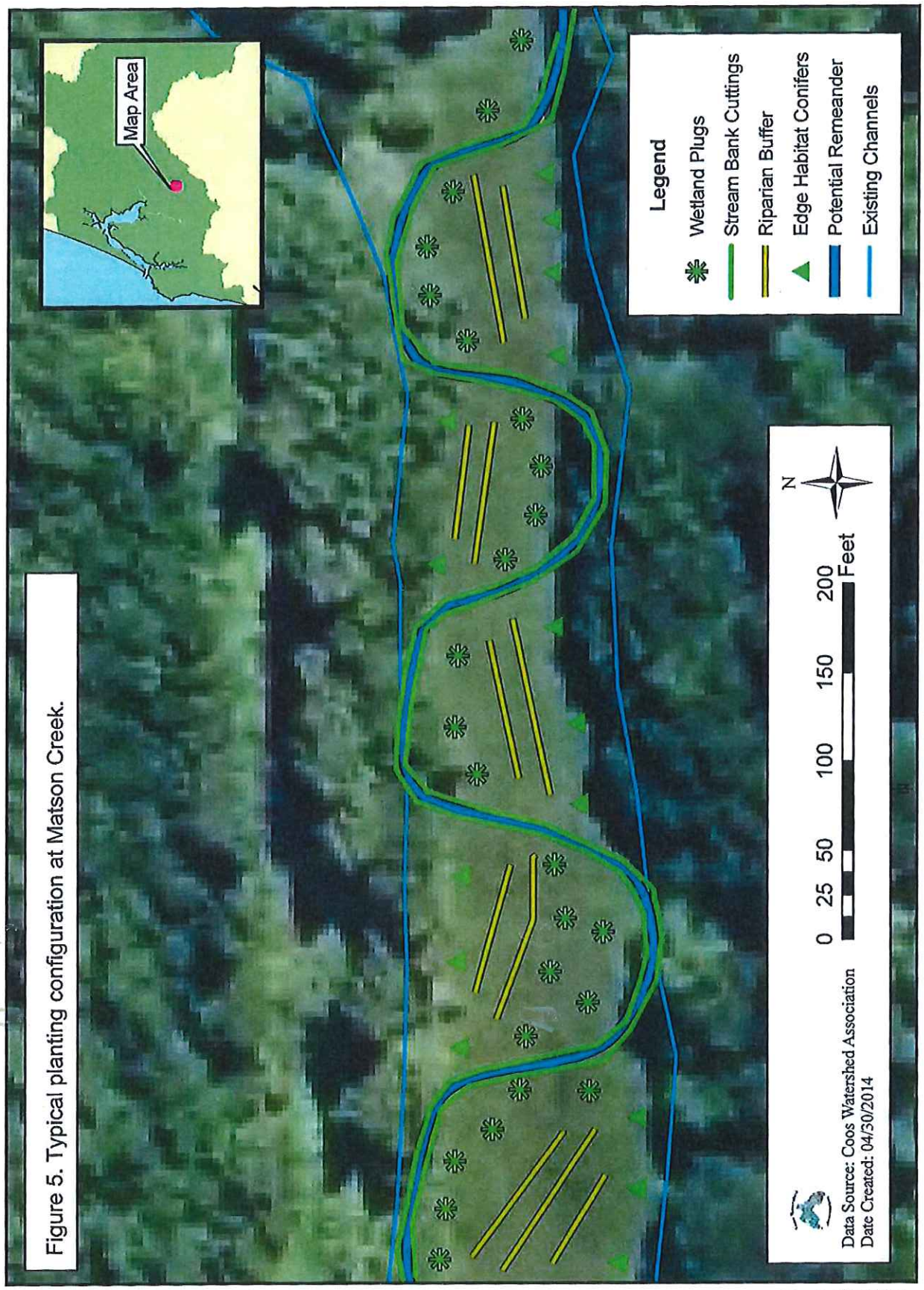


Figure 5. Typical planting configuration at Matson Creek.

Appendix 1. Large wood structure stability analysis.

TABLE OF CONTENTS

Date of Last Revision: May 4, 2014

Designer:
Coos Watershed Association

Reviewed by:
TBD

Reference for Design Method of Large Wood Structures:
NRCS NEH 654 Technical Supplement 14J (2007)

Reference for Companion Paper:
Rafferty, M. (2013). *Development of a Computational Design Tool for Evaluating the Stability of Large Wood Structures Proposed for Stream Enhancement*. Masters of Science Thesis, Colorado State University.

Large Wood Structure Stability Analysis Spreadsheet was developed by Michael Rafferty, P.E.
Version 1.0

Matson Creek Restoration
Factors of Safety and Design Constants

Spreadsheet developed by
Michael Rafferty, P.E.

Symbol	Description	Value
FS_V	Factor of Safety for Vertical Force Balance	1.50
FS_H	Factor of Safety for Horizontal Force Balance	2.00
FS_M	Factor of Safety for Moment Force Balance	2.00

Symbol	Description	Units	Value
C_{Lrock}	Coefficient of lift for submerged boulder (D'Aoust, 2000)	-	0.17
C_{Drock}	Coefficient of drag for submerged boulder (Schultz, 1954)	-	0.85
g	Gravitational acceleration constant	ft/s^2	32.174
DF_{RW}	Diameter factor for rootwad ($DF_{RW} = D_{RW}/D_{TS}$)	-	3.00
LF_{RW}	Length factor for rootwad ($LF_{RW} = L_{RW}/D_{TS}$)	-	1.50
SG_{rock}	Specific gravity of quartz particles	-	2.65
γ_{rock}	Dry unit weight of boulders	lb/ft^3	165.0
γ_w	Specific weight of water at 50°F	lb/ft^3	62.40
η	Rootwad porosity from NRCS Tech Note 15 (2001)	-	0.20
ν	Kinematic viscosity of water at 50°F	ft/s^2	1.41E-05

Matson Creek Restoration
Hydrologic and Hydraulic Inputs

Spreadsheet developed by
Michael Rafferty, P.E.

Average Return Interval (ARI) of Design Discharge: 2 yr

Site ID	Proposed Station	Design Discharge, Q_{des} (cfs)	Maximum Depth, d_w (ft)	Average Velocity, u_{avg} (ft/s)	Bankfull Width, W_{BF} (ft)	Wetted Area, A_W (ft^2)	Radius of Curvature, R_c (ft)
25.00	10+35	94	3.50	5.00	14.0	250	33

Matson Creek Restoration
Stream Bed Substrate Properties

Spreadsheet developed by
Michael Rafferty, P.E.

Site ID	Proposed Station	Stream bed D_{50} (mm)	Stream Bed Substrate Grain Size Class	Bed Soil Class	Dry Unit Weight[1], γ_{bed} (lb/ft^3)	Buoyant Unit Weight, γ'_{bed} (lb/ft^3)	Friction Angle, ϕ_{bed} (deg)
25	10+35	8.00	Fine gravel	5	116.8	72.7	35

Source: Compiled from Julien (2010) and Shen and Julien (1993); soil classes from NRCS Table TS14E–2 Soil classification

[1] γ_{bed} (kg/m^3) = 1,600 + 300 log D_{50} (mm) (from Julien 2010)

Matson Creek Restoration
Bank Soil Properties

Spreadsheet developed by
Michael Rafferty, P.E.

Site ID	Proposed Station	Bank Soils (from field observations)	Bank Soil Class	Dry Unit Weight, γ_{bank} (lb/ft^3)	Buoyant Unit Weight, γ'_{bank} (lb/ft^3)	Friction Angle, ϕ_{bank} (deg)
25	10+35	Coarse sand, dense	5	120.0	74.7	43

Matson Creek Restoration
Large Wood Properties

Spreadsheet developed by
Michael Rafferty, P.E.

Project Location: West Coast

Timber Unit Weights			Air-dried[1] γ_{Td} (lb/ft^3)	Green[2] γ_{Tgr} (lb/ft^3)
Selected Species	Common Name	Scientific Name		
Tree Type #1:	Douglas-fir, Coast	Pseudotsuga menziesii var. menzi.	33.5	38.0
Tree Type #2:				
Tree Type #3:				
Tree Type #4:				
Tree Type #5:				
Tree Type #6:				
Tree Type #7:				
Tree Type #8:				
Tree Type #9:				
Tree Type #10:				

[1] **Air-dried unit weight,** γ_{Td} = Average unit weight of wood after exposure to air on a 12% moisture content volume basis. Air-dried unit weight is used in the force balance calculations for the portion of wood that is above the proposed thalweg elevation (assuming unsaturated conditions).

[2] **Green unit weight,** γ_{Tgr} = Average unit weight of freshly sawn wood when the cell walls are completely saturated with water. Green unit weight is used in the force balance calculations as a conservative estimate of the unit weight for the portion of wood that is below the proposed thalweg elevation (assuming saturated conditions). For comparison, Thevenet, Citterio, & Piegay (1998) determined wood unit weight typically increases by more than 100% after less than 24 hours exposure to water.

Source for timber unit weights:

U.S. Department of Agriculture, U.S. Forest Service. (2009) Specific Gravity and Other Properties of Wood and Bark for 156 Tree Species Found in North America. Research Note NRS-38. Table 1A.

Matson Creek Restoration

Spreadsheet developed by Michael Rafferty, P.E.

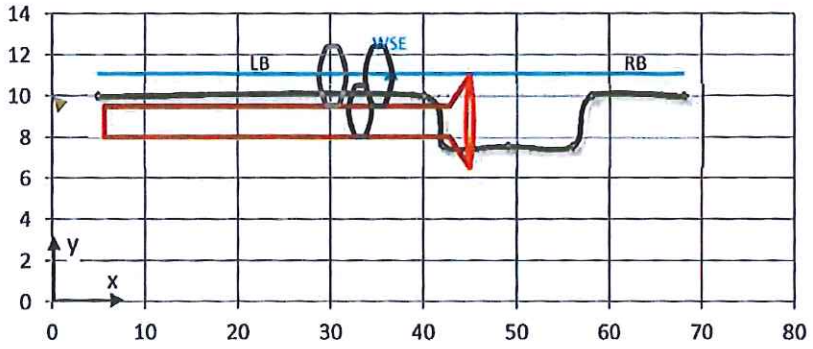
Single Log Stability Analysis Model Inputs

Site ID	Structure Type	Structure Position	Meander	Station	d_w (ft)	R_c/W_{BF}	u_{des} (ft/s)
25	Transport Jam	Left bank	Outside	10+35	3.50	2.36	7.73

Multi-Log Structures	Layer	Log ID
	Key Log	1

Channel Geometry Coordinates		
Proposed	x (ft)	y (ft)
Fldpln LB	5.0	10.00
Top LB	40.0	10.00
Toe LB	42.0	7.60
Thalweg	49.0	7.60
Toe RB	56.0	7.60
Top RB	58.0	10.00
Fldpln RB	68.0	10.00

Proposed Cross-Section and Structure Geometry (Looking D/S)

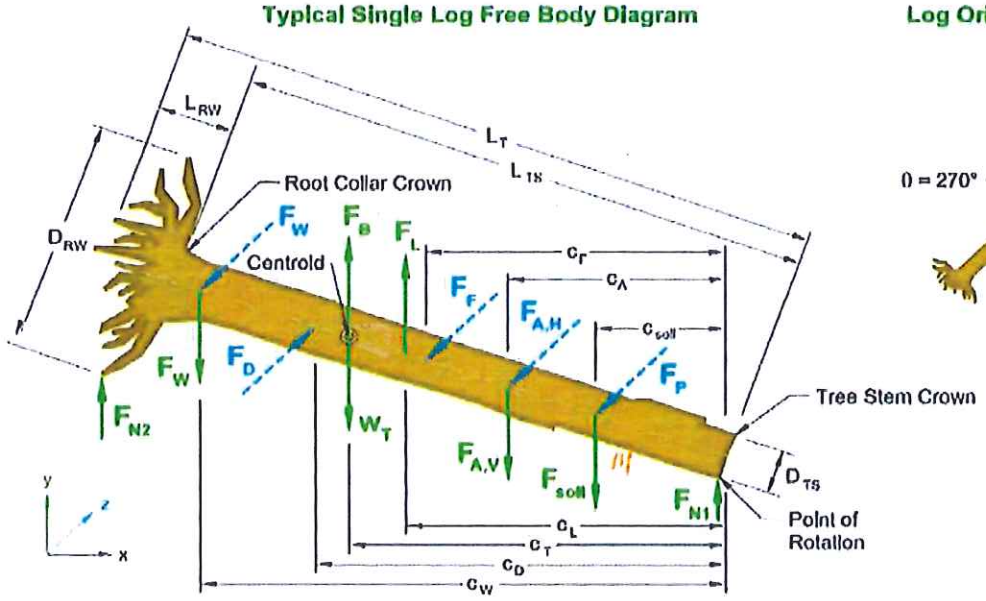


Wood Species	Rootwad	L_T (ft)	D_{TS} (ft)	L_{RW} (ft)	D_{RW} (ft)	γ_{Td} (lb/ft^3)	γ_{Tgr} (lb/ft^3)
Douglas-fir, Coast	Yes	40.0	1.50	2.25	4.50	33.5	38.0

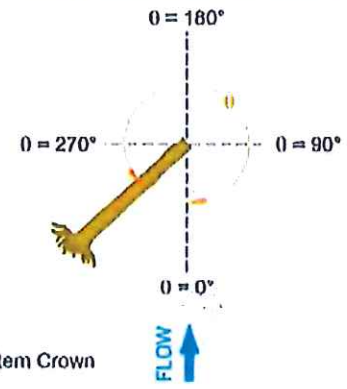
Structure Geometry	θ (deg)	β (deg)	Define Fixed Point	x_T (ft)	y_T (ft)	$y_{T,min}$ (ft)	$y_{T,max}$ (ft)	A_{Tp} (ft^2)
	80.0	0.0	Rootwad: Crown	45.00	11.00	6.50	11.00	8.03

Soils	Material	γ_s (lb/ft^3)	γ'_s (lb/ft^3)	ϕ (deg)	Soil Class	$L_{T,em}$ (ft)	$d_{b,max}$ (ft)	$d_{b,avg}$ (ft)
Stream Bed	Fine gravel	116.8	72.7	35.0	5	0.00	0.00	0.00
Bank	Coarse sand, dense	120.0	74.7	43.0	5	35.35	0.50	0.50

Typical Single Log Free Body Diagram



Log Orientation (Plan View)



25 Transport Jam Key Log Log ID 1 Page 2

Vertical Force Analysis

Net Buoyancy Force

Wood	V_{TS} (ft^3)	V_{RW} (ft^3)	V_T (ft^3)	W_T (lbf)	F_B (lbf)
↑WSE	0.0	0.0	0.0	0	0
↓WS↑Thw	66.7	12.3	79.0	2,650	4,930
↓Thalweg	0.0	1.5	1.5	57	93
Total	66.7	13.8	80.5	2,707	5,023

Lift Force

C_{LT}	0.15
F_L (lbf)	71

Soil Ballast Force

Soil	V_{dry} (ft^3)	V_{sat} (ft^3)	V_{soil} (ft^3)	F_{soil} (lbf)
Bed	0.0	0.0	0.0	0
Bank	0.0	26.3	26.3	1,969
Total	0.0	26.3	26.3	1,969

Vertical Force Balance

F_B (lbf)	5,023	↑
F_L (lbf)	71	↑
W_T (lbf)	2,707	↓
F_{soil} (lbf)	1,969	↓
$F_{W,V}$ (lbf)	0	
$F_{A,V}$ (lbf)	3,235	↓
ΣF_V (lbf)	2,817	↓
FS_V	1.55	✓

Horizontal Force Analysis

Drag Force

A_{Tp} / A_W	Fr_L	C_{DI}	C_w	C_D*	F_D (lbf)
0.03	1.11	1.08	0.09	1.24	580

Passive Soil Pressure / Friction Force

Soil	K_P	F_P (lbf)	L_{Tf} (ft)	μ	F_F (lbf)
Bed	3.69	0	2.00	0.70	102
Bank	5.29	5,207	36.70	0.93	2,491
Total	-	5,207	38.70	-	2,593

Horizontal Force Balance

F_D (lbf)	580	→
F_P (lbf)	5,207	←
F_F (lbf)	2,593	←
$F_{W,H}$ (lbf)	0	
$F_{A,H}$ (lbf)	762	←
ΣF_H (lbf)	7,982	←
FS_H	14.77	✓

Moment Force Balance

Driving Moment Centroids / Resisting Moment Centroids

$c_{T,B}$ (ft)	c_L (ft)	c_D (ft)	$c_{T,W}$ (ft)	c_{soil} (ft)	$c_{F\&N}$ (ft)	c_P (ft)
22.4	38.4	37.7	22.4	17.6	18.3	23.5

*Distances are from the stem tip

Point of Rotation: Stem Tip

Moment Force Balance

M_d (lbf)	137,104	↻
M_r (lbf)	426,786	↺
FS_M	3.11	✓

Anchor Forces

Additional Soil Ballast

V_{Adry} (ft^3)	V_{Awet} (ft^3)	c_{Asoil} (ft)	$F_{A,Vsoil}$ (lbf)	$F_{A,HP}$ (lbf)
			0	0

Mechanical Anchors

Type	c_{Am} (ft)	Soils	F_{Am} (lbf)
			0
			0

Boulder Ballast

Position	D_r (ft)	c_{Ar} (ft)	$V_{r,dry}$ (ft^3)	$V_{r,wet}$ (ft^3)	W_r (lbf)	$F_{L,r}$ (lbf)	$F_{D,r}$ (lbf)	$F_{A,Vr}$ (lbf)	$F_{A,Hr}$ (lbf)
Above	2.90	30.0	5.4	7.4	1,647	29	147	1,618	0
Behind	2.50	28.0	0.0	8.2	839	3	17	0	762
Above	2.90	25.0	5.4	7.4	1,647	29	147	1,618	0

Matson Creek Restoration
Notation, Units, and List of Symbols

Notation

Symbol	Description	Unit
A_W	Wetted area of channel at design discharge	ft^2
A_{Tp}	Projected area of wood in plane perpendicular to flow	ft^2
c_D	Centroid of the drag force along log axis	ft
c_{Am}	Centroid of a mechanical anchor along log axis	ft
c_{Ar}	Centroid of a ballast boulder along log axis	ft
c_{Asoil}	Centroid of the added ballast soil along log axis	ft
$c_{F\&N}$	Centroid of friction and normal forces along log axis	ft
c_L	Centroid of the lift force along log axis	ft
c_P	Centroid of the passive soil force along log axis	ft
c_{soil}	Centroid of the vertical soil forces along log axis	ft
$c_{T,B}$	Centroid of the buoyancy force along log axis	ft
$c_{T,W}$	Centroid of the log volume along log axis	ft
c_{WI}	Centroid of a wood interaction force along log axis	ft
C_{Lrock}	Coefficient of lift for submerged boulder	-
C_{LT}	Effective coefficient of lift for submerged tree	-
C_{DI}	Base coefficient of drag for tree, before adjustments	-
$C_D{}^*$	Effective coefficient of drag for submerged tree	-
C_{DI}	Base coefficient of drag for tree, before adjustments	-
C_W	Wave drag coefficient of submerged tree	-
$d_{b,avg}$	Average buried depth of log	ft
$d_{b,max}$	Maximum buried depth of log	ft
d_w	Maximum flow depth at design discharge in reach	ft
D_{50}	Median grain size in millimeters (SI units)	mm
D_r	Equivalent diameter of boulder	ft
D_{RW}	Assumed diameter of rootwad	ft
D_{TS}	Nominal diameter of tree stem (DBH)	ft
DF_{RW}	Diameter factor for rootwad ($DF_{RW} = D_{RW}/D_{TS}$)	-
e	Void ratio of soils	-
$F_{A,H}$	Total horizontal load capacity of anchor techniques	lbf
$F_{A,HP}$	Passive soil pressure applied to log from soil ballast	lbf
$F_{A,Hr}$	Horizontal resisting force on log from boulder	lbf
F_{Am}	Load capacity of mechanical anchor	lbf
$F_{A,V}$	Total vertical load capacity of anchor techniques	lbf
$F_{A,Vr}$	Vertical resisting force on log from boulder	lbf
$F_{A,Vsoil}$	Vertical soil loading on log from added ballast soil	lbf
F_B	Buoyant force applied to log	lbf
F_D	Drag forces applied to log	lbf
$F_{D,r}$	Drag forces applied to boulder	lbf
F_F	Friction force applied to log	lbf
F_H	Resultant horizontal force applied to log	lbf
F_L	Lift force applied to log	lbf
$F_{L,r}$	Lift force applied to boulder	lbf
F_P	Passive soil pressure force applied to log	lbf
F_{soil}	Vertical soil loading on log	lbf
$F_{W,H}$	Horizontal forces from interactions with other logs	lbf
$F_{W,V}$	Vertical forces from interactions with other logs	lbf

Notation (continued)

Symbol	Description	Unit
F_V	Resultant vertical force applied to log	lbf
Fr_L	Log Froude number	-
FS_V	Factor of Safety for Vertical Force Balance	-
FS_H	Factor of Safety for Horizontal Force Balance	-
FS_M	Factor of Safety for Moment Force Balance	-
g	Gravitational acceleration constant	ft/s^2
K_P	Coefficient of Passive Earth Pressure	-
$L_{T,em}$	Total embedded length of log	ft
L_{RW}	Assumed length of rootwad	ft
L_T	Total length of tree (including rootwad)	ft
L_{Tf}	Length of log in contact with bed or banks	ft
L_{TS}	Length of tree stem (not including rootwad)	ft
$L_{TS,ex}$	Exposed length of tree stem	ft
LF_{RW}	Length factor for rootwad ($LF_{RW} = L_{RW}/D_{TS}$)	-
M_d	Driving moment about embedded tip	lbf
M_r	Driving moment about embedded tip	lbf
N	Blow count of standard penetration test	-
p_o	Porosity of soil volume	-
Q_{des}	Design discharge	cfs
R	Radius	ft
R_c	Radius of curvature at channel centerline	ft
SG_r	Specific gravity of quartz particles	-
SG_T	Specific gravity of tree	-
u_{avg}	Average velocity of cross section in reach	ft/s
u_{des}	Design velocity	ft/s
u_m	Adjusted velocity at outer meander bend	ft/s
V_{dry}	Volume of soils above stage level of design flow	ft^3
V_{sat}	Volume of soils below stage level of design flow	ft^3
V_{soil}	Total volume of soils over log	ft^3
V_{RW}	Volume of rootwad	ft^3
V_S	Volume of solids in soil (void ratio calculation)	ft^3
V_T	Total volume of log	ft^3
V_{TS}	Total volume of tree	ft^3
V_V	Volume of voids in soil	ft^3
V_{Adry}	Volume of ballast above stage of design flow	ft^3
V_{Awet}	Volume of ballast below stage of design flow	ft^3
$V_{r,dry}$	Volume of boulder above stage of design flow	ft^3
$V_{r,wet}$	Volume of boulder below stage of design flow	ft^3
W_{BF}	Bankfull width at structure site	ft
W_r	Effective weight of boulder	lbf
W_T	Total log weight	lbf
x	Horizontal coordinate (distance)	ft
y	Vertical coordinate (elevation)	ft
$y_{T,max}$	Minimum elevation of log	ft
$y_{T,min}$	Maximum elevation of log	ft

Greek Symbols

Symbol	Description	Unit
β	Tilt angle from stem tip to vertical	deg
γ_{bank}	Dry specific weight of bank soils	lb/ft^3
$\gamma_{bank,sat}$	Saturated unit weight of bank soils	lb/ft^3
γ'_{bank}	Effective buoyant unit weight of bank soils	lb/ft^3
γ_{bed}	Dry specific weight of stream bed substrate	lb/ft^3
γ'_{bed}	Effective buoyant unit weight of stream bed substrate	lb/ft^3
γ_{rock}	Dry unit weight of boulders	lb/ft^3
γ_s	Dry specific weight of soil	lb/ft^3
γ'_s	Effective buoyant unit weight of soil	lb/ft^3
γ_{Td}	Air-dried unit weight of tree (12% MC basis)	lb/ft^3
γ_{Tgr}	Green unit weight of tree	lb/ft^3
γ_w	Specific weight of water at 50°F	lb/ft^3
η	Rootwad porosity	-
θ	Rootwad (or large end of log) orientation to flow	deg
μ	Coefficient of friction	-
ν	Kinematic viscosity of water at 50°F	ft/s^2
Σ	Sum of forces	-
ϕ_{bank}	Internal friction angle of bank soils	deg
ϕ_{bed}	Internal friction angle of stream bed substrate	deg

Units

Notation	Description
cfs	Cubic feet per second
ft	Feet
lb	Pound
lbf	Pounds force
kg	Kilograms
m	Meters
mm	Millimeters
s	Seconds
yr	Year

Abbreviations

Notation	Description
ARI	Average return interval
Avg	Average
DBH	Diameter at breast height
deg	Degrees
Dia	Diameter
Dist	Distance
D/S	Downstream
ELJ	Engineered log jam
Ex	Example
Fldpln	Floodplain
H&H	Hydrologic and hydraulic
ID	Identification
i.e.	That is
LB	Left bank
LW	Large wood
Max	Maximum
MC	Moisture content
Min	Minimum
ML	Multi-log
SL	Single log
N/A	Not applicable
no	Number
Pt	Point
rad	Radians
RB	Right bank
RW	Rootwad
SL	Single log
Thw	Thalweg (lowest elevation in channel bed)
Typ	Typical
U.S.	United States
WS	Water surface
WSE	Water surface elevation
↑	Above
↓	Below

Appendix 2. Matson Creek mitigation planting plan.

Matson Creek – South Arm

Current Conditions

The South Arm valley, containing the Matson Creek mainstem and Trib. #3, is typical of agriculturally modified stream-wet meadow systems in coastal Oregon. This 16 acre valley consists mainly of pasture grasses and non-native herbaceous species (e.g., creeping buttercup, birdsfoot trefoil), which have flourished with a lower water table due to channelization of the stream. Some large patches of native small-fruited bulrush (an obligate wetland species) can be found along the northern edges of the valley, but this is the majority of native species found throughout this valley. Along the creek, on the valley side of the riparian edge, little to no vegetation exists aside from pasture grass. Vegetation on the upland side of the creek consists of red alder, salmonberry, red elderberry, big leaf maple, Sitka spruce, and myrtlewood – typical riparian vegetation found in the Coos watershed. This vegetation will remain undisturbed during restoration implementation and will provide a seed source for recruitment of these species. The forested northern edge of the valley consists of mixed conifer species (Douglas fir, Sitka spruce, Western red cedar, Western hemlock) interspersed with myrtlewood, big leaf maple, and madrone. The main threats to native plants in this valley are from encroaching blackberry and competition with the established prairie grass. Fortunately, reed canary grass, a highly invasive grass, is found in limited quantities in this valley. Active establishment of native riparian and wetland vegetation is necessary for the development of a diverse plant community to outcompete invasive species.

Vegetation Planting Plan

For this project, we will aim to re-establish two types of plant communities, wetland and riparian, after the stream is re-meandered through the center of the valley. This planting plan is based on the Anderson Creek Restoration Project completed in 2002-2003 by the Coos Watershed Association and South Slough National Estuarine Research Reserve, as well as the *Native Freshwater Wetland Plant Associations of Northwestern Oregon* (Christy 2004). The planting plan will establish native riparian and freshwater wetland species to stabilize the floodplain, shade the Matson Creek channel, and provide a diversity of wetland habitat options for a variety of fish and wildlife species. The planting plan is designed to give native vegetation a significant head start on the expected colonization of the disturbed portions of the site by non-native grasses and herbs. See Table 1 for specific species and quantities.

Once the channel is re-meandered, the valley floor will be primarily wet meadow, dominated by small-fruited bulrush (*Scirpus microcarpus*), slough sedge (*Carex obnupta*), and soft rush (*Juncus effusus*). These species will be collected on-site to preserve the local gene pool and keep costs down. Plugs will be collected as 6" x 6" sections from each 4' x 4' patch of each species and will be planted at a 6' x 6' spacing. Slough sedge and soft rush will be planted in larger numbers due to the dominance of small-fruited bulrush at the Anderson Creek Restoration site. The valley floor at this site is mainly small-fruited bulrush but was originally planted in a 4:1 ratio of slough sedge to small-fruited bulrush. Despite it's dominance at Anderson Creek, it is an

excellent species to include in this project. We will attempt a 6:1 ratio of slough sedge and soft rush to small-fruited bulrush in order to keep the valley floor as diverse as possible.

The banks of the newly re-meandered creek will be planted with willows (*Salix* sp.) and red osier dogwood (*Cornus sericea*) to stabilize this new habitat. Willow and dogwood cuttings will be harvested from the Matson Creek Wetland Preserve. Cuttings will be 5-6' to ensure that a sufficient amount of plant material can be planted into the bank for stabilization while still allowing enough plant material to leaf out for habitat. Cuttings will be planted densely along the banks at a 1' x 1' spacing.

The riparian buffer will be planted with a mix of hardwoods, shrubs and Sitka spruce. Hardwood species include Oregon ash and Pacific crabapple, which are great for revegetating wet areas and provide food and habitat for birds. Shrub species include Douglas spirea, twinberry, and Pacific ninebark. These three species are commonly found in lowland wet meadows in the Coos watershed, establish quickly, and provide food and habitat for wildlife. Sitka spruce can withstand wet areas and will be a source of large wood recruitment in the years following restoration. Trees will be planted at a 8' x 8' spacing and shrubs will be planted at a 3' x 3' spacing. Trees and shrubs will be staggered to mimic the mosaic structure of a riparian buffer. Placement is based off of recommendations in the *Coastal Oregon Riparian Silviculture Guide* (Massingill 2003).

Finally, the edge habitat between the riparian buffer and the established surrounding forest will be planted with Western red cedar and Western hemlock to increase conifer diversity at the project site. Conifers will be planted at a 8' x 8' spacing as recommended by the Riparian Silviculture Guide.

Table 4. Species, stock type, quantities, source, and planting location for native species on the South Arm.

Species	Stock	Quantity	Source	Location
Small-fruited bulrush	Plug	406	On-site	Valley floor
Slough sedge	Plug	1,014	On-site	Valley floor
Soft rush	Plug	1,014	On-site	Valley floor
Willow	Cutting	19,203	On-site	Stream bank
Red osier dogwood	Cutting	19,203	On-site	Stream bank
Douglas spirea	Bareroot/cutting	1,403	On-site	Riparian buffer
Pacific ninebark	Bareroot/cutting	1,403	On-site	Riparian buffer
Twinberry	Bareroot	1,405	Native plant nursery	Riparian buffer
Oregon ash	Bareroot	296	Native plant nursery	Riparian buffer
Pacific crabapple	Bareroot	296	Native plant nursery	Riparian buffer
Sitka spruce	Bareroot	296	Native plant nursery	Riparian buffer
Western red cedar	Bareroot	296	Native plant nursery	Edge habitat
Western hemlock	Bareroot	297	Native plant nursery	Edge habitat
	Total	46,532		

Plant Protection and Maintenance

Vexar tubes and bamboo stakes will be used for protection from deer and elk browse at time of planting. Planting sites may require annual visits for maintenance to clear competing vegetation until plants are established. Depending on how quickly the vegetation establishes, this may require two visits per year for 3-5 years. Maintenance activities will include clearing competing

vegetation around plantings with weed whackers, hedge trimmers, and loppers. Tree protection material will either be repaired or replaced, if necessary.

Matson Creek – North Arm

Current Conditions

The North Arm of the valley encompasses approximately 9 acres of wetland and pasture. The wetland area can be found near the confluence of the mainstem and Trib. #1 of Matson Creek. Vegetation here consists of obligate wetland species including cattail, slough sedge, small-fruited bulrush, and burreed. The upper North Arm valley consists of the typical agriculturally modified riparian area. The Trib. #1 stream has been channelized and moved to the south side of the valley which has created conditions for pasture grass versus wet meadow species. Vegetation on the valley side of the riparian buffer has been cleared while vegetation on the upland side of the creek consists of red alder, salmonberry, red elderberry, big leaf maple, Sitka spruce, and myrtlewood. The forested northern edge of the valley consists of mixed conifers species (Douglas fir, Sitka spruce, Western red cedar, Western hemlock) interspersed with myrtlewood, big leaf maple, and madrone. The main threats to native plants in this valley are from encroaching blackberry and competition with the established prairie grass. Fortunately, reed canary grass, a highly invasive grass, is found in limited quantities in this valley. Active establishment of native riparian and wetland vegetation is necessary for the development of a diverse plant community to outcompete invasive species.

Vegetation Planting Plan

The planting plan for this site will be similar to the South Arm planting plan, but on a smaller scale given that there is less acreage and less pasture grass area. All of the same species will be planted with similar locations in terms of valley floor, stream bank, riparian buffer, and edge habitat. See Table 2 for species and quantities.

Table 5. Species, stock type, quantities, source, and planting location for native species on the North Arm.

Species	Stock	Quantity	Source	Location
Small-fruited bulrush	Plug	190	On-site	Valley floor
Slough sedge	Plug	474	On-site	Valley floor
Soft rush	Plug	473	On-site	Valley floor
Willow	Cutting	10,828	On-site	Stream bank
Red osier dogwood	Cutting	10,829	On-site	Stream bank
Douglas spirea	Bareroot/cutting	424	On-site	Riparian buffer
Pacific ninebark	Bareroot/cutting	424	On-site	Riparian buffer
Twinberry	Bareroot	424	Native plant nursery	Riparian buffer
Oregon ash	Bareroot	90	Native plant nursery	Riparian buffer
Pacific crabapple	Bareroot	89	Native plant nursery	Riparian buffer
Sitka spruce	Bareroot	89	Native plant nursery	Riparian buffer
Western red cedar	Bareroot	89	Native plant nursery	Edge habitat
Western hemlock	Bareroot	89	Native plant nursery	Edge habitat
	Total	24,512		

Plant Protection and Maintenance

Vexar tubes and bamboo stakes will be used for protection from deer and elk browse at time of planting. Planting sites may require annual visits for maintenance to clear competing vegetation

until plants are established. Depending on how quickly the vegetation establishes, this may require two visits per year for 3-5 years. Maintenance activities will include clearing competing vegetation around plantings with weed whackers, hedge trimmers, and loppers. Tree protection material will either be repaired or replaced, if necessary.

Literature Cited

Christy, J.A. 2004. *Native Freshwater Wetland Plant Associations of Northwestern Oregon.* Oregon Natural Heritage Information Center, Institute for Natural Resources, Oregon State University, Corvallis, OR. 250 pp.

Massingill, C. 2003. *Coastal Oregon Riparian Silviculture Guide.* Coos Watershed Association, Charleston, OR. 102 pp.

Section Five

Baseline Conditions at Pony and Matson Creeks

Analysis of Mitigation Needs for the Elimination of Instream Flow Requirements in Pony Creek
And
Design of Proposed Compensatory Stream Features at the Matson Creek Wetland Preserve

Task 1 Summary Report
Coos Watershed Association
April 6, 2013

Project Summary:
The Coos Bay/North Bend Water Board (Water Board) has Oregon Department of Fish & Wildlife (ODFW) fish passage mitigation requirements resulting from its Pony Creek reservoir projectsThe Water Board has contracted with the Coos Watershed Association (CoosWA) to conduct analyses needed to quantify the replacement values and to design a mitigation plan to provide these values at the Matson Creek Wetland Preserve.

Task #1: Establish Baseline Conditions in Pony Creek (completed 4/1/2013).

The CoosWA conducted a winter Aquatic Habitat Inventory (AHI) in March, 2013 on approximately 1,000 feet of Pony Creek (from Newmark to the Water treatment plant on Ocean Blvd.) to establish baseline habitat conditions for winter flows under the existing in-stream releases. In addition, CoosWA provided technical guidance to Sol Coast during their AHI on Matson Creek and subsequently processed the resulting data.

Deliverables:

1.a. Aquatic Habitat Inventory (Winter) for Pony Creek from Newmark Ave. to Ocean Blvd.

1.b. Aquatic Habitat Inventory database for both the Pony Creek Winter survey as well as the Matson Creek summer, 2012 survey.

1.c. Aquatic habitat Reach Summaries for Pony Creek and Matson Creek project areas.

These deliverables were provided in digital form to the Water Board with copies to Sol Coast on March 28, 2013.

Reach Summaries

Pony Creek. The Coos Watershed Association (CoosWA) conducted winter Aquatic Inventory Survey on Pony Creek during the middle of March 2013. Surveys took place on the portion of Pony Creek that runs between Newmark Avenue and Ocean Boulevard. Landowner contacts to

gain permission were conducted in the beginning of February, to insure that CoosWA survey crews could gain access and permission to the private property found along Pony Creek. CoosWA surveyors followed the Oregon Department of Fish and Wildlife's (ODFW) Aquatic Inventory Survey Protocol. All survey crew members have previously attended ODFW's Aquatic Inventory Training held annually at the Adair Village just outside of Corvallis, Oregon.

Survey crews designated a total of 5 survey reaches that encompass 50 individual habitat units. Reach 1 starts at the Inlet side of the culvert that passes under Newmark Ave. just adjacent to the Coca Cola distribution facility. Reach 2 starts on the upstream end of the bridge where Broadway crosses Pony Creek near the Hough, MacAdam, & Wartnik office. Reach 3 starts at the southwestern corner of Goodwill's property where the creek gets less confined and begins to meander. Reach 4 starts just before the Pony Creek Homeowner's Association property, where the creek gets again confined due to a more rural residential type of land use. Finally, Reach 5 starts just below Brooklyn lane where the creek begins to meander and introduction of a mixed conifer and deciduous riparian is developed. Reach 5 ends at the outlet side of the culvert where Ocean Blvd. crosses Pony Creek.

Reach 1. Reach 1 contains 382 meters of primary channel habitat and another 34 meters of secondary channel habitat, with a total wetted area of 1,175 m^2. The valley in Reach 1 is a wide active floodplain with an average active channel height of 0.4 meters, and an average width of 3.2 meters. The average unit gradient or slope for Reach 1 was low at 0.4%. Riparian vegetation is small deciduous willows and alders, with some grasses. Wood volume per 100 meters was 0.5 m^3, with 13 pieces in the reach. A total of 20 units were surveyed in Reach 1, with the majority of the habitat unit types being glides and lateral scour pools. There were only 2 riffle units found in Reach 1, and they represented a wetted habitat area of just 30 m^2. The substrate for Reach 1 was mostly fines composed of sand and silt (83%), with the remainder gravel (18%) and cobble (1%).

Reach 2. Reach 2 contains 211 meters of primary channel habitat and 0 meters of secondary channel habitat, with a total wetted area of 530 m^2. The valley in Reach 2 is a wide active floodplain with an average active channel height of 0.5 meters, and an average width of 5.0 meters. The average unit gradient or slope for Reach 2 was low at 0.4%. Riparian vegetation is small deciduous willows and alders, with some grasses and blackberries. Wood volume per 100 meters was 0.3 m^3, with 5 pieces in the reach. A total of 6 units were surveyed in Reach 2, with only glides and lateral scour pools providing habitat. There were no riffles found in Reach 2. The substrate for Reach 2 was mostly fines composed of sand and silt (86%), with remainder gravel (8%) and cobble (7%).

Reach 3. Reach 3 contains 190 meters of primary channel habitat and 40 meters of secondary channel habitat, with a total wetted area of 596 m^2. The valley in Reach 3 is a wide active floodplain with an average active channel height of 0.4 meters, and an average width of 9.0 meters. The average unit gradient or slope for Reach 3 was very low at 0.1%. Riparian

vegetation is small deciduous willows and alders with wetland grasses like sedges and rushes. Wood volume per 100 meters was 0.9 m^3, with 14 pieces in the reach. A total of 6 units were surveyed in Reach 3, with the majority of habitat consisting of glides and lateral scour pools. There were no riffles found in Reach 3, but there was one abandoned culvert that Pony Creek flows through approximately 75 meters before the end of the reach. The substrate for Reach 3 was mostly fines composed of sand and silt (97%), with the remainder gravel (3%).

Reach 4. Reach 4 contains 282 meters of primary channel habitat and 0 meters of secondary channel habitat, with a total wetted area of 591 m^2. The valley in Reach 4 is a wide active floodplain with an average active channel height of 0.5 meters, and an average width of 3.5 meters. The average unit gradient or slope for Reach 4 was fairly low at 0.1%. Riparian vegetation is small to medium deciduous trees, ranging from alders to willows and some grasses along with blackberries. Wood volume per 100 meters was 0.2 m^3, with 8 pieces in the reach. A total of 5 units were surveyed in Reach 4, with all of the habitat units being glides and lateral scour pools. There were no riffles found in Reach 4. The substrate for Reach 4 was mostly fines composed of sand and silt (99%), with a small amount of gravel (1%).

Reach 5. Reach 5 contains 512 meters of primary channel habitat and 20 meters of secondary channel habitat, with a total wetted area of 1,432 m^2. The valley in Reach 5 is a wide active floodplain with an average active channel height of 0.5 meters, and an average width of 4.6 meters. The average unit gradient or slope for Reach 2 was low at 0.4%. Riparian vegetation is a mixed large spruce forest, with lots of small to medium deciduous trees composed of primarily alders. Other vegetation includes grasses, blackberries, and some salal. Wood volume per 100 meters is moderately high (3.1 m^3), with 52 pieces within the reach. A total of 13 units were surveyed in Reach 5, with all of the habitat being glides and lateral scour pools. There were no riffles found in Reach 5. The substrate for Reach 5 was mostly fines composed of sand and silt (96%), with the remainder gravel (2%) and cobble (1%).

Matson Creek and Tributaries. Sol Coast, with the assistance of CoosWA, conducted summer AHI surveys during October, 2012 on Matson Creek and 2 unnamed tributary streams that drain into Matson. Surveyors followed the Oregon Department of Fish and Wildlife's (ODFW) summer aquatic inventory protocols. Survey crews delineated a total of 8 survey reaches that encompass 83 individual habitat units within the Matson Creek sub-basin. These consisted of 3 mainstem reaches and another 5 reaches in two tributary streams.

Mainstem Reach 1 starts at a white survey pole near where the valley forks approximately 30 meters downstream from the start of Tributary #1 that goes up the North Arm. Mainstem Reach 2 starts near the top of the valley where the creek begins to turn south and head away from the pasture. Mainstem Reach 3 starts at the forest boundary and proceeds 47 meters before ending at a small waterfall that blocks anadromous fish migration upstream. Tributary #1 Reach 1 starts just 30 meters upstream from the start of the mainstem survey heading to the North from the

middle of the fork in the upper valley. Tributary #1 Reach 2 starts where the valley begins to narrow and alders begin to be present. Tributary #1 Reach 3 starts near the forest boundary and heads away from the valley till it ends at a bedrock slide. Tributary #3 Reach 1 starts at the junction with the mainstem near the upper end of the right fork in the valley following the power lines. Tributary #3 Reach 2 heads up the left valley of the right fork following the power lines until a debris pile in the stream is encountered.

Mainstem Reach 1. Reach 1 contains 1,002 meters of primary channel habitat and another 139 meters of secondary channel habitat, with a total wetted area of 1,864 m^2 surveyed. The valley had a wide active floodplain with an average active channel height of 0.5 meters, and an average width of 2.8 meters. The average unit gradient or slope was at 1.5%. Riparian vegetation was mostly sedges, perennial grasses, and ferns with a small amount of cascara. Wood volume per 100 meters was 5.0 m^3, with 57 pieces in the reach. A total of 28 units were surveyed, including riffles, straight scour pools, and glides representing a majority of the habitat unit types. There were 11 riffle units in reach 1, totaling 616 m^2 of wetted habitat. The substrate was mostly fines composed of sand and silt (79%), with the remainder gravel (19%) and cobble (2%). There were four tributaries in this reach; 2 on the left side of the creek and 2 on the right side. The stream cuts across the valley shortly after Tributary #1; power lines cross over much of the stream in this reach. Elk trails and small fish were sighted.

Mainstem Reach 2. Reach 2 contains 203 meters of primary channel habitat—and no secondary channel habitat— with a total wetted area of 323 m^2. The valley was broad with constraining terraces. The average active channel height was 0.5 meters, and the average width was 2.7 meters. The average unit gradient or slope was at 1.6%. Salmonberry, elderberry, and alders made up the majority of the riparian vegetation. Wood volume per 100 meters was 8.3 m^3, with 22 pieces found within the reach. Of the eight habitat units in reach 2; riffles and lateral scour pools were the only types. There were 5 riffles in this reach, with a total area of 261 m^2. The majority of the substrate was sand and gravel (62%) with the remainder silt and organics (24%) and cobble (9%). There was one tributary on the right in this reach. A riparian transect was conducted about 40 meters after the start of reach two. The average number of trees within a 5 m wide band was 6 hardwoods and 0 conifers. Elk tracks and juvenile salmonids were observed.

Mainstem Reach 3. Reach 3 contains 47 meters of primary channel habitat and 0 meters of secondary channel habitat, with a total wetted area surveyed of 98 m^2. The valley was narrow with an open V-shape. The average active channel height was 0.7 meters, and the average width was 2.2 m. The average unit gradient or slope was moderate at 6.3%. Riparian vegetation was mostly salmonberry, herbs, ferns, and deciduous trees; such as maple and alder. Wood volume per 100 meters was 30.4 m^3, consisting of 4 pieces. A total of 6 units were delineated in the reach, with the majority being composed of riffles and lateral scour pools. There were two riffles comprising 26 m^2 of surface area. Substrate was mostly gravel (28%) and bedrock (28%) with

the remainder silt and organics (13%), sand (23%), and cobble (9%). No tributaries entered the mainstem of Matson Creek in Reach 3.

Tributary #1 Reach 1. Reach 1 of Tributary #1 contains 656 meters of primary channel habitat and another 176 meters of secondary channel habitat, with a total wetted area of 974 m^2. The valley has a wide active floodplain. The average active channel height was 0.2 meters, and the average width was 5.0 meters. The average unit gradient or slope was at 0.8%. Riparian vegetation was mostly sedges, perennial grasses, ferns, and myrtle trees. Wood volume per 100 meters was 4.9 m^3, comprising 15 pieces. Of the 17 units delineated in Reach 1, riffles and glides represented a majority of the habitat unit types. There are 5 riffles with a total of 78 m^2 of wetted habitat. The substrate was mostly fines composed of sand and silt (97%), with the remainder gravel (3%). There were three tributaries that entered in this reach; two on the right side of the stream and one on the left. Frogs, small fish, newts, and elk tracks were observed in this reach.

Tributary #1 Reach 2. Reach 2 of Tributary #1 contains 260 meters of primary channel habitat—and no secondary channel habitat—with a total wetted area of 221 m^2. The valley is broad with constraining terraces with an average active channel height of 0.3 meters, and an average width of 1.5 meters. The average channel slope is 2.4%. Salmonberry and alders make up the majority of riparian vegetation. Wood volume per 100 meters was 5.1m^3, with 31 pieces found in the reach. Of the 7 units delineated; the 4 riffles were the majority and covered 197 m^2 of surface area. The majority of the substrate was silt and sand (85%), with the remainder gravel (15%). No tributaries enter in this reach. Elk tracks and small fish were sighted.

Tributary #1 Reach 3. Reach 3 of Tributary #1 contains 66 meters of primary channel habitat and 0 meters of secondary channel habitat, with a total wetted area surveyed of 65 m^2. The valley is narrow with a moderate V-shape. Average active channel height is 0.2 meters, and the average width is 1.0m. The average unit gradient is 8.9%. Riparian vegetation is mostly salmonberry and alders. Wood volume per 100 meters is 7.5m^3, with 5 pieces within the reach. Two habitat units were delineated in the reach, containing one riffle and one cascade over bedrock. The riffle unit had a total surface area of 35m^2. The cascade over bedrock was a potential barrier to fish and the thus formed the upper end of the survey. The majority of the substrate was bedrock (50%) with the remainder fines (20%), gravel (25%), and cobble (5%).

Tributary #3 Reach 1. Reach 1 of Tributary #3 contains 396 meters of primary channel habitat and 0 meters of secondary channel habitat, comprising a total wetted surface area of 800 m^2. The valley has a wide active floodplain. Average active channel height is 0.3 meters, and the average width is 3.1 meters. Average stream gradient is 1.5%. Riparian vegetation is mostly sedges, perennial grasses, and ferns. Wood volume per 100 meters is 6.0 m^3, with 15 pieces in the reach. Riffles were the majority of the 10 habitat units delineated in the reach. The 4 riffles in this reach have a total surface area of 200 m^2. The majority of the substrate is fines (82%) with the remainder gravel (9%) and bedrock (10%).

Tributary #3 Reach 2. Reach 2 of Tributary #3 contains 82 meters of primary channel habitat and 24 meters of secondary channel habitat; with a total wetted surface area of 85 m^2. The valley is broad with constraining terraces with an average active channel height of 0.3 meters, and an average width of 3.0 meters. Average stream slope is 1.4%. Salmonberry and alders make up the majority of the riparian vegetation. Wood volume per 100 meters is 10.2 m^3, with 5 pieces in the reach. Five habitat units were delineated in reach 2, with the 2 riffles comprising the majority. These riffles have a total surface area of 40 m^2. The majority of the substrate was silt and sand (92%), with the remainder gravel (8%). No tributaries entered Tributary #3 in this reach.

Summary Tables.

Table 1. Large Wood Analysis per 100 meters of stream.

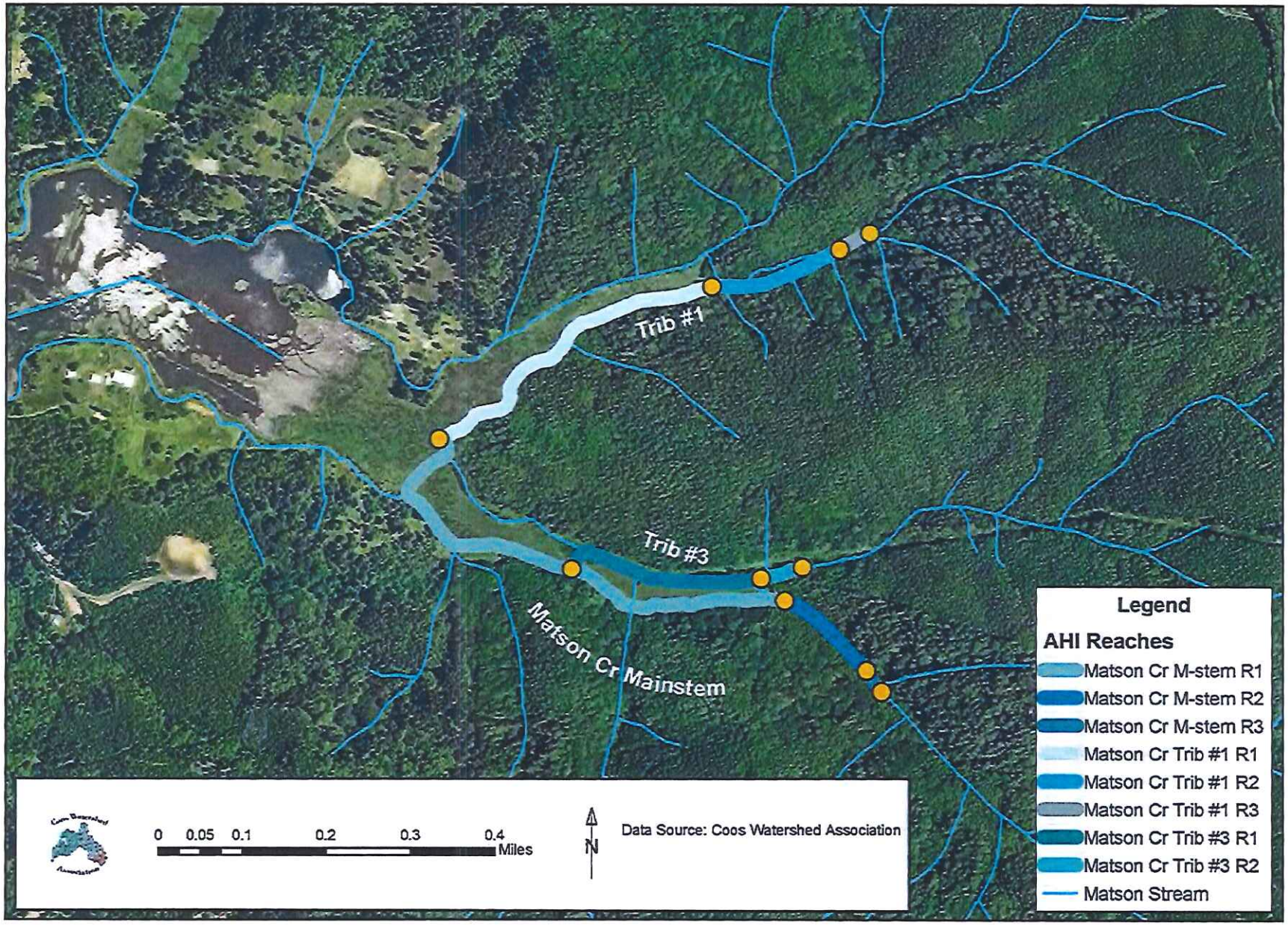
Survey name	Reach	# of Pieces	Wood Volume	# of Key Pieces
Pony Creek	1	3.4	0.5	0
	2	2.4	0.3	0
	3	7.4	0.9	0
	4	2.8	0.2	0
	5	10.2	3.1	0.2
Matson Creek Mainstem	1	5.7	5	0.2
	2	10.9	8.3	0
	3	8.5	30.4	2.1
Matson Creek Tributary #1	1	2.3	4.9	0.5
	2	11.9	5.1	0
	3	7.6	7.5	0
Matson Creek Tributary #3	1	3.8	6	0.3
	2	6.2	10.2	0

Table 2. Substrate Composition per Reach.

Survey name	Reach	% Silt/Organics	% Sand	% Gravel	% Cobble	% Boulders	% Bedrock
Pony Creek	1	9	74	16	1	0	0
	2	8	78	8	7	0	0
	3	10	88	3	0	0	0
	4	9	90	1	0	0	0
	5	11	86	2	1	0	0
Matson Creek Mainstem	1	46	29	19	2	0	4
	2	24	38	29	9	0	0
	3	13	23	28	9	0	28
Matson Creek Tributary #1	1	60	37	3	0	0	0
	2	44	41	16	0	0	0
	3	10	10	25	5	0	50
Matson Creek Tributary #3	1	56	26	9	0	0	10
	2	52	40	8	0	0	0

Conclusions.

The aquatic habitat inventories of Pony Creek and the Matson Creek basin quantify habitat values in both systems to indicate what types of habitats presently exist in Pony Creek that would be affected by reductions in non-summer flows, and where these values can be created in Matson Creek as mitigation for these losses. Two areas that immediately emerge from a cursory analysis are the broad channels with connection to the floodplain that exist in Pony Creek but can be replaced in Matson by meandering channels, additional large wood placement, and planting of willows and other deciduous trees that will encourage beavers to establish colonies and flood areas (a critical missing habitat type); and additional plantings at Matson that will replicate the spruce riparian areas in Reach 5 of Pony Creek with the idea of developing spruce bogs (another rare habitat type). Exact determination of existing and replacement values, and design of the mitigation features, will be conducted in subsequent Tasks under CoosWA's contract with the Water Board.


Trib #1
Trib #3
Matson Cr Mainstem
Legend
AHI Reaches
Matson Cr M-stem R1
Matson Cr M-stem R2
Matson Cr M-stem R3
Matson Cr Trib #1 R1
Matson Cr Trib #1 R2
Matson Cr Trib #1 R3
Matson Cr Trib #3 R1
Matson Cr Trib #3 R2
Matson Stream
0 0.05 0.1 0.2 0.3 0.4
Miles
N
Data Source: Coos Watershed Association

OREGON DEPARTMENT OF FISH AND WILDLIFE **MATSON**

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 10/11/2012

REACH 1 **T00I-R00I-S00II** **REACH 1**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	0%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	100%

Valley Width Index 24.8 VWI Range: 23 - 26.5

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	100%
Bedrock	0%	Multiple Channel	0%
Terrace	0%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	1,002	1,456	0
Secondary	139	108	0

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 2	First Terrace *n* = 0
Width:	1.4	Width:	2.8	55.0 (54 - 56)	(- 0)
Depth:	0.24	Height:	0.5	1.0 (0.8 - 1.1)	(- 0)

W:D ratio: 6.0
Entrenchment (ACW:FPW ratio): 19.8
Stream Flow Type: LF
Habitat Units/100m (total channel length): 2.5
Average Unit Gradient: 1.5%
Habitat Units/100m (primary channel length): 2.8
Water temperature (°C): 52.0 - 52.0

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	WL	RR
Riparian Vegetation:	P	G

Bank Condition and Shade

Bank Status	Percent Reach Length	Shade (% of 180)
Actively Eroding:		Reach avg: 55%
Undercut Banks:	0%	Range: 8 - 100

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	57	5.7
Volume (m^3):	50	5.0
Key pieces (>=12m x 0.60m):	2	0.2

OREGON DEPARTMENT OF FISH AND WILDLIFE — MATSON

HABITAT INVENTORY — Report Date: 5/19/2014 — Survey Date: 10/11/2012

REACH 2 — **T00I-R00I-S00II** — **REACH 2**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	100%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index 12.5 VWI Range: 12.5 - 12.5

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	100%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	0%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	203	323	0
Secondary	1	0	0

Channel Dimensions (m)

Wetted		Active		Floodprone n = 1		First Terrace n = 1	
Width:	1.6	Width:	2.7	4.2	(4.2 - 4.2)	9.0	(9 - 9)
Depth:	0.14	Height:	0.5	1.0	(1 - 1)	1.5	(1.5 - 1.5)

W:D ratio: 5.3
Entrenchment (ACW:FPW ratio): 1.6
Stream Flow Type: LF
Habitat Units/100m (total channel length): 3.9
Average Unit Gradient: 1.6%
Habitat Units/100m (primary channel length): 4.0
Water temperature (°C): 51.0 - 51.0

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	NU	ST
Riparian Vegetation:	S	P

Bank Condition and Shade

Bank Status	Percent Reach Length	Shade (% of 180)
Actively Eroding:		Reach avg: 93%
Undercut Banks:	4%	Range: 69 - 100

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	22	10.9
Volume (m^3):	17	8.3
Key pieces (>=12m x 0.60m):	0	0.0

REACH 3 T00L-R00L-S00II REACH 3

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	0%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	100%	Wide Floodplain	0%

Valley Width Index 3.4 VWI Range: 3.4 - 3.4

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	100%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	0%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	47	98	0
Secondary	0	0	0

Channel Dimensions (m)

Wetted	Active	Floodprone n = 1	First Terrace n = 0
Width: 2.1	Width: 2.2	5.5 (5.5 - 5.5)	(- 0)
Depth: 0.20	Height: 0.7	1.4 (1.4 - 1.4)	(- 0)

W:D ratio: 3.1 Entrenchment (ACW:FPW ratio): 2.5
Stream Flow Type: LF Habitat Units/100m (total channel length): 12.7
Average Unit Gradient: 6.3% Habitat Units/100m (primary channel length): 12.7
Water temperature (°C): 51.0 - 51.0

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	NU	ST
Riparian Vegetation:	S	P

Bank Condition and Shade

Bank Status	Percent Reach Length	Shade (% of 180)
Actively Eroding:		Reach avg: 96%
Undercut Banks:	6%	Range: 89 - 100

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	4	8.5
Volume (m^3):	14	30.4
Key pieces (>=12m x 0.60m):	1	2.1

OREGON DEPARTMENT OF FISH AND WILDLIFE **MATSON**

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 10/11/2012

REACH 1 **T00I-R00I-S00II** **REACH 1**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)	Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
GLIDE	6	323	1.3	0.37	420	0	76	22	3	0	0	0
POOL-LATERAL SCOUR	3	60	1.7	0.32	94	0	47	37	17	0	0	0
POOL-PLUNGE	1	5	1.4	0.35	7	0	85	10	5	0	0	0
POOL-STRAIGHT SCOUR	6	171	2.1	0.38	427	0	76	22	3	0	0	0
RIFFLE	11	582	1.0	0.09	616	0	14	39	41	6	0	0
STEP/BEDROCK	1	0	0.8	0.01	0	0	0	0	0	0	0	100
Total:	28	1,140	1.4	0.24	1,563	0	**Avg:** 46	29	19	2	0	4

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Percent	Large Boulders Number	(# / $100m^2$)
Dammed & BW Pools	0	0			0	0.00%	0	0.0
Scour Pools	10	236	1.9	0.36	528	33.78%	0	0.0
Glides	6	323	1.3	0.37	420	26.83%	0	0.0
Riffles	11	582	1.0	0.09	616	39.37%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	1	0	0.8	0.01	0	0.01%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	10	8.8	10.0
Pools >=1m deep:	0	0.0	0.0
Complex pools (LWD pieces>=3):	1	0.9	1.0
Pool frequency (channel widths/pool):	40.7		
Residual pool depth (avg):	0.27		

OREGON DEPARTMENT OF FISH AND WILDLIFE **MATSON**

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 10/11/2012

REACH 2 **T00I-R00I-S00II** **REACH 2**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
POOL-LATERAL SCOUR	3	30	2.1	0.30	62	0		48	40	8	3	0	0
RIFFLE	5	174	1.2	0.04	261	0		10	36	42	12	0	0
Total:	8	204	1.6	0.14	323	0	**Avg:**	24	38	29	9	0	0

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / $100m^2$)
Dammed & BW Pools	0	0			0	0.00%	0	0.0
Scour Pools	3	30	2.1	0.30	62	19.05%	0	0.0
Glides	0	0			0	0.00%	0	0.0
Riffles	5	174	1.2	0.04	261	80.95%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	0	0			0	0.00%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	3	14.7	14.8
Pools >=1m deep:	0	0.0	0.0
Complex pools (LWD pieces>=3):	1	4.9	4.9
Pool frequency (channel widths/pool):	25.6		
Residual pool depth (avg):	0.25		

OREGON DEPARTMENT OF FISH AND WILDLIFE **MATSON**

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 10/11/2012

REACH 3 **T00L-R00L-S00II** **REACH 3**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
POOL-LATERAL SCOUR	2	20	2.6	0.33	47	0		25	45	23	8	0	0
POOL-PLUNGE	1	6	3.8	0.40	24	0		20	20	20	15	0	25
RIFFLE	2	16	1.7	0.05	26	0		3	13	53	13	0	20
STEP/COBBLE	1	5	0.3	0.03	2	0		0	0	0	0	0	100
Total:	6	47	2.1	0.20	98	0	**Avg:**	13	23	28	9	0	28

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / 100m^2)
Dammed & BW Pools	0	0			0	0.00%	0	0.0
Scour Pools	3	26	3.0	0.35	70	71.84%	0	0.0
Glides	0	0			0	0.00%	0	0.0
Riffles	2	16	1.7	0.05	26	26.62%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	1	5	0.3	0.03	2	1.54%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	3	63.6	63.6
Pools >=1m deep:	0	0.0	0.0
Complex pools (LWD pieces>=3):	0	0.0	0.0
Pool frequency (channel widths/pool):	7.2		
Residual pool depth (avg):	0.30		

STREAM SUMMARY **MATSON**

Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk	Large Boulders (#>0.5m)
42	1,391	1.5	0.22	1,984	37	30	22	4	0	6	0

Habitat Group	Wetted Area (m^2)	Percent
Dammed & BW Pools	0	0.00%
Scour Pools	660	33.26%
Glides	420	21.15%
Riffles	903	45.51%
Rapids	0	0.00%
Cascades	0	0.00%
Step/Falls	2	0.09%
Dry	0	0.00%
Culverts	0	0.00%

OREGON DEPARTMENT OF FISH AND WILDLIFE MATSON

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 10/11/2012

RIPARIAN ZONE VEGETATION SUMMARY

REACH 2 REACH 2

Summary of Riparian Zone (0-30m) 1 transects

Total hardwoods/1000	1158
Total conifers/1000 ft	0
Total conifers >20" dbh/1000 ft	0
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-meter wide band

Diameter class (cm)	Zone 1 0-10 meters		Zone 2 10 - 20 meters		Zone 3 20 - 30 meters		Zones 1-3 0-30 meters	
	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	0.0	0.0	0.0	1.0	0.0	0.0	0.0	1.0
15-30cm	0.0	1.0	0.0	4.0	0.0	5.0	0.0	10.0
30-50cm	0.0	5.0	0.0	1.0	0.0	2.0	0.0	8.0
50-90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m2	0.0	6.0	0.0	6.0	0.0	7.0	0.0	6.3

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	68	68	73
Shrub cover	70	48	38
Grass/forb cover			

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	0	50	100
High terrace	100	50	0
Low terrace	0	0	0
Floodplain	0	0	0
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	16	33	48

OREGON DEPARTMENT OF FISH AND WILDLIFE — MATSON

HABITAT INVENTORY - RIPARIAN SURVEY — 10/11/2012

Summary of Riparian Zone (0-30m) for all reaches 1 **transects**

Summary of riparian zone (0-100 feet) extrapolated to 1,000 feet along stream

Total hardwoods/1000	1158
Total conifers/1000 ft	0
Total conifers >20" dbh/1000 ft	0
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-m wide band

Diameter class (cm)	Zones 1-3 0-30 meters Conifer	Hardwood
3-15cm	0.0	1.0
15-30cm	0.0	10.0
30-50cm	0.0	8.0
50-90cm	0.0	0.0
>90cm	0.0	0.0

OREGON DEPARTMENT OF FISH AND WILDLIFE MATSON

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 0/11/2012

RIPARIAN ZONE VEGETATION

Reach 2 Reach 2

Unit	Side	Zone	Surface	Slope	Cover (percent) Canopy	Shrub	Grass		Diameter class (cm) 3-15	15-30	30-50	50-90	>90	Notes
30	LF	1	HT	12	65	60		Conifer						GPS: 43.18246 - 124.07341
								Hardwood			1			
30	LF	2	HT	1	70	55		Conifer						
								Hardwood		1				
30	LF	3	HS	26	75	40		Conifer						
								Hardwood		3	1			
30	RT	1	HT	20	70	80		Conifer						
								Hardwood		1	4			
30	RT	2	HS	65	65	40		Conifer						
								Hardwood	1	3	1			
30	RT	3	HS	70	70	35		Conifer						
								Hardwood		2	1			

Comment Summary

MATSON

REACH#	UNIT#	TYPE	CHAN	DIST. (m)	COMMENTS	NOTE ESTIMATOR	NOTE NUMERATOR
1	1	GL	01	30.5	/TJ	Survey starts at white pole	TJ#1 43.30677 -124.13120
1	2	GL	11	30.5	WL		Elk
1	3	SP	00	78		Stream cuts across valley	
1	4	GL	00	102.5	WL		Elk
1	5	SP	00	172.5		Power line cross over	
1	6	GL	00	263		Spawning survey sign	
1	7	SP	00	287.6	WL		Small fish
1	8	GL	01	396.6	TJ/, WL	TJ#2 43.18304 -124.07843	Small fish, elk
1	11	GL	00	490.6	/TJ		TJ#3
1	12	RI	01	640.6	WL	TJ#3 43.18304 -123.07665	Step over hard pan,ht =.73m
1	15	SP	00	645.6	TJ/		TJ#4 43.18263 -124.07603
1	16	RI	01	719.6	WL		Units 17-3:Elk
1	17	RI	11	719.6	WL		
1	18	RI	11	719.6	WL		
1	19	SP	00	727.1	WL		
1	20	RI	00	773.6	WL		
1	21	LP	00	791.6	WL		Units 21-26: Small fish
1	22	RI	00	802.6	WL		
1	23	SP	00	818.6	WL		
1	24	RI	00	911.6	WL		
1	25	LP	00	945.1	WL		
1	26	RI	00	959.1	WL		
1	27	LP	00	967.6	WL		
1	28	RI	00	1001.6	WL		
2	29	RI	00	1039.6	WL		
2	30	LP	00	1052.1	WL		Riparian done
2	31	RI	00	1070.1	WL		Units 31-34: Small fish
2	32	LP	00	1074.1	WL		
2	33	RI	00	1121.1	WL		

Comment Summary

MATSON

REACH#	UNIT#	TYPE	CHAN	DIST. (m)	COMMENTS	NOTE ESTIMATOR	NOTE NUMERATOR
2	34	LP	00	1134.1	WL		
2	35	RI	01	1204.1	/TJ, WL		Juvinile salmon
2	36	RI	11	1204.1		TJ#5 43.18193 -124.07260	
3	41	PP	00	1246.3	WL		Small fish
3	42	SC	00	1251.3		43.18190 -124.07224	Waterfall over bedrock

OREGON DEPARTMENT OF FISH AND WILDLIFE **MATSON TRIB#1**

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 10/15/2012

REACH 1 **T00I-R00I-S00II** **REACH 1**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	0%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	100%

Valley Width Index 22.0 VWI Range: 22 - 22

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	100%
Bedrock	0%	Multiple Channel	0%
Terrace	0%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	656	882	0
Secondary	176	92	0

Channel Dimensions (m)

Wetted		Active		Floodprone n = 1		First Terrace n = 0	
Width:	1.3	Width:	5.0	93.0	(93 - 93)	(-0	)
Depth:	0.16	Height:	0.2	0.4	(0.4 - 0.4)	(-0	)

W:D ratio: 25.0
Entrenchment (ACW:FPW ratio): 18.6
Stream Flow Type: LF
Habitat Units/100m (total channel length): 2.0
Average Unit Gradient: 0.8%
Habitat Units/100m (primary channel length): 2.6
Water temperature (°C): 56.0 - 56.0

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	WL	RR
Riparian Vegetation:	P	G

Bank Condition and Shade

Bank Status	Percent Reach Length	Shade (% of 180)
Actively Eroding:		Reach avg: 50%
Undercut Banks:	0%	Range: 28 - 100

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	15	2.3
Volume (m^3):	32	4.9
Key pieces (>=12m x 0.60m):	3	0.5

OREGON DEPARTMENT OF FISH AND WILDLIFE **MATSON TRIB#1**

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 10/15/2012

REACH 2 **T00I-R00I-S00II** **REACH 2**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	100%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index 13.3 VWI Range: 13.3 - 13.3

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	100%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	0%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	260	221	0
Secondary	0	0	0

Channel Dimensions (m)

Wetted	Active	Floodprone *n* = 1	First Terrace *n* = 1
Width: 1.0	Width: 1.5	16.5 (16.5 - 16.5)	2.8 (2.8 - 2.8)
Depth: 0.16	Height: 0.3	0.5 (0.5 - 0.5)	0.3 (0.3 - 0.3)

W:D ratio: 6.0
Entrenchment (ACW:FPW ratio): 11.0
Stream Flow Type: LF
Habitat Units/100m (total channel length): 2.7
Average Unit Gradient: 2.4%
Habitat Units/100m (primary channel length): 2.7
Water temperature (°C): 56.0 - 56.0

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	NU	RR
Riparian Vegetation:	D15	S

Bank Condition and Shade

Bank Status	Percent Reach Length	Shade (% of 180)
Actively Eroding:		Reach avg: 100%
Undercut Banks:	5%	Range: 100 - 100

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	31	11.9
Volume (m^3):	13	5.1
Key pieces (>=12m x 0.60m):	0	0.0

OREGON DEPARTMENT OF FISH AND WILDLIFE — MATSON TRIB#1

HABITAT INVENTORY — Report Date: 5/19/2014 — Survey Date: 10/15/2012

REACH 3 — T00I-R00I-S00II — REACH 3

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	0%
Moderate V-shape	100%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index 20.0 VWI Range: 20 - 20

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	100%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	0%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	66	65	0
Secondary	0	0	0

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 1		First Terrace *n* = 1	
Width:	1.0	Width:	1.0	13.0	(13 - 13)	3.0	(3 - 3)
Depth:	0.04	Height:	0.2	0.4	(0.4 - 0.4)	0.3	(0.3 - 0.3)

W:D ratio: 5.0
Stream Flow Type: LF
Average Unit Gradient: 8.9%
Water temperature (°C): 56.0 - 56.0

Entrenchment (ACW:FPW ratio): 13.0
Habitat Units/100m (total channel length): 3.0
Habitat Units/100m (primary channel length): 3.0

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	NU	RR
Riparian Vegetation:	D15	S

Bank Condition and Shade

Bank Status	Percent Reach Length	Shade (% of 180)
Actively Eroding:		Reach avg: 100%
Undercut Banks:	3%	Range: 100 - 100

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	5	7.6
Volume (m^3):	5	7.5
Key pieces (>=12m x 0.60m):	0	0.0

OREGON DEPARTMENT OF FISH AND WILDLIFE **MATSON TRIB#1**

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 10/15/2012

REACH 1 **T00I-R00I-S00II** **REACH 1**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
GLIDE	7	521	2.1	0.13	738	0		40	53	6	0	0	0
MIX OF HABITATS	1	100	0.5	0.10	50	0		100	0	0	0	0	0
POOL-STRAIGHT SCOUR	4	91	1.2	0.38	109	0		75	25	0	0	0	0
RIFFLE	5	120	0.6	0.06	78	0		68	30	2	0	0	0
Total:	17	832	1.3	0.16	975	0	**Avg:**	60	37	3	0	0	0

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / $100m^2$)
Dammed & BW Pools	0	0			0	0.00%	0	0.0
Scour Pools	4	91	1.2	0.38	109	11.16%	0	0.0
Glides	7	521	2.1	0.13	738	75.75%	0	0.0
Riffles	5	120	0.6	0.06	78	7.96%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	0	0			0	0.00%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	4	4.8	6.1
Pools >=1m deep:	0	0.0	0.0
Complex pools (LWD pieces>=3):	0	0.0	0.0
Pool frequency (channel widths/pool):	41.6		
Residual pool depth (avg):	0.25		

OREGON DEPARTMENT OF FISH AND WILDLIFE **MATSON TRIB#1**

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 10/15/2012

REACH 2 **T00I-R00I-S00II** **REACH 2**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
POOL-LATERAL SCOUR	2	4	1.5	0.28	6	0		65	28	8	0	0	0
POOL-STRAIGHT SCOUR	1	17	1.1	0.40	19	0		90	10	0	0	0	0
RIFFLE	4	239	0.8	0.05	197	0		21	55	24	0	0	0
Total:	7	260	1.0	0.16	221	0	**Avg:**	44	41	16	0	0	0

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Percent	Large Boulders Number	(# / 100m^2)
Dammed & BW Pools	0	0			0	0.00%	0	0.0
Scour Pools	3	21	1.3	0.32	25	11.07%	0	0.0
Glides	0	0			0	0.00%	0	0.0
Riffles	4	239	0.8	0.05	197	88.93%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	0	0			0	0.00%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	3	11.5	11.5
Pools >=1m deep:	0	0.0	0.0
Complex pools (LWD pieces>=3):	0	0.0	0.0
Pool frequency (channel widths/pool):	57.8		
Residual pool depth (avg):	0.20		

OREGON DEPARTMENT OF FISH AND WILDLIFE **MATSON TRIB#1**

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 10/15/2012

REACH 3 **T00I-R00I-S00II** **REACH 3**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
CASCADE/BEDROCK	1	27	1.1	0.03	30	100		0	0	0	0	0	100
RIFFLE	1	39	0.9	0.05	35	0		20	20	50	10	0	0
Total:	2	66	1.0	0.04	65	100	**Avg:**	10	10	25	5	0	50

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Percent	Large Boulders Number	(# / $100m^2$)
Dammed & BW Pools	0	0			0	0.00%	0	0.0
Scour Pools	0	0			0	0.00%	0	0.0
Glides	0	0			0	0.00%	0	0.0
Riffles	1	39	0.9	0.05	35	54.17%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	1	27	1.1	0.03	30	45.83%	100	336.7
Step/Falls	0	0			0	0.00%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	0	0.0	0.0
Pools >=1m deep:	0	0.0	0.0
Complex pools (LWD pieces>=3):	0	0.0	0.0
Pool frequency (channel widths/pool):	0.0		
Residual pool depth (avg):			

STREAM SUMMARY **MATSON TRIB#1**

Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk	Large Boulders (#>0.5m)
26	1,158	1.2	0.15	1,261	52	36	8	0	0	4	100

Habitat Group	Wetted Area (m^2)	Percent
Dammed & BW Pools	0	0.00%
Scour Pools	133	10.57%
Glides	738	58.56%
Riffles	310	24.55%
Rapids	0	0.00%
Cascades	30	2.36%
Step/Falls	0	0.00%
Dry	0	0.00%
Culverts	0	0.00%

Comment Summary

MATSON TRIB#1

REACH#	UNIT#	TYPE	CHAN	DIST. (m)	COMMENTS	NOTE ESTIMATOR	NOTE NUMERATOR
1	1	GL	00	34	WL		Units 1-5 small fish, deer,elk
1	2	SP	00	68.5	WL		3-spined stickleback dead
1	3	GL	00	172	WL		
1	4	SP	00	204	WL		
1	5	GL	00	261	WL		
1	6	RI	01	278	TJ/, /TJ	TJ#1&2 43.18499 -124.07738	TJ#1 & #2 temp = 56
1	10	GL	01	342	/TJ		TJ#3 temp = 56
1	11	RI	11	342	WL		Rough skinned newt
1	12	SP	00	360	WL		frog
1	13	GL	00	510	WL		deer, frog
1	14	GL	00	600	WL		frog
1	15	GL	00	622	WL		elk scat, frog, newt
1	16	SP	00	628.5	WL		elk and deer
1	17	RI	00	655.5	WL		elk and deer
2	20	RI	00	804.5	WL		Units 20-23 elk
2	21	LP	00	806.5	WL		small fish
2	22	RI	00	857.5	WL		
2	23	LP	00	859.5	WL		small fish
3	26	CR	00	981.5	WL,PN		Bedrock slide. Fish barrier

OREGON DEPARTMENT OF FISH AND WILDLIFE **MATSON TRIB#3**

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 10/15/2012

REACH 1 **T26s-R12w-S22ne** **REACH 1**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	0%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	100%

Valley Width Index 17.7 VWI Range: 17.7 - 17.7

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	100%
Bedrock	0%	Multiple Channel	0%
Terrace	0%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	396	800	0
Secondary	0	0	0

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 1	First Terrace *n* = 1
Width:	1.9	Width:	3.1	46.0 (46 - 46)	5.5 (5.5 - 5.5)
Depth:	0.16	Height:	0.3	0.6 (0.6 - 0.6)	0.6 (0.6 - 0.6)

W:D ratio: 10.3
Entrenchment (ACW:FPW ratio): 14.8
Stream Flow Type: LF
Habitat Units/100m (total channel length): 2.5
Average Unit Gradient: 1.5%
Habitat Units/100m (primary channel length): 2.5
Water temperature (°C): 56.0 - 56.0

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	WL	RR
Riparian Vegetation:	P	G

Bank Condition and Shade

Bank Status	Percent Reach Length	Shade (% of 180)
Actively Eroding:		Reach avg: 65%
Undercut Banks:	1%	Range: 19 - 100

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	15	3.8
Volume (m^3):	24	6.0
Key pieces (>=12m x 0.60m):	1	0.3

OREGON DEPARTMENT OF FISH AND WILDLIFE — MATSON TRIB#3

HABITAT INVENTORY — Report Date: 5/19/2014 — Survey Date: 10/15/2012

REACH 2 — T26s-R12w-S22ne — REACH 2

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	100%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index 20.0 VWI Range: 20 - 20

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	100%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	0%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	81	78	0
Secondary	24	7	0

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 1	First Terrace *n* = 1
Width:	1.1	Width:	3.0	50.0 (50 - 50)	4.0 (4 - 4)
Depth:	0.17	Height:	0.3	0.5 (0.5 - 0.5)	0.5 (0.5 - 0.5)

W:D ratio: 12.0
Entrenchment (ACW:FPW ratio): 16.7
Stream Flow Type: LF
Habitat Units/100m (total channel length): 4.8
Average Unit Gradient: 1.4%
Habitat Units/100m (primary channel length): 6.2
Water temperature (°C): 56.0 - 56.0

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	NU	RR
Riparian Vegetation:	D15	S

Bank Condition and Shade

Bank Status	Percent Reach Length	Shade (% of 180)
Actively Eroding:		Reach avg: 97%
Undercut Banks:	0%	Range: 86 - 100

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	5	6.2
Volume (m^3):	8	10.2
Key pieces (>=12m x 0.60m):	0	0.0

OREGON DEPARTMENT OF FISH AND WILDLIFE **MATSON TRIB#3**

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 10/15/2012

REACH 1 **T26s-R12w-S22ne** **REACH 1**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)	Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
GLIDE	1	56	1.3	0.10	73	0	60	40	0	0	0	0
POOL-LATERAL SCOUR	1	5	1.4	0.40	6	0	90	10	0	0	0	0
POOL-PLUNGE	2	56	5.0	0.20	436	0	93	5	3	0	0	0
POOL-STRAIGHT SCOUR	1	50	1.7	0.50	84	0	70	30	0	0	0	0
RIFFLE	4	231	0.9	0.05	200	0	38	41	21	0	0	0
STEP/BEDROCK	1	0	0.8	0.01	0	0	0	0	0	0	0	100
Total:	10	396	1.9	0.16	800	0	**Avg:** 56	26	9	0	0	10

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / $100m^2$)
Dammed & BW Pools	0	0			0	0.00%	0	0.0
Scour Pools	4	110	3.3	0.33	527	65.85%	0	0.0
Glides	1	56	1.3	0.10	73	9.10%	0	0.0
Riffles	4	231	0.9	0.05	200	25.02%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	1	0	0.8	0.01	0	0.03%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	4	10.1	10.1
Pools >=1m deep:	0	0.0	0.0
Complex pools (LWD pieces>=3):	0	0.0	0.0
Pool frequency (channel widths/pool):	32.0		
Residual pool depth (avg):	0.28		

OREGON DEPARTMENT OF FISH AND WILDLIFE **MATSON TRIB#3**

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 10/15/2012

REACH 2 **T26s-R12w-S22ne** **REACH 2**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
MIX OF HABITATS	1	36	1.0	0.10	36	0		20	60	20	0	0	0
POOL-LATERAL SCOUR	1	2	1.9	0.30	4	0		80	20	0	0	0	0
POOL-STRAIGHT SCOUR	1	4	1.5	0.35	5	0		65	35	0	0	0	0
RIFFLE	2	63	0.6	0.05	40	0		48	43	10	0	0	0
Total:	5	104	1.1	0.17	85	0	**Avg:**	52	40	8	0	0	0

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Percent	Large Boulders Number	(# / 100m^2)
Dammed & BW Pools	0	0			0	0.00%	0	0.0
Scour Pools	2	6	1.7	0.33	9	10.62%	0	0.0
Glides	0	0			0	0.00%	0	0.0
Riffles	2	63	0.6	0.05	40	47.16%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	0	0			0	0.00%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	2	19.2	24.8
Pools >=1m deep:	0	0.0	0.0
Complex pools (LWD pieces>=3):	1	9.6	12.4
Pool frequency (channel widths/pool):	17.3		
Residual pool depth (avg):	0.29		

STREAM SUMMARY **MATSON TRIB#3**

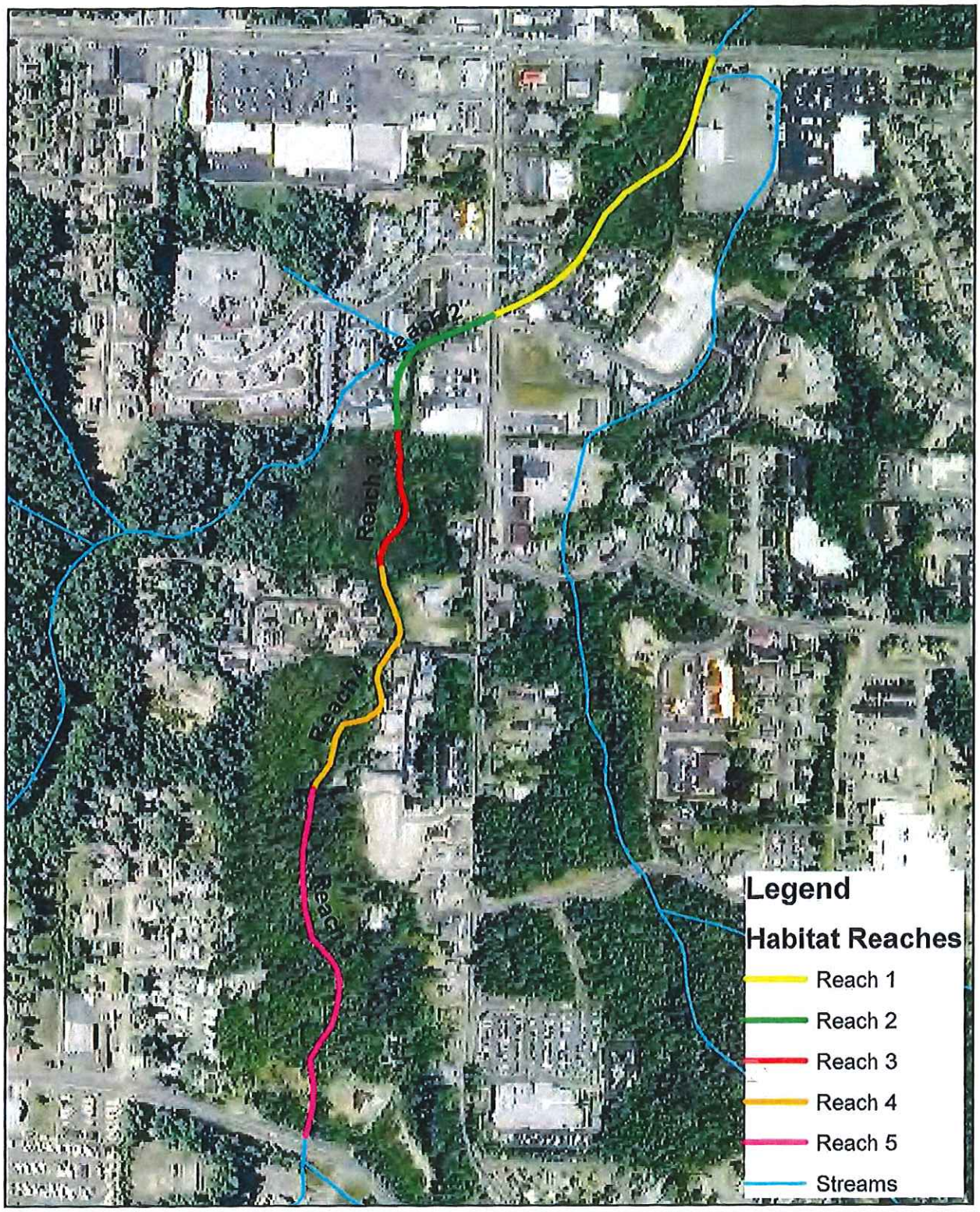
Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk	Large Boulders (#>0.5m)
15	500	1.6	0.16	885	54	30	9	0	0	7	0

Habitat Group	Wetted Area (m^2)	Percent
Dammed & BW Pools	0	0.00%
Scour Pools	536	60.53%
Glides	73	8.23%
Riffles	240	27.16%
Rapids	0	0.00%
Cascades	0	0.00%
Step/Falls	0	0.02%
Dry	0	0.00%
Culverts	0	0.00%

Comment Summary

REACH#	UNIT#	TYPE	CHAN	DIST. (m)	COMMENTS	NOTE ESTIMATOR	NOTE NUMERATOR

Pony Creek Winter 2013 Aquatic Inventory Survey



OREGON DEPARTMENT OF FISH AND WILDLIFE **Pony Creek**

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 3/14/2013

REACH 1 **T25S-R13W-S22NW** **REACH 1**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	0%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	100%

Valley Width Index 4.0 VWI Range: 2.8 - 5.2

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	0%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	100%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	382	1,103	0
Secondary	34	72	0

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 2	First Terrace *n* = 1
Width:	2.9	Width:	3.2	10.3 (3.5 - 17)	4.7 (4.7 - 4.7)
Depth:	0.61	Height:	0.4	0.7 (0.6 - 0.8)	0.9 (0.9 - 0.9)

W:D ratio: 8.9 Entrenchment (ACW:FPW ratio): 2.9

Stream Flow Type: MF Habitat Units/100m (total channel length): 4.8

Average Unit Gradient: 0.4% Habitat Units/100m (primary channel length): 5.2

Water temperature (°C): 51.0 - 51.0

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	UR	IN
Riparian Vegetation:	D15	G

Bank Condition and Shade

Bank Status	Percent Reach Length	Shade (% of 180)
Actively Eroding:	2%	Reach avg: 41%
Undercut Banks:	1%	Range: 23 - 75

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	13	3.4
Volume (m^3):	2	0.5
Key pieces (>=12m x 0.60m):	0	0.0

OREGON DEPARTMENT OF FISH AND WILDLIFE **Pony Creek**

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 3/14/2013

REACH 2 **T25S-R13W-S21NE** **REACH 2**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	0%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	100%

Valley Width Index 7.0 VWI Range: 7 - 7

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	0%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	100%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	211	530	0
Secondary	0	0	0

Channel Dimensions (m)

Wetted		Active		Floodprone n = 1	First Terrace n = 1
Width:	2.6	Width:	5.0	7.0 (7 - 7)	10.0 (10 - 10)
Depth:	0.75	Height:	0.5	1.0 (1 - 1)	2.0 (2 - 2)

W:D ratio: 10.0 Entrenchment (ACW:FPW ratio): 1.4

Stream Flow Type: MF Habitat Units/100m (total channel length): 2.8

Average Unit Gradient: 0.4% Habitat Units/100m (primary channel length): 2.8

Water temperature (°C): 51.0 - 51.0

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	IN	UR
Riparian Vegetation:	D15	G

Bank Condition and Shade

Bank Status	Percent Reach Length	Shade (% of 180)
Actively Eroding:	2%	Reach avg: 51%
Undercut Banks:	0%	Range: 42 - 100

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	5	2.4
Volume (m^3):	1	0.3
Key pieces (>=12m x 0.60m):	0	0.0

OREGON DEPARTMENT OF FISH AND WILDLIFE **Pony Creek**

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 3/18/2013

REACH 3 **T25S-R13W-S21NE** **REACH 3**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	0%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	100%

Valley Width Index 10.0 VWI Range: 10 - 10

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	100%
Bedrock	0%	Multiple Channel	0%
Terrace	0%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	190	536	0
Secondary	40	60	0

Channel Dimensions (m)

Wetted	Active	Floodprone n = 1	First Terrace n = 0
Width: 2.4	Width: 9.0	14.0 (14 - 14)	(-0)
Depth: 0.86	Height: 0.4	0.7 (0.7 - 0.7)	(-0)

W:D ratio: 25.7
Entrenchment (ACW:FPW ratio): 1.6
Stream Flow Type: MF
Habitat Units/100m (total channel length): 2.6
Average Unit Gradient: 0.1%
Habitat Units/100m (primary channel length): 3.2
Water temperature (°C): 50.0 - 50.0

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	WL	UR
Riparian Vegetation:	S	G

Bank Condition and Shade

Bank Status	Percent Reach Length	Shade (% of 180)
Actively Eroding:	2%	Reach avg: 59%
Undercut Banks:	1%	Range: 25 - 100

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	14	7.4
Volume (m^3):	2	0.9
Key pieces (>=12m x 0.60m):	0	0.0

OREGON DEPARTMENT OF FISH AND WILDLIFE — Pony Creek

HABITAT INVENTORY — Report Date: 5/19/2014 — Survey Date: 3/18/2013

REACH 4 — T25S-R13W-S21EE — REACH 4

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	0%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	100%

Valley Width Index 5.0 VWI Range: 5 - 5

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	0%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	100%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	282	591	0
Secondary	0	0	0

Channel Dimensions (m)

Wetted	Active	Floodprone *n* = 1	First Terrace *n* = 1
Width: 2.1	Width: 3.5	6.0 (6 - 6)	7.0 (7 - 7)
Depth: 1.02	Height: 0.5	0.9 (0.9 - 0.9)	1.2 (1.2 - 1.2)

W:D ratio: 7.8
Entrenchment (ACW:FPW ratio): 1.7
Stream Flow Type: MF
Habitat Units/100m (total channel length): 1.8
Average Unit Gradient: 0.1%
Habitat Units/100m (primary channel length): 1.8
Water temperature (°C): 52.0 - 52.0

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	RR	IN
Riparian Vegetation:	D15	G

Bank Condition and Shade

Bank Status	Percent Reach Length	Shade (% of 180)
Actively Eroding:	3%	Reach avg: 60%
Undercut Banks:	3%	Range: 50 - 72

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	8	2.8
Volume (m^3):	0	0.2
Key pieces (>=12m x 0.60m):	0	0.0

OREGON DEPARTMENT OF FISH AND WILDLIFE **Pony Creek**
HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 3/18/2013

REACH 5 **T25S-R13W-S21SE** **REACH 5**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	0%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	100%

Valley Width Index 5.3 VWI Range: 4.6 - 6

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	100%
Bedrock	0%	Multiple Channel	0%
Terrace	0%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	512	1,416	0
Secondary	20	16	0

Channel Dimensions (m)

Wetted		Active		Floodprone n = 2		First Terrace n = 2	
Width:	2.7	Width:	4.6	5.5	(5.5 - 5.5)	7.2	(7 - 7.4)
Depth:	0.65	Height:	0.5	0.9	(0.8 - 1)	1.1	(1 - 1.1)

W:D ratio: 10.3
Stream Flow Type: MF
Average Unit Gradient: 0.4%
Water temperature (°C): 52.0 - 52.0
Entrenchment (ACW:FPW ratio): 1.2
Habitat Units/100m (total channel length): 2.4
Habitat Units/100m (primary channel length): 2.5

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	ST	RR
Riparian Vegetation:	C50	G

Bank Condition and Shade

Bank Status	Percent Reach Length	Shade (% of 180)
Actively Eroding:	3%	Reach avg: 54%
Undercut Banks:	3%	Range: 42 - 86

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	52	10.2
Volume (m^3):	16	3.1
Key pieces (>=12m x 0.60m):	1	0.2

OREGON DEPARTMENT OF FISH AND WILDLIFE **Pony Creek**

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 3/14/2013

REACH 1 **T25S-R13W-S22NW** **REACH 1**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)	Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
GLIDE	10	205	2.7	0.48	541	0	9	78	13	1	0	0
POOL-BACKWATER	1	11	5.3	0.15	58	0	20	80	0	0	0	0
POOL-LATERAL SCOUR	7	186	3.0	0.96	545	0	9	81	8	2	0	0
RIFFLE	2	14	2.2	0.30	30	0	5	23	70	3	0	0
Total:	20	416	2.9	0.61	1,175	0	**Avg:** 9	74	16	1	0	0

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / $100m^2$)
Dammed & BW Pools	1	11	5.3	0.15	58	4.96%	0	0.0
Scour Pools	7	186	3.0	0.96	545	46.41%	0	0.0
Glides	10	205	2.7	0.48	541	46.07%	0	0.0
Riffles	2	14	2.2	0.30	30	2.56%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	0	0			0	0.00%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	8	19.3	21.0
Pools >=1m deep:	3	7.2	7.9
Complex pools (LWD pieces>=3):	1	2.4	2.6
Pool frequency (channel widths/pool):	16.5		
Residual pool depth (avg):	0.52		

OREGON DEPARTMENT OF FISH AND WILDLIFE **Pony Creek**

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 3/14/2013

REACH 2 **T25S-R13W-S21NE** **REACH 2**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
GLIDE	3	113	2.2	0.58	250	0		7	80	8	5	0	0
POOL-LATERAL SCOUR	3	98	3.0	0.92	280	0		8	75	8	8	0	0
Total:	6	211	2.6	0.75	530	0	**Avg:**	8	78	8	7	0	0

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / $100m^2$)
Dammed & BW Pools	0	0			0	0.00%	0	0.0
Scour Pools	3	98	3.0	0.92	280	52.80%	0	0.0
Glides	3	113	2.2	0.58	250	47.20%	0	0.0
Riffles	0	0			0	0.00%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	0	0			0	0.00%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	3	14.2	14.2
Pools >=1m deep:	1	4.7	4.7
Complex pools (LWD pieces>=3):	0	0.0	0.0
Pool frequency (channel widths/pool):	14.1		
Residual pool depth (avg):	0.43		

OREGON DEPARTMENT OF FISH AND WILDLIFE — Pony Creek

HABITAT INVENTORY — Report Date: 5/19/2014 — Survey Date: 3/18/2013

REACH 3 — **T25S-R13W-S21NE** — **REACH 3**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
CULVERT CROSSING	1	5	1.6	1.00	8	0		10	80	10	0	0	0
GLIDE	2	52	2.5	0.38	102	0		10	90	0	0	0	0
POOL-LATERAL SCOUR	3	173	2.6	1.13	486	0		10	88	2	0	0	0
Total:	6	230	2.4	0.86	596	0	**Avg:**	10	88	3	0	0	0

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / $100m^2$)
Dammed & BW Pools	0	0			0	0.00%	0	0.0
Scour Pools	3	173	2.6	1.13	486	81.53%	0	0.0
Glides	2	52	2.5	0.38	102	17.13%	0	0.0
Riffles	0	0			0	0.00%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	0	0			0	0.00%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	1	5	1.6	1.00	8	1.34%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	3	13.0	15.8
Pools >=1m deep:	2	8.7	10.5
Complex pools (LWD pieces>=3):	2	8.7	10.5
Pool frequency (channel widths/pool):	8.5		
Residual pool depth (avg):	0.53		

OREGON DEPARTMENT OF FISH AND WILDLIFE **Pony Creek**

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 3/18/2013

REACH 4 **T25S-R13W-S21EE** **REACH 4**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
GLIDE	2	95	2.3	0.65	207	0		8	93	0	0	0	0
POOL-LATERAL SCOUR	3	187	2.1	1.27	384	0		10	88	2	0	0	0
Total:	5	282	2.1	1.02	591	0	**Avg:**	9	90	1	0	0	0

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / 100m^2)
Dammed & BW Pools	0	0			0	0.00%	0	0.0
Scour Pools	3	187	2.1	1.27	384	64.99%	0	0.0
Glides	2	95	2.3	0.65	207	35.01%	0	0.0
Riffles	0	0			0	0.00%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	0	0			0	0.00%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	3	10.6	10.6
Pools >=1m deep:	3	10.6	10.6
Complex pools (LWD pieces>=3):	1	3.5	3.5
Pool frequency (channel widths/pool):	26.9		
Residual pool depth (avg):	0.73		

OREGON DEPARTMENT OF FISH AND WILDLIFE — Pony Creek

HABITAT INVENTORY — Report Date: 5/19/2014 — Survey Date: 3/18/2013

REACH 5 — **T25S-R13W-S21SE** — **REACH 5**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)	Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
GLIDE	6	241	2.9	0.48	663	0	11	87	2	1	0	0
POOL-LATERAL SCOUR	7	291	2.5	0.80	769	0	11	86	3	1	0	0
Total:	13	532	2.7	0.65	1,432	0	**Avg:** 11	86	2	1	0	0

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / $100m^2$)
Dammed & BW Pools	0	0			0	0.00%	0	0.0
Scour Pools	7	291	2.5	0.80	769	53.68%	0	0.0
Glides	6	241	2.9	0.48	663	46.32%	0	0.0
Riffles	0	0			0	0.00%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	0	0			0	0.00%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	7	13.2	13.7
Pools >=1m deep:	2	3.8	3.9
Complex pools (LWD pieces>=3):	5	9.4	9.8
Pool frequency (channel widths/pool):	16.7		
Residual pool depth (avg):	0.43		

STREAM SUMMARY **Pony Creek**

Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk	Large Boulders (#>0.5m)
50	1,671	2.7	0.71	4,323	9	81	8	2	0	0	0

Habitat Group	Wetted Area (m^2)	Percent
Dammed & BW Pools	58	1.35%
Scour Pools	2,463	56.98%
Glides	1,763	40.79%
Riffles	30	0.70%
Rapids	0	0.00%
Cascades	0	0.00%
Step/Falls	0	0.00%
Dry	0	0.00%
Culverts	8	0.19%

OREGON DEPARTMENT OF FISH AND WILDLIFE — Pony Creek

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 3/14/2013

RIPARIAN ZONE VEGETATION SUMMARY

REACH 1 — REACH 1

Summary of Riparian Zone (0-30m) 2 transects

Total hardwoods/1000	610
Total conifers/1000 ft	0
Total conifers >20" dbh/1000 ft	0
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-meter wide band

Diameter class (cm)	Zone 1 0-10 meters		Zone 2 10 - 20 meters		Zone 3 20 - 30 meters		Zones 1-3 0-30 meters	
	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	0.0	4.0	0.0	2.5	0.0	1.5	0.0	8.0
15-30cm	0.0	0.0	0.0	0.5	0.0	0.5	0.0	1.0
30-50cm	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0
50-90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m2	0.0	4.0	0.0	3.0	0.0	3.0	0.0	3.3

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	30	20	28
Shrub cover	16	8	13
Grass/forb cover	84	68	38

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	0	0	25
High terrace	25	25	25
Low terrace	75	50	0
Floodplain	0	0	0
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	0	25	50
Riprap	0	0	0
Surface slope (%)	8	3	8

OREGON DEPARTMENT OF FISH AND WILDLIFE — Pony Creek

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 3/14/2013

RIPARIAN ZONE VEGETATION SUMMARY

REACH 2 — REACH 2

Summary of Riparian Zone (0-30m) 1 transects

Total hardwoods/1000	975
Total conifers/1000 ft	0
Total conifers >20" dbh/1000 ft	0
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-meter wide band

Diameter class (cm)	Zone 1 0-10 meters		Zone 2 10 - 20 meters		Zone 3 20 - 30 meters		Zones 1-3 0-30 meters	
	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	0.0	6.0	0.0	0.0	0.0	2.0	0.0	8.0
15-30cm	0.0	4.0	0.0	0.0	0.0	3.0	0.0	7.0
30-50cm	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0
50-90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m2	0.0	11.0	0.0	0.0	0.0	5.0	0.0	5.3

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	43	15	15
Shrub cover	43	40	40
Grass/forb cover	58	60	60

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	100	0	0
High terrace	0	50	50
Low terrace	0	50	50
Floodplain	0	0	0
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	35	2	3

OREGON DEPARTMENT OF FISH AND WILDLIFE — Pony Creek

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 3/18/2013

RIPARIAN ZONE VEGETATION SUMMARY

REACH 3 — REACH 3

Summary of Riparian Zone (0-30m) 1 transects

Total hardwoods/1000	549
Total conifers/1000 ft	0
Total conifers >20" dbh/1000 ft	0
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-meter wide band

Diameter class (cm)	Zone 1 0-10 meters Conifer	Zone 1 0-10 meters Hardwood	Zone 2 10 - 20 meters Conifer	Zone 2 10 - 20 meters Hardwood	Zone 3 20 - 30 meters Conifer	Zone 3 20 - 30 meters Hardwood	Zones 1-3 0-30 meters Conifer	Zones 1-3 0-30 meters Hardwood
3-15cm	0.0	0.0	0.0	3.0	0.0	1.0	0.0	4.0
15-30cm	0.0	0.0	0.0	2.0	0.0	2.0	0.0	4.0
30-50cm	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0
50-90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m2	0.0	0.0	0.0	5.0	0.0	4.0	0.0	3.0

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	5	5	10
Shrub cover	25	18	20
Grass/forb cover	75	83	80

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	0	0	0
High terrace	0	0	0
Low terrace	100	100	100
Floodplain	0	0	0
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	6	5	5

OREGON DEPARTMENT OF FISH AND WILDLIFE — Pony Creek

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 3/18/2013

RIPARIAN ZONE VEGETATION SUMMARY

REACH 4 — REACH 4

Summary of Riparian Zone (0-30m) 1 transects

Total hardwoods/1000	610
Total conifers/1000 ft	61
Total conifers >20" dbh/1000 ft	0
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-meter wide band

Diameter	Zone 1 0-10 meters		Zone 2 10 - 20 meters		Zone 3 20 - 30 meters		Zones 1-3 0-30 meters	
class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	0.0	0.0	0.0	3.0	0.0	1.0	0.0	4.0
15-30cm	0.0	0.0	0.0	2.0	1.0	2.0	1.0	4.0
30-50cm	0.0	1.0	0.0	1.0	0.0	0.0	0.0	2.0
50-90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m2	0.0	1.0	0.0	6.0	1.0	3.0	0.3	3.3

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	65	68	60
Shrub cover	50	65	65
Grass/forb cover	50	35	35

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	100	0	50
High terrace	0	100	50
Low terrace	0	0	0
Floodplain	0	0	0
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	18	5	19

OREGON DEPARTMENT OF FISH AND WILDLIFE — Pony Creek

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 3/18/2013

RIPARIAN ZONE VEGETATION SUMMARY

REACH 5 **REACH 5**

Summary of Riparian Zone (0-30m) 2 transects

Total hardwoods/1000	274
Total conifers/1000 ft	30
Total conifers >20" dbh/1000 ft	30
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-meter wide band

Diameter class (cm)	Zone 1 0-10 meters		Zone 2 10 - 20 meters		Zone 3 20 - 30 meters		Zones 1-3 0-30 meters	
	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	0.0	0.5	0.0	0.5	0.0	1.5	0.0	2.5
15-30cm	0.0	0.5	0.0	1.0	0.0	0.5	0.0	2.0
30-50cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50-90cm	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m2	0.5	1.0	0.0	1.5	0.0	2.0	0.2	1.5

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	33	38	41
Shrub cover	40	50	55
Grass/forb cover	60	50	45

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	25	0	0
High terrace	0	0	0
Low terrace	75	100	100
Floodplain	0	0	0
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	5	2	2

OREGON DEPARTMENT OF FISH AND WILDLIFE — Pony Creek

HABITAT INVENTORY - RIPARIAN SURVEY — 3/14/2013

Summary of Riparian Zone (0-30m) for all reaches **7 transects**

Summary of riparian zone (0-100 feet) extrapolated to 1,000 feet along stream

Total hardwoods/1000	557
Total conifers/1000 ft	17
Total conifers >20" dbh/1000 ft	9
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-m wide band

Diameter class (cm)	Zones 1-3 0-30 meters Conifer	Hardwood
3-15cm	0.0	5.3
15-30cm	0.1	3.0
30-50cm	0.0	0.9
50-90cm	0.1	0.0
>90cm	0.0	0.0

OREGON DEPARTMENT OF FISH AND WILDLIFE — Pony Creek

HABITAT INVENTORY Report Date: 5/19/2014 — Survey Date: 3/14/2013

RIPARIAN ZONE VEGETATION

Reach 1 — Reach 1

Unit	Side	Zone	Surface	Slope	Cover (percent)				Diameter class (cm)					Notes
					Canopy	Shrub	Grass		3-15	15-30	30-50	50-90	>90	
10	LF	1	HT	12	60	30	70	Conifer						
								Hardwood	4					
10	LF	2	HT	5	40	20	80	Conifer						
								Hardwood	2					
10	LF	3	HT	4	40	20	80	Conifer						
								Hardwood	1					
10	RT	1	LT	10	50	20	80	Conifer						
								Hardwood	3					
10	RT	2	LT	3	40	10	90	Conifer						
								Hardwood	3	1				
10	RT	3	HS	27	70	30	70	Conifer						
								Hardwood	2	1	2			
20	LF	1	LT	5	0	15	85	Conifer						
								Hardwood						
20	LF	2	LT	3	0	0	100	Conifer						
								Hardwood						
20	LF	3	RB	0	0	0	0	Conifer						RB= parking lot pavement
								Hardwood						
20	RT	1	LT	4	10	0	100	Conifer						
								Hardwood	1					
20	RT	2	RB	0	0	0	0	Conifer						RB= parking lot pavement
								Hardwood						
20	RT	3	RB	0	0	0	0	Conifer						RB= parking lot pavement
								Hardwood						

OREGON DEPARTMENT OF FISH AND WILDLIFE Pony Creek

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 3/14/2013

RIPARIAN ZONE VEGETATION

Reach 2 Reach 2

					Cover (percent)				Diameter class (cm)					
Unit	Side	Zone	Surface	Slope	Canopy	Shrub	Grass		3-15	15-30	30-50	50-90	>90	Notes
26	LF	1	HS	30	50	10	90	Conifer						
								Hardwood	3	2				
26	LF	2	LT	3	30	30	70	Conifer						
								Hardwood						
26	LF	3	LT	5	30	30	70	Conifer						
								Hardwood	2	3				
26	RT	1	HS	40	35	75	25	Conifer						
								Hardwood	3	2	1			
26	RT	2	HT	0	0	50	50	Conifer						
								Hardwood						
26	RT	3	HT	0	0	50	50	Conifer						
								Hardwood						

OREGON DEPARTMENT OF FISH AND WILDLIFE Pony Creek

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 3/18/2013

RIPARIAN ZONE VEGETATION

Reach 3 Reach 3

					Cover (percent)				Diameter class (cm)					
Unit	Side	Zone	Surface	Slope	Canopy	Shrub	Grass		3-15	15-30	30-50	50-90	>90	Notes
30	LF	1	LT	5	0	20	80	Conifer						
								Hardwood						
30	LF	2	LT	7	10	15	85	Conifer						
								Hardwood						
30	LF	3	LT	5	0	10	90	Conifer						
								Hardwood						
30	RT	1	LT	7	10	30	70	Conifer						
								Hardwood						
30	RT	2	LT	3	0	20	80	Conifer						
								Hardwood	3	2				
30	RT	3	LT	4	20	30	70	Conifer						
								Hardwood	1	2	1			

OREGON DEPARTMENT OF FISH AND WILDLIFE Pony Creek

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 3/18/2013

RIPARIAN ZONE VEGETATION

Reach 4 Reach 4

					Cover (percent)				Diameter class (cm)					
Unit	Side	Zone	Surface	Slope	Canopy	Shrub	Grass		3-15	15-30	30-50	50-90	>90	Notes
36	LF	1	HS	15	70	60	40	Conifer						
								Hardwood			1			
36	LF	2	HT	5	75	70	30	Conifer						
								Hardwood	3	2	1			
36	LF	3	HS	30	70	70	30	Conifer		1				
								Hardwood	1	2				
36	RT	1	HS	20	60	40	60	Conifer						
								Hardwood						
36	RT	2	HT	5	60	60	40	Conifer						
								Hardwood						
36	RT	3	HT	7	50	60	40	Conifer						
								Hardwood						

OREGON DEPARTMENT OF FISH AND WILDLIFE Pony Creek

HABITAT INVENTORY Report Date: 5/19/2014 Survey Date: 3/18/2013

RIPARIAN ZONE VEGETATION

Reach 5 Reach 5

Unit	Side	Zone	Surface	Slope	Cover (percent) Canopy	Shrub	Grass		Diameter class (cm) 3-15	15-30	30-50	50-90	>90	Notes
40	LF	1	LT	4	20	50	50	Conifer						
								Hardwood						
40	LF	2	LT	3	30	60	40	Conifer						
								Hardwood	1	1				
40	LF	3	LT	6	45	60	40	Conifer						
								Hardwood						
40	RT	1	LT	2	20	20	80	Conifer						
								Hardwood						
40	RT	2	LT	0	25	30	70	Conifer						
								Hardwood						
40	RT	3	LT	0	40	30	70	Conifer						
								Hardwood	2					
49	LF	1	HS	10	20	30	70	Conifer				1		
								Hardwood						
49	LF	2	LT	3	15	40	60	Conifer						
								Hardwood						
49	LF	3	LT	0	0	70	30	Conifer						
								Hardwood						
49	RT	1	LT	4	70	60	40	Conifer						
								Hardwood	1	1				
49	RT	2	LT	0	80	70	30	Conifer						
								Hardwood		1				
49	RT	3	LT	0	80	60	40	Conifer						
								Hardwood	1	1				

Comment Summary

Pony Creek

REACH#	UNIT#	TYPE	CHAN	DIST. (m)	COMMENTS	NOTE ESTIMATOR	NOTE NUMERATOR
1	1	GL	00	9	CE/	Start at Newmark culvert	
1	3	GL	00	51.5	BV		Beaver slide
1	4	LP	01	88.5	BV		Beaver slide
1	6	GL	00	97.5	WL		Small dark fish(1)
1	7	LP	00	129.5			Drainage on Lt
1	10	GL	00	221.5	BV		
1	11	LP	00	234.5	BV		
1	12	GL	01	244.5		TJ#1, small, 50F, mstem=51F	
1	13	GL	11	244.5	TJ/		GPS: 43.38968 -124.23778
1	14	LP	00	304.5	BV	Parking lot on Lt and Rt	
1	17	GL	00	337.5	CE/		2 culverts in unit
1	18	LP	00	352.5		Pacific Sleep on Lt	
1	19	RI	00	359.5	CE/		
1	20	GL	00	381.5	BC, CE/CE		Culverts on both banks
2	21	LP	00	402.5	BC	Bridge over all of unit	Pool widens under bridge
2	23	LP	00	508.5	CE/, BV		
2	24	GL	00	560.5	BV	UPS store on Lt	
2	25	LP	00	573.5	BV		
2	26	GL	00	592.5	WL		Fish present
3	27	LP	01	620.5	BV	Ends at old beaver dam	
3	28	GL	11	620.5	/TJ	TJ#2, 51F, mstem=51F	GPS: 43.38744 -124.24053
3	29	GL	00	632.5	BV	Old Beaver pond type	
3	30	LP	00	702.5	BV, WL	lots of deer/elk/ducks	
3	31	CC	00	707.5		old boiler; 18", embedded	
3	32	LP	00	782.5	BV	Beaver spotted	
4	33	GL	00	852.5	BV	2 4-6" cutthroat trout	
4	34	LP	00	913.5	BC, SS/		Footbridge
4	35	LP	00	988.5	BC, WL	Small foot bridge	Cutthroat
4	36	GL	00	1013.5	BC	Small foot bridge	Footbridge

Comment Summary

Pony Creek

REACH#	UNIT#	TYPE	CHAN	DIST. (m)	COMMENTS	NOTE ESTIMATOR	NOTE NUMERATOR
5	38	GL	00	1114.5		Big Spruce trees	
5	40	GL	00	1232.5			Tire in creek
5	41	LP	00	1302.5	BV		
5	42	GL	00	1363.5	BV, WL	Lots of Elk activity	
5	45	LP	00	1469.5	BC, WL	Brushy	Footbridge, ducks
5	46	GL	00	1491.5	BV		Tire in creek
5	48	GL	00	1539.5	BV, /GS		
5	49	LP	01	1576.5	BV		
5	50	LP	11	1576.5	TJ/, WL	TJ#4 43.38050 -124.24123	43.38050 -124.24123, fish

Appendix

The Wetlands Conservancy

July 30, 2014

Rob K. Schab
Coos Bay - North Bend Water Board
2305 Ocean Boulevard
PO Box 539
Coos Bay Oregon 97420-0108

Dear Rob:

The Wetlands Conservancy is excited to once again partner with the Coos Bay - North Bend Water Board on restoration and enhancement activities at our Matson Creek Preserve. Our joint 2009 project that reestablished tidal flooding and natural drainage patterns to the preserve implemented a major part of TWC's restoration strategy and future desired conditions for the preserve. The Coos Bay – North Bend Water Board proposed fish habitat restoration project has been identified as a priority action in our Matson Creek Management Plan.

The Wetlands Conservancy's Oregon's Greatest Wetland Initiative, coastal estaury conservation and preserve management plans have provided guidance and project opportunity for other fish passage waiver and wetland mitigation needs.

We look forward to continuing our relationship with Coos Bay - North Bend Water Board to enhance the ecological functions and values at Matson Creek Preserve.

Sincerely,

Esther Lev

Esther Lev
Executive Director

VICTOR ATIYEH
GOVERNOR

OFFICE OF THE GOVERNOR
STATE CAPITOL
SALEM, OREGON 97310

November 13, 1986

District Engineer
Corps of Engineers
U. S. Army
Portland District
P. O. Box 2946
Portland, OR 97208

Att: A. J. Heineman, Chief
Navigation Division

Ref: PN 071-OYA-4-006699
Pony Creek - Dam

Dear Sir:

I approve the project subject to the conditions outlined in Material Removal/Fill Permit No. 4444 issued by the Division of State Lands.

On September 26, 1986 the Department of Environmental Quality certified there was reasonable assurance that the project, as described, would not violate applicable water quality standards.

On November 6, 1986, the Department of Land Conservation and Development certified that the project, as described, is consistent with Oregon's Coastal Management Program.

Sincerely,

Victor Atiyeh
Governor

VA:sp

cc: Coos Bay - North Bend Water Board
Ch2M Hill - Mr. Jim Fuller
Department of Environmental Quality
Department of Fish and Wildlife
Department of Land Conservation and Development
U. S. Fish and Wildlife Service
Division of State Lands

September 8, 2014

Mr. Greg Apke

ODFW Fish Passage Coordinator

3406 Cherry Avenue NE,

Salem, OR 97303

RE: Addendum to Coos Bay North Bend Water Board FISH PASSAGE WAIVER APPLICATION AT LOWER PONY CREEK DAM

Mr. Apke,

Please accept this addendum to the **FISH PASSAGE WAIVER APPLICATION AT LOWER PONY CREEK DAM** into that application file.

Page 10 **MITIGATION FUNDING (ADD "AND CONSTRUCTION TIMELINE")**

Change paragraph 1 to read as follows:

"The project constructed cost estimate is $136,000 of which full funding was approved by the applicant Board of Directors. Pending approval of this request by the ODFW Commission, the following construction timeline has been established:

December, 2014	ODFW Commission Approval
January – March, 2015	90% Design Completion
April, 2015	Request for Bids, Construction
April – June, 2015	Permitting
July – September, 2015	Construction"

Page 10 **DESCRIBE HOW THE MITIGATION WILL BE EVALUATED, MONITORED, AND MAINTAINED**

Change paragraph 1 to read as follows:

"Once completed, the mitigation will be subjected to an as-built survey to document and verify resulting stream length, placement and volumes of LWD, frequency and depth of pools and the viability of reintroduced native plantings. The as-built survey will establish photo points along the affected stream reaches in a minimum of four locations, approved by district ODFW staff, which document the persistence of LWD as well as natural stream channel morphology, and will be annually photographed for the first five years after project completion. Biological surveys will be completed to confirm multi-species salmonid presence, annually, for the first five years after project completion. Survey methodology and timing will be determined by the ODFW Charleston District biologists and may include snorkel observation, seining, trapping or electrofishing.

The mitigation is designed as a re-naturalization and will not require physical maintenance. Success criteria will be based on the completion of the prescribed restoration measures.

The land is held by the Wetland Conservancy (TWC). TWC has committed to work with the applicant to expand the existing conservation easement to encompass the extent of the above described restoration activities and maintain a conservation use into perpetuity."

Respectfully,

Shannon Souza, PE

Project Manager

Cc: Michael Gray, ODFW Charleston District Fish Biologist

Rob Schab, Coos Bay North Bend Water Board Director

September 8, 2014

Mr. Greg Apke

ODFW Fish Passage Coordinator

3406 Cherry Avenue NE,

Salem, OR 97303

RE: Addendum to Coos Bay North Bend Water Board REQUEST FOR AMENDMENT OF MOU FOR FISH PASSAGE AT UPPER PONY CREEK DAM

Mr. Apke,

Please accept this addendum to the **REQUEST FOR AMENDMENT OF MOU FOR FISH PASSAGE AT UPPER PONY CREEK DAM** into that application file.

Page 3 **STREAM DESCRIPTION**

Change 1st sentence paragraph 2 to read as follows:

"The reach of lower Pony Creek affected by this proposal extends from LPCD to Newmark Avenue and is approximately 1 mile (5,200 ft.) long."

Page 12 **MITIGATION FUNDING (ADD "AND CONSTRUCTION TIMELINE")**

Change paragraph 1 to read as follows:

"The project constructed cost estimate is $204,000 of which full funding was approved by the applicant Board of Directors. Pending approval of this request by the ODFW Commission, the following construction timeline has been established:

December, 2014	ODFW Commission Approval
January – March, 2015	90% Design Completion
April, 2015	Request for Bids, Construction
April – June, 2015	Permitting

July – September, 2015 Construction"

Page 12 **DESCRIBE HOW THE MITIGATION WILL BE EVALUATED, MONITORED, AND MAINTAINED**

Change paragraph 1 to read as follows:

"Once completed, the mitigation will be subjected to an as-built survey to document and verify resulting stream length, placement and volumes of LWD, frequency and depth of pools and the viability of reintroduced native plantings. The as-built survey will establish photo points along the affected stream reaches in a minimum of four locations, approved by district ODFW staff, which document the persistence of LWD as well as natural stream channel morphology, and will be annually photographed for the first five years after project completion. Biological surveys will be completed to confirm multi-species salmonid presence, annually, for the first five years after project completion. Survey methodology and timing will be determined by the ODFW Charleston District biologists and may include snorkel observation, seining, trapping or electrofishing.

The mitigation is designed as a re-naturalization and will not require physical maintenance. Success criteria will be based on the completion of the prescribed restoration measures.

The land is held by the Wetland Conservancy (TWC). TWC has committed to work with the applicant to expand the existing conservation easement to encompass the extent of the above described restoration activities and maintain a conservation use into perpetuity."

Respectfully,

Shannon Souza, PE

Project Manager

Cc: Michael Gray, ODFW Charleston District Fish Biologist

Rob Schab, Coos Bay North Bend Water Board Director

RESOLUTION NO. 336

COOS BAY - NORTH BEND WATER BOARD

RESOLUTION TO AUTHORIZE THE FILING OF THE APPLICATION FOR FISH PASSAGE WAIVER ON MERRITT DAM AND MODIFICATION OF THE MEMORANDUM OF UNDERSTANDING ON UPPER PONY CREEK DAM

WHEREAS, The Coos Bay – North Bend Water Board (hereinafter "Water Board") has previously entered into a Memorandum of Understanding (MOU) with the Oregon Department of Fish and Wildlife (hereinafter ODFW) regarding a waiver of fish passage at Upper Pony Creek dam; and

WHEREAS, the Water Board intends to request a modification of the existing MOU with ODFW and also intends to file an application for the waiver of ODFW fish passage requirements for Merritt Dam; and

WHEREAS, ODFW has contacted the General Manager of the Water Board and has requested that the Board of Directors of the Water Board authorize the proposed modification of the MOU and, further, authorize the filing of the application for fish passage waiver on Merritt Dam.

NOW THEREFORE, be it resolved by the Board of Directors of the Coos Bay - North Bend Water Board, Coos County, Oregon as follows:

1. The above recitals are true and accurate and are hereby incorporated herein by this reference.

2. The Board of Directors of the Water Board hereby authorizes Water Board staff to negotiate a modification of the existing MOU with the ODFW.

3. The Board of Directors of the Water Board hereby authorizes Water Board staff to file an application for waiver of the fish passage requirement for Merritt Dam.

Adopted by the Board of Directors this 18th day of September, 2014.

Charles J. Sharps, Ph.D.
Board Chairman

ATTEST:

Richard N. Vigue
Board Secretary