



25th Annual Pelton Round Butte Fisheries
Workshop
July 17-18th 2019

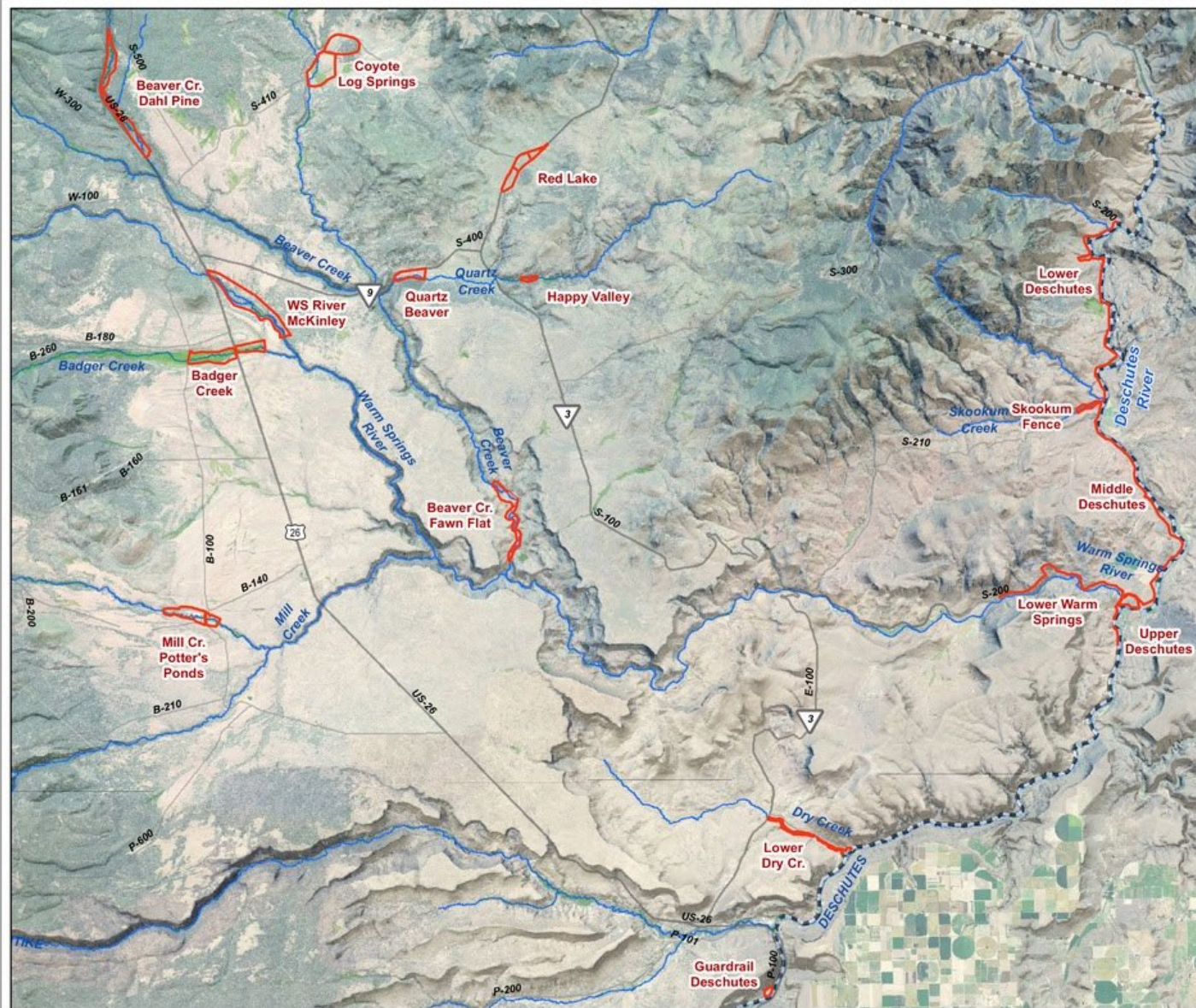
Aquatic Restoration Strategy
for the Warm Springs Reservation



Aquatic Restoration on the Reservation

1. Where we have been
2. Strategy development and execution
3. Where we are going





The Confederated Tribes of Warm Springs Riparian Project Fence Overview

- Riparian Project Fence
- Major Streams
- US 26
- Highways
- Major Roads
- Reservation Boundary
- Wetlands

Riparian Fence Project	Fence Miles	Acres Protected	Stream Miles
Badger Creek	4.5	220	5
Beaver Creek-Dahl Pine	6.76	242	4
Beaver Creek - Fawn Flat	4.58	151	2.63
Coyote Creek - Log Springs	4.1	359	5.75
Deschutes - Guardrail	0.6	14	0.3
Deschutes - Lower	10.1	148	6.2
Deschutes - Middle	5.75	180	6.3
Deschutes - Upper	5.74	8	1.16
Lower Dry Creek	4.1	53	2
Lower Warm Springs	4.7	177	4.2
Mill Creek Potter's Pond	3.4	153	3.5
Quartz Creek - Beaver	1.47	55	1
Quartz Creek - Happy Valley	0.92	16.2	0.4
Quartz Creek - Red Lake	3.38	132	3.45
Skookum Creek	1.5	27	0.7
Warm Springs - McKinley	4.8	348	3.4
Total	66.4	2,283.20	49.99

0 0.5 1 2 Miles
1:130,000
2/8/2017
Imagery 2016
CTWS GIS Center.mxd



Passive Restoration

66 miles of riparian fencing protecting 2,283 acres and 50 stream miles



1998



Current





Shitike Creek Habitat Restoration 2009



Mill Creek Habitat Restoration 2015





High flows April 2019

**Warm Springs
River LWD
Additions Project
July 2016**

Over 900 logs
placed instream

Completed in 2018

- 1. Comprehensive 20-year plan with prioritization and ranking tool kit**
- 2. Flood study and conceptual planning for the lower six miles of Shitike Creek**
- 3. Conceptual designs for 12 large restoration projects**
- 4. Forest Roads analysis to address sediment reduction**
- 5. Two full restoration designs**

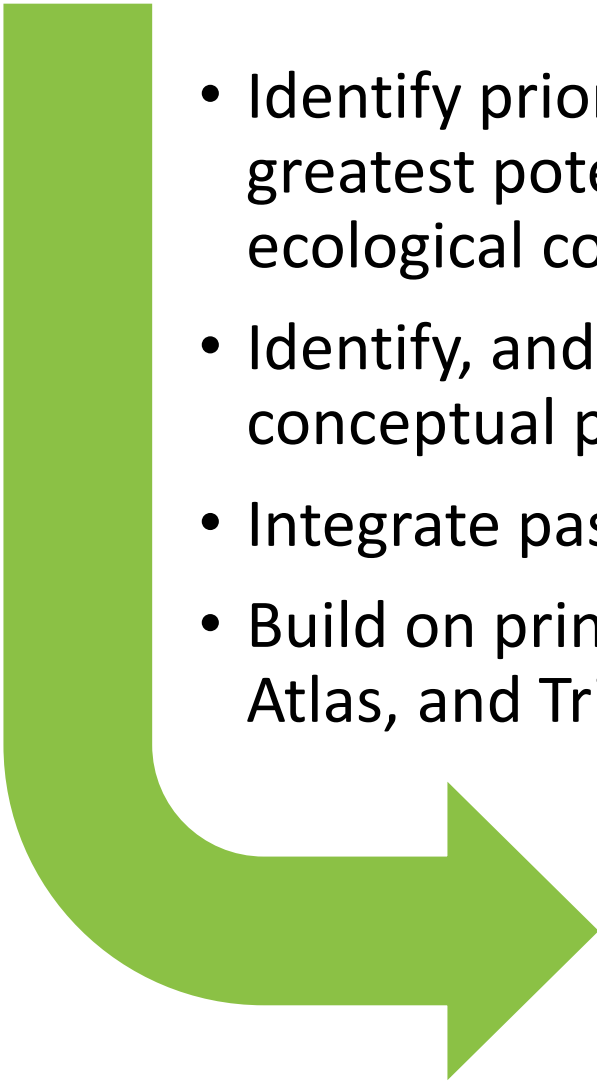
Aquatic Strategy

for the Warm Springs Reservation



The Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO)

Prioritization Process – Goals

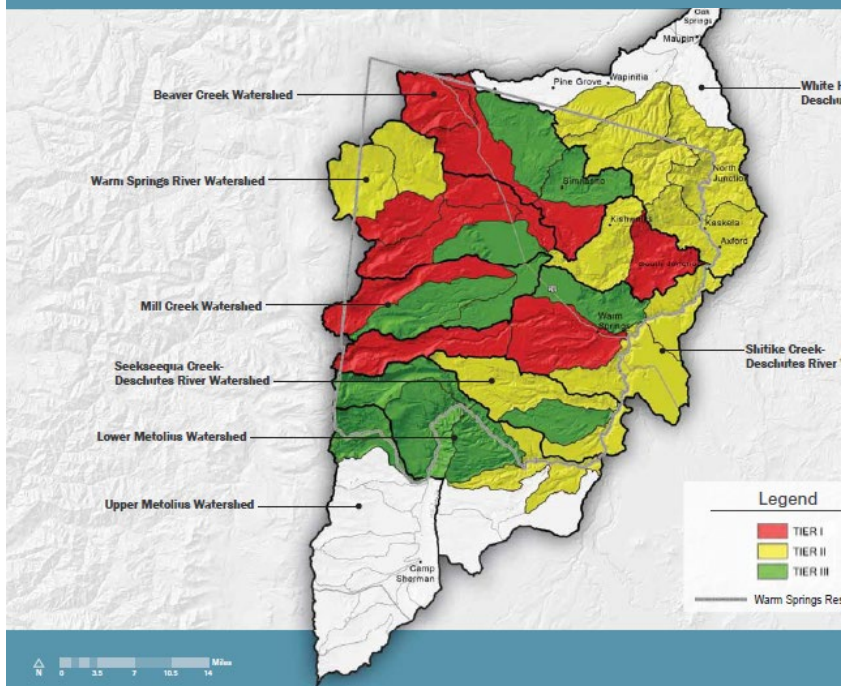
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- Identify priority subwatersheds with capacity for the greatest potential to restore and enhance high-quality ecological conditions on the Reservation.
 - Identify, and rank project-level recommendations, conceptual projects, for a broad range of actions.
 - Integrate past, current, and future data.
 - Build on principles and lessons learned from ISRP, Atlas, and Tribal John Day Strategy efforts.

Prioritization Matrix:

- “Living” tool for Tribal staff
- Flexible and adaptable as conditions and priorities change

Prioritization Process – Scale

8 Watersheds and 34 Subwatersheds



Subwatersheds:

- Primary geographic unit supported by resolution of data
- Small enough to show differences in focal fish distribution and abundance
- Similar habitat features, limiting factors, land use, and human impacts

Prioritization Process – Focal Species

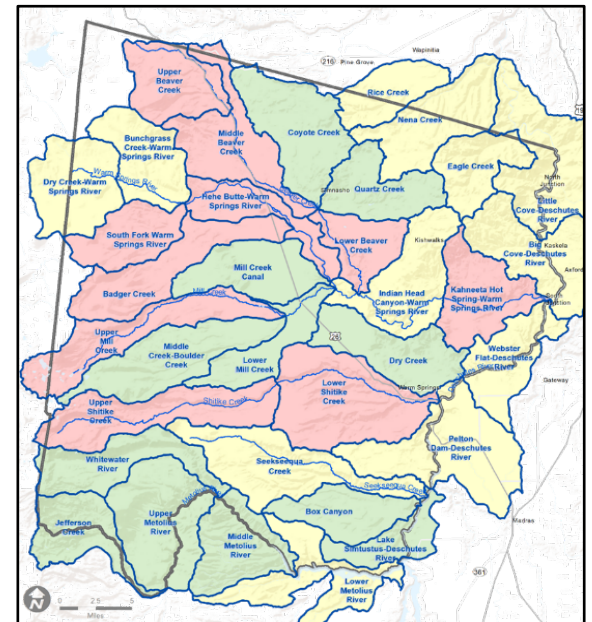
- Spring Chinook Salmon
- Summer Steelhead
- Bull Trout
- Pacific Lamprey



Subwatershed Scoring Overview

- Identification of where greatest potential exists to restore high-quality conditions
 - Potential = Normative or historic condition compared to current condition
- Evaluation of historic, current, and potential conditions for:
 - fish use, geomorphic, habitat, water quality, fish limiting life stage, climate change resiliency, and fish production potential

Subwatershed scoring outcome: ranking of restoration potential into three tiers



Subwatershed Scoring – Data

- Data sources:
 - CTWSRO Fish Distribution Data, Habitat Data, Redd Data, Snorkel Data, Reports
 - Surveys and Remote Sensing Data
 - Deschutes Subbasin Plan
 - EDT / QHA Condition Scores
 - Limiting Factors
 - Aquatic Strategy Forest Roads Analysis
 - GRAIP Analysis (completed 2018)
 - StreamNet
 - Watershed Assessments
 - NorWeST Climate Change Models
 - Orthoimagery
 - PGE Reintroduction Reports

Subwatershed Scoring – Fish Use

- Prioritize restoration in areas of historic, current, or potential fish use
- Scores based on number of life histories in each subwatershed (historic, current, and potential distributions)

LOWER METOLIUS RIVER SUBWATERSHED						
		Species	Lifestage	Historic	Current	Fish Use Potential
<div>Number of Historic Life Histories</div> <div>19</div>		Spring Chinook Salmon	Adult Immigration & Holding			
			Adult Spawning			
			Incubation/Emergence			
			Juvenile Rearing			
			Juvenile Emigration			
<div>Number of Current Life Histories</div> <div>8</div>		Summer Steelhead	Adult Immigration & Holding			
			Adult Spawning			
			Incubation/Emergence			
			Juvenile Rearing			
			Juvenile Emigration			
<div>Number of Potential Life Histories</div> <div>15</div>		Bull Trout	Adult Immigration/Emigration			
			Adult Spawning			
			Incubation/Emergence			
			Juvenile Rearing			
			Juvenile Emigration			
		Pacific Lamprey	Adult Immigration & Holding			
			Adult Spawning			
			Larval Rearing			
			Juvenile Emigration			

Subwatershed Scoring – Geomorphic Condition

- Prioritize restoration in areas where there is geomorphic potential to affect change
- Scores based on historic and current stream and valley widths, flood prone widths, and confinement data from EDT, assessments, aerial imagery, LiDAR, etc.



Geomorphic Potential Scoring Table	
Condition	Score
Unconfined	20
Moderately Unconfined	15
Mixed Unconfined and Confined	10
Moderately Confined	5
Confined	0

Subwatershed Scoring – Habitat Condition

- Prioritize restoration in areas where there is potential for aquatic habitat restoration
- Scores based on historical and current riparian condition, channel stability, habitat diversity, fine sediment, high flow, and low flow
- EDT and QHA scores supplemented and updated with CTWSRO habitat data, watershed assessments, Forest Roads Analysis, remote sensing, etc.

Subwatershed Scoring – Habitat Condition

Habitat Potential ¹						
QHA Reach	Riparian Condition	Channel Stability	Habitat Diversity	Fine Sediment	High Flow	Low Flow
Beaver Cr-2 (WS)	0.5	1.0	1.0	1.5	1.0	1.0
Beaver Cr-3 (WS)	1.5	2.0	2.0	2.0	1.0	1.0
--	--	--	--	--	--	--
--	--	--	--	--	--	--
Averages (If Multiple QHA Data points)	1.0	1.5	1.5	1.8	1.0	1.0
EDT Rating	1.5	1.0	1.0	0.5	0.2	1.0
Other Data	Some Degraded Riparian Condition	1.42 and 10.87 Percent Unstable Banks	34.1 and 16.8 IMRP Wood / Mi	23.7 and 20.1 Percent Fine Sediment, 29.1 Tons of Sediment / Yr. from Forest Roads	Some High Flow Concern	Some Low Flow Concern
Source(s)	Beaver Creek Assessment 2014	CTWS 2018	CTWS 2018	CTWS 2018, TetraTech 2018	Beaver Creek Assessment 2014	Beaver Creek Assessment 2014
Other Rating - convert to QHA condition score range	1.0	1.5	1.5	3.0	1.0	1.0
Final Rating	1.0	1.5	1.5	3.0	1.0	1.0
Criteria for (Final Rating) Revision	--	--	--	Very high fine sediment loading rates from Forest Roads Analysis 2018	--	--

Overall Habitat Condition Rating:

1.5

EDT / QHA Attribute Rating*	
Change in Condition From Historic to Current	Definition
0.0 - 0.9	100% of normative condition
1.0 - 1.9	75% of normative condition
2.0 - 2.9	50% of normative condition
3.0 - 3.9	25% of normative condition
4.0	0% of normative condition

*From NPCC 2005

Habitat Restoration Potential Scoring Table**			
Overall Condition Rating Range		Score	Ranking
0.00	0.25	2.5	Least Restoration Potential
0.26	0.50	5.0	Lower Restoration Potential
0.51	0.75	7.5	Low Restoration Potential
0.76	1.00	10.0	Moderate - Low Restoration Potential
1.01	1.25	12.5	Moderate Restoration Potential
1.26	1.50	15.0	Moderate - High Restoration Potential
1.51	1.75	17.5	High Restoration Potential
1.76	2.00	20.0	Highest Restoration Potential

**Restoration Potential = Current condition compared to normative or historical condition

Subwatershed Scoring – Water Quality

- Prioritize restoration in areas where there is potential to improve water quality
- Scores based on reference and current metrics for oxygen, low temperature, high temperature, pollutants
- EDT and QHA scores supplemented and updated with CTWSRO habitat data, watershed assessments, Forest Roads Analysis, etc.

Water Quality Metrics				
QHA Reach	Oxygen ¹	Low Temperature ¹	High Temperature ¹	Pollutants ¹
Boulder Cr (WS)	0.0	0.0	1.0	0.5
--	--	--	--	--
--	--	--	--	--
--	--	--	--	--
Averages (If Multiple EDT Data points)	0.0	0.0	1.0	0.5
EDT Rating	0.0	0.0	1.0	0.5
Other Data	--	--	17.3 Average Max Temp Recorded (19, 17, 16, 14, 18, 20)	--
Source(s)	--	--	CTWS Habitat Data, 2018	--
Other Data	--	--	13.2 Degrees	--
Source(s)	--	--	Modeled 20-year Average August Temperature NorWest	--
Other Rating - Convert to QHA condition score range	0.0	0.0	2.0	0.0
Final Rating	0.0	0.0	2.0	0.5
Criteria for Revision	--	--	High Max Temps Recorded during CTWS Habitat Surveys	--
Overall Water Quality Condition Rating:			0.6	

Subwatershed Scoring – Fish Limiting Life Stage

- Prioritize restoration in areas of population-limiting life stages
- Scores based on current presence of population-limiting life stages
- Potential to address population “bottleneck” lifestages

LOWER BEAVER CREEK FISH PERIODICITY					
Species	Lifestage	Winter	Spring	Summer	Fall
Spring Chinook Salmon	Adult Immigration & Holding				
	Adult Spawning				
	Incubation/Emergence				
	Juvenile Rearing				
	Juvenile Emigration				
Summer Steelhead	Adult Immigration & Holding				
	Adult Spawning				
	Incubation/Emergence				
	Juvenile Rearing				
	Juvenile Emigration				
Bull Trout	Adult Immigration/Emigration				
	Adult Spawning				
	Incubation/Emergence				
	Juvenile Rearing				
	Juvenile Emigration				
Pacific Lamprey	Adult Immigration & Holding				
	Adult Spawning				
	Larval Rearing				
	Juvenile Emigration				

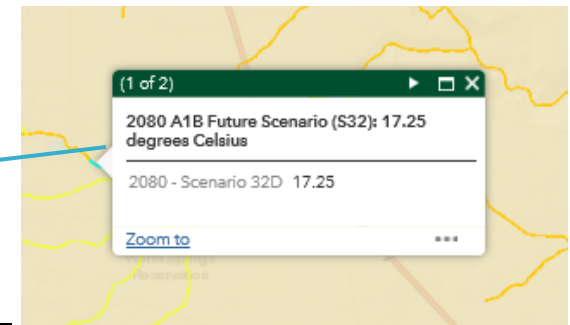
Fish Limiting Life Stage Rankings:					
Lifestage	Chinook	Steelhead	Bull Trout	Lamprey	Comments
Adult Immigration & Holding	M	M	M	M	Immigration and holding of all species.
Adult Spawning	M	M	M	M	Spawning of all species in lower Beaver Creek.
Incubation/Emergence	M	M	L	M	Presume most bull trout spawning occurs in upper watershed, with colder temperatures.
Summer Rearing	H	H	M	N/A	For Lamprey this stage included in Incubation/Emergence
Winter Rearing	H	H	M	N/A	For Lamprey this stage included in Incubation/Emergence
Juvenile Emigration	L	L	M	L	

Fish Limiting Life Stage Score
11

Subwatershed Scoring – Climate Change

- Prioritization of restoration in areas projected to be more vulnerable to climate change and resulting temperature increases
- Scores based on NorWeST Temperature Map projections of modeled climate change in August mean instream temperatures from historic condition to 2080

Temperature Resiliency ²	
Modeled Temperature Increase Between 20-year Average and 2080 Projection (°C)	4.0







Climate Change Resiliency Scoring Table			
Modeled Temperature Change From 20-year Average to 2080 (°C)		Score	Resiliency to Climate Change Impacting Instream Temperatures
0.00	2.00	2.5	Highest
2.01	2.10	5.0	Very High
2.11	2.20	7.5	High
2.21	2.30	10.0	Medium
2.31	2.40	12.5	Intermediate
2.41	2.50	15.0	Low
2.51	2.60	17.5	Very Low
2.61	4.00	20.0	Lowest

Temperature Resiliency Score:	20.0
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Subwatershed Scoring – Fish Production Potential

- Prioritization of restoration in areas of high fish population production potential
- Scores based on documented or assumed areas of high species value and productivity based on current and historical ecological condition, location, and overall production potential

 ReddData07_16.xls
 ReddDataAllUTM06_16.xls
 ReddDataAllUTMformat2017wsg84.xlsx
 ReddHeaderFormat2017.xlsx

Received by NOAA/NMFS/Hydropower Division, October 10, 2008

Reintroduction and Conservation Plan
for Anadromous Fish
In the Upper Deschutes River Sub-basin, Oregon
Edition 1: Spring Chinook Salmon and Summer Steelhead

Oregon Department of Fish and Wildlife
and
Confederated Tribes of the Warm Springs
Reservation of Oregon

Natural Production Monitoring Progress Report
Jan. 1, 2015 – Dec. 31, 2016

Monitoring Wild Populations of Spring Chinook Salmon
(Oncorhynchus tshawytscha) and Summer Steelhead
(Oncorhynchus mykiss) in Tributaries of the lower Deschutes River
within the boundaries of The Confederated Tribes of the Warm
Springs of Oregon Reservation

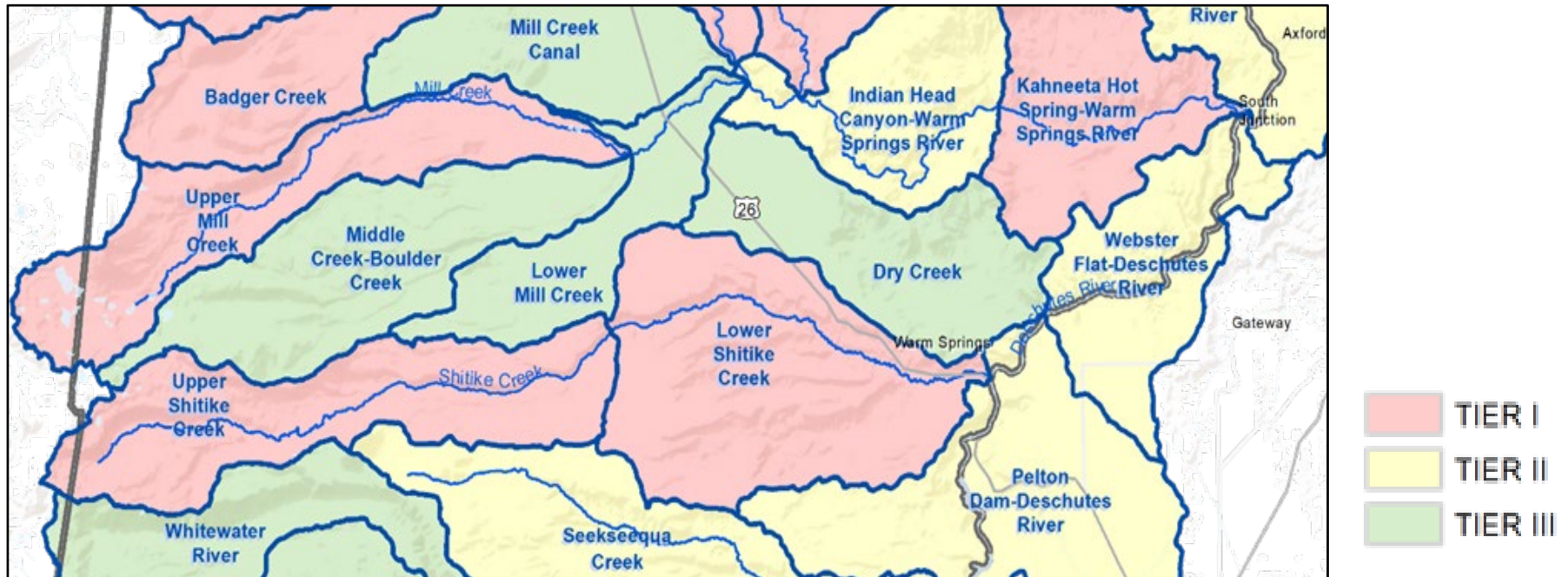
BPA Project # 2008-311-00
BPA contracts #: 64276, 69558, 73078
Graham Boostrom
Cyndi Baker
CONFEDERATED TRIBES OF THE WARM SPRINGS RESERVATION
OF OREGON
Branch of Natural Resources
Fisheries Research



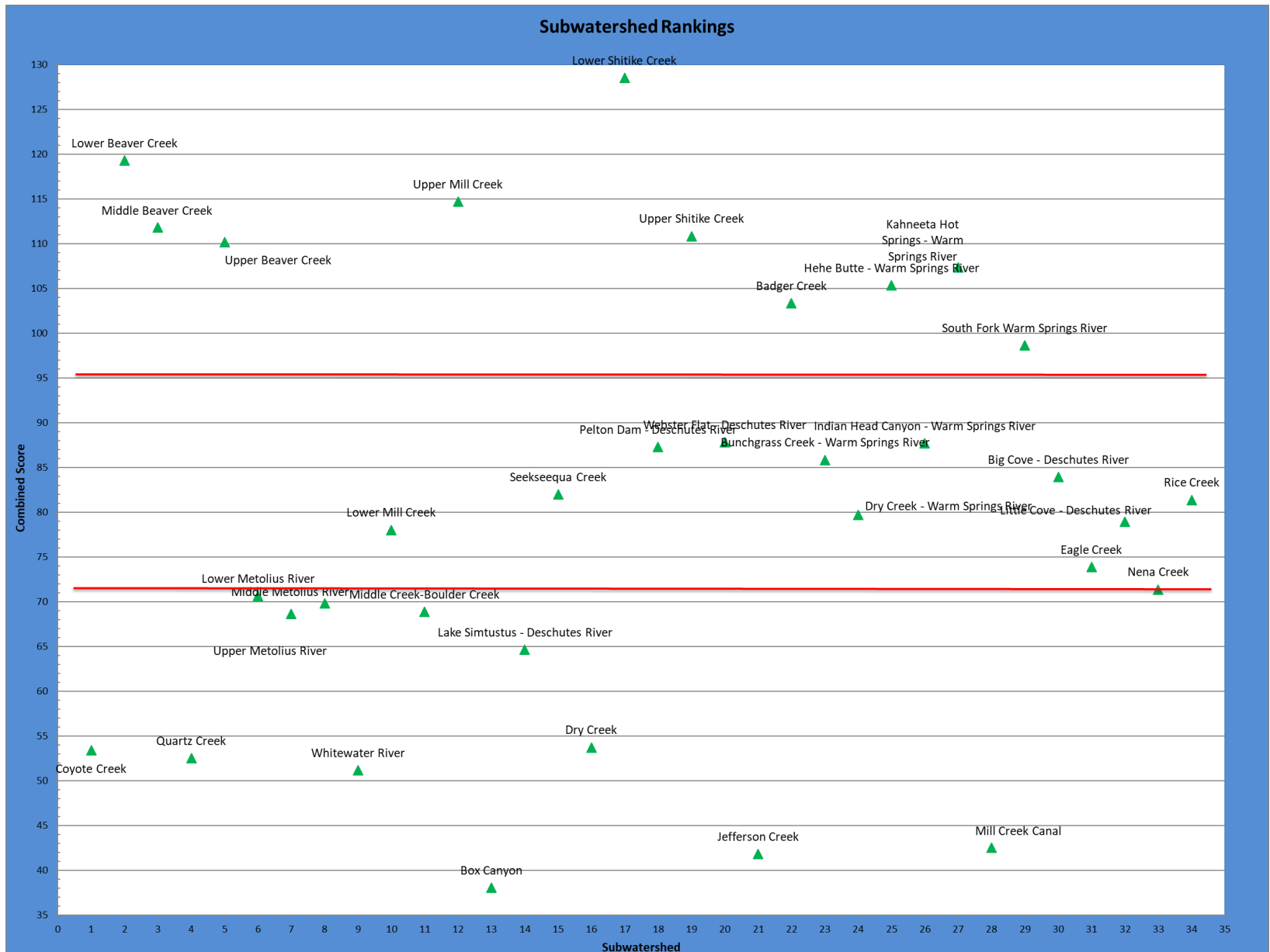
Potential Fish Production Score	
Productivity	Score
Poor	0
Low	5
Moderate	10
High	15
Excellent	20

Subwatershed Scoring Results – Overview

- Combination of all scoring categories (180 points possible)
- Scores range from 38 points (Box Canyon Subwatershed) to 129 points (Lower Shitike Creek Subwatershed)
- Three tiers (high, medium, and low restoration potential)



Subwatershed Scoring Results – Tier Rankings



Subwatershed Scoring Results

WARM SPRINGS RESERVATION SUBWATERSHED RANKINGS												
Watershed Name	Subwatershed Name	Fish Use Scoring			Geomorphic, Habitat, and Water Quality Scoring			Change Impact Scoring			RESULTS	
		Score Based on Historic Number of Life Stages	Score Based on Current Number of Life Stages	Score based on Potential Number of Restored Life Stages	Score Based on Geomorphic Potential	Score Based on Habitat Potential	Score Based on Water Quality Potential	Score Based on Fish Limiting Life Stage Use	Score Based on Climate Change Resiliency Potential	Score Based on Potential Fish Production	Cumulative Score	Ranking (Tier I,II,III)
Beaver Creek	Coyote Creek	2	2	0	5	15	5	2	13	10	53	Tier III
	Lower Beaver Creek	18	18	0	15	15	8	11	20	15	119	Tier I
	Middle Beaver Creek	18	18	0	15	15	10	11	10	15	112	Tier I
	Quartz Creek	0	0	0	15	20	3	0	10	5	53	Tier III
	Upper Beaver Creek	15	15	0	15	20	10	11	10	15	110	Tier I
Lower Metolius River	Lower Metolius River	18	6	12	0	5	3	5	8	15	71	Tier III
	Middle Metolius River	18	8	9	0	3	3	5	8	15	69	Tier III
	Upper Metolius River	18	8	9	0	5	3	4	8	15	70	Tier III
	Whitewater River	15	5	9	0	5	3	2	3	10	51	Tier III
Mill Creek	Lower Mill Creek	20	20	0	0	3	5	8	13	10	78	Tier II
	Middle Creek-Boulder Creek	5	5	0	15	20	8	3	3	10	69	Tier III
	Upper Mill Creek	20	20	0	15	18	3	10	10	20	115	Tier I
Seekseequa Creek-Deschutes River	Box Canyon	5	0	5	0	10	3	0	10	5	38	Tier III
	Lake Sintustus - Deschutes River	18	3	15	0	3	3	1	13	10	65	Tier III
	Seekseequa Creek	15	5	9	10	13	3	0	13	15	82	Tier II
Shitike Creek-Deschutes River	Dry Creek	2	2	0	10	18	3	2	13	5	54	Tier III
	Lower Shitike Creek	20	20	0	10	18	18	11	13	20	129	Tier I
	Pelton Dam - Deschutes River	18	9	12	0	10	8	3	13	15	87	Tier II
	Upper Shitike Creek	20	16	4	15	13	5	8	10	20	111	Tier I
	Webster Flat - Deschutes River	18	18	0	0	10	8	7	13	15	88	Tier II
Upper Metolius River	Jefferson Creek	6	5	1	0	3	3	2	8	15	42	Tier III
Warm Springs River	Badger Creek	15	15	0	20	20	5	6	13	10	103	Tier I
	Bunchgrass Creek - Warm Springs River	20	16	4	5	13	3	8	3	15	86	Tier II
	Dry Creek - Warm Springs River	5	5	0	20	13	5	2	15	15	80	Tier II
	Hehe Butte - Warm Springs River	20	20	0	15	8	3	10	15	15	105	Tier I
	Indian Head Canyon - Warm Springs River	17	17	0	0	13	5	9	13	15	88	Tier II
	Kahneeta Hot Springs - Warm Springs River	17	17	0	5	13	13	9	15	20	107	Tier I
	Mill Creek Canal	0	0	0	15	10	3	0	10	5	43	Tier III
	South Fork Warm Springs River	15	11	4	20	13	5	7	10	15	99	Tier I
White Horse Rapids-Deschutes River	Big Cove - Deschutes River	16	16	0	0	13	5	7	18	10	84	Tier II
	Eagle Creek	5	5	0	0	13	15	3	18	15	74	Tier II
	Little Cove - Deschutes River	16	16	0	0	10	5	7	15	10	79	Tier II
	Nena Creek	5	5	0	0	20	10	3	13	15	71	Tier II
	Rice Creek	5	5	0	15	15	10	3	13	15	81	Tier II

Project Scoring – Inputs

- Proposed restoration actions
- Tier ranking of the subwatershed (location)
- Impact on limiting factors
- Ability to address ecological processes
- Ability to buffer impacts from climate change
- Project scale and connectivity to other projects and habitats

Beaver Creek Watershed, Middle Beaver Creek Subwatershed. Project Descriptions and Actions			Biological Rankings			Physical Processes Rankings			Subtotal Biological Scores	Subtotal Physical Scores	TOTAL SCORE
			Subwatershed Ranking	Restoration Actions Score	Action Effects on Limiting Factors Score	Natural Processes Score	Climate Change Score	Project Scale and Connectivity Score			
	Opportunity Location (Subwatershed., Reach, & RM's)										
Action No.	Middle Beaver Creek – Highway 26 Relocation Project	Action Type	Tier I	102	217	Full Restoration		Excellent			
3	Reduce - Mitigate Point or Non-Point Source Impacts	Direct Action		10	6		2				
7	Road Decommissioning or Abandonment	Direct Action		10	5		2				
15	Riparian Fencing	Direct Action		5	23		6				

Project Scoring Inputs – Restoration Actions

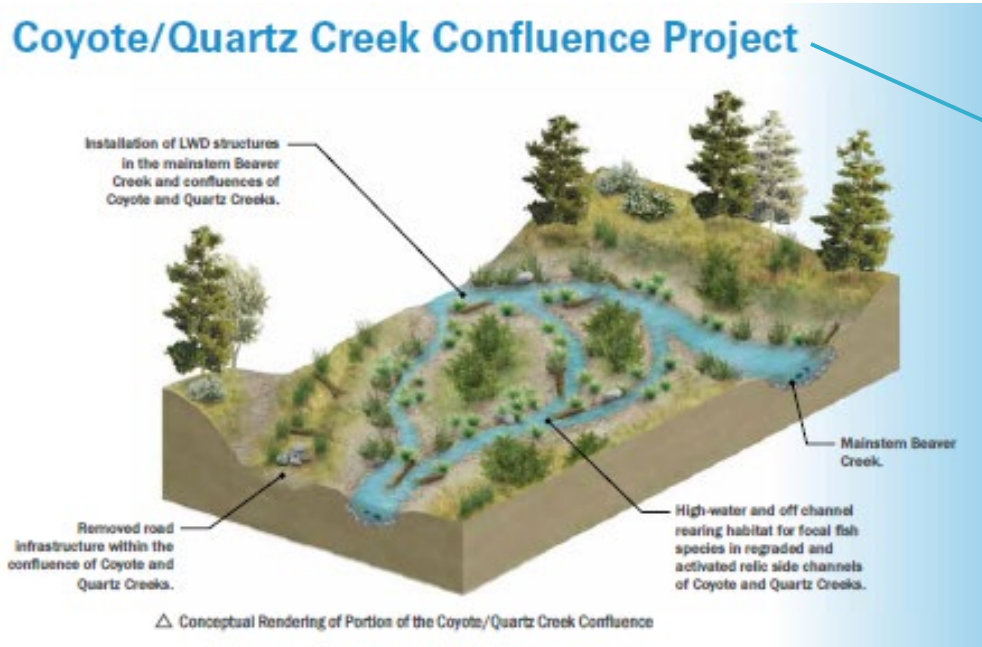
Action Category	Action Number	Potential Restoration Actions
Land and Water Preservation	1	Protection: (Acquisitions, Easements, Coop. Agreements)
	2	Land Management: (Grazing Plans, Fire management, etc.)
Water Quality Improvements	3	Reduce - Mitigate Point or Non-Point Source Impacts
	4	Nutrients Additions (carcasses)
Sediment Reduction	5	Upland Vegetation Treatment - Management
	6	Road Grading - Drainage Improvements
Water Quantity	7	Road Decommissioning or Abandonment
	8	Water Management - Improve Irrigation Efficiency
Riparian Restoration and Management	9	Acquire or Increase Instream Flow (Lease/Purchase; Groundwater Storage)
	10	Remove Non-native Plants
	11	Off--Site Water Developments
	12	Riparian Buffer Strip, Planting
	13	Selective Thinning
	14	Beaver Re-introduction or Management
	15	Riparian Fencing
Bank Restoration or Modification	16	Bank Shaping and Stabilization
	17	Removal of Bank Armoring
Instream Structures and Habitat Complexity	18	Restore Streambanks with LWD - Bioengineering
	19	Boulder Placements
	20	LWD Placements - Individual Whole Trees, Log Jams, etc.
	21	Weirs for Grade Control

Action Category	Action Number	Potential Restoration Actions
Floodplain Reconnection	22	Levee Modifications: Removal, Setback, Breach
	23	Remove and/or Relocate Floodplain Infrastructure
	24	Restoration of Floodplain Topography and Vegetation
	25	Floodplain Excavation: Benching
Side-Channel / Off-Channel Habitat Restoration	26	Improve Thermal Refugia (reconnect cold springs, winter temps)
	27	Perennial Side Channel
	28	Secondary Channel (non-perennial)
	29	Floodplain Pond
	30	Wetland
	31	Alcove
Stream Channel Modifications	32	Hyporheic Off-Channel Habitat (Groundwater)
	33	Spawning Gravel Augmentation
	34	Pool Construction
	35	Riffle Construction
	36	Meander (Oxbow) Re-connect - Reconstruction
	37	Channel Reconstruction
Fish Passage Restoration	38	Structural Passage (Diversions, Screening)
	39	Barrier or Culvert Replacement or Removal
	40	Dam Removal or Breaching

Activity No.	Coyote / Quartz Creek – Beaver Creek Confluence Project
7	Road Decommissioning or Abandonment
3	Reduce - Mitigate Point or Non-Point Source Impacts
19	Boulder Placements
20	LWD Placements - Individual Whole Trees, Logjams, etc.
22	Levee Modifications: Removal, Setback, Breach
24	Restoration of Floodplain Topography and Vegetation
25	Floodplain Excavation: Benching
27	Perennial Side Channel
28	Secondary Channel (non-perennial)
31	Alcove
34	Pool Construction
11	Off--Site Water Developments

- 40 Restoration Actions
- Range from Passive to Active
- Scores assigned to each Proposed Action
Based on the ability to Address Limiting Factors, and Climate Change

Project Scoring Inputs – Tier Ranking



Subwatershed Tier	SCORE
Tier I	20
Node	15
Tier II	10
Tier III	5

Ecological Node: *“A smaller geographic area within a lower ranked (Tier 2 or Tier 3) subwatershed that may have significant fish use or potential use based on close proximity to known spawning habitat, refuge habitat (thermal refugia, hiding cover, or available floodplain), or important tributary junctions.”*

Project Scoring Inputs – Limiting Factors

Limiting Factors Rankings ^{1/}			
No.	NOAA	Rating	Data Sources & Comments
1.1	Habitat Quantity: Anthropogenic Barriers	L	No known barriers in subwatershed
4.1	Riparian Condition: Riparian Vegetation	M	
4.2	Riparian Condition: LWD recruitment	H	CTWS - low LWD density (9.2 pieces/ mi).
5.1	Peripheral and Transitional Habitats: Side Channels & Wetland Conditions	L	Limited potential - Google Earth
5.2	Peripheral and Transitional Habitats: Floodplain Condition	L	Limited potential - Google Earth
6.1	Channel Structure and Form: Bed and Channel Form	H	High percentage of unstable banks (CTWS 2018)
6.2	Channel Structure and Form: Instream Structural Complexity	H	
7.2	Sediment Conditions: Increased Sediment Quantity	H	
8.1	Water Quality: Temperature	M	Rating Based on Norwest Historical Average High August Temperatures, 2003 - 2011
8.7	Water Quantity: Toxic Contaminants	M	
9.2	Water Quantity: Decreased Water Quantity	M	
9.3	Water Quantity: Altered Flow Timing	L	
Source Data: <input checked="" type="checkbox"/> Sub-Basin <input type="checkbox"/> Recovery Plan <input type="checkbox"/>			

^{1/} Rankings based primarily for Chinook salmon & steelhead.

^{2/} NOAA Fisheries uses the term Ecological Concern instead of Limiting Factor, but the two are used interchangeably.

Beaver-Coyote Cr

NOAA LF DESCRIPTION	NOAA LF Number	Action Number	LF Rank for Subwatershed	Action Impact on LF	Combined Impact	Combined Impact Score
Anthro. Barriers	1.1	38	L	D	LD	2
LWD Recruitment	4.2	1	H	D	HD	5



Action Effects on Limiting Factors	
Combined Impacts	SCORE
HD	5
HI	3
MD	3
MI	2
LD	2
LI	1

Project Scoring Inputs – Restoration Action Impact to Limiting Factors

Beaver-Coyote Cr						
NOAA LF DESCRIPTION	NOAA LF Number	Action Number	LF Rank for Subwatershed	Action Impact on LF	Combined Impact	Combined Impact Score
Anthro. Barriers	1.1	38	L	D	LD	2
	1.1	39	L	D	LD	2
	1.1	40	L	D	LD	2
Predation	2.1	34	#N/A	I	#N/A	0
	2.1	36	#N/A	I	#N/A	0

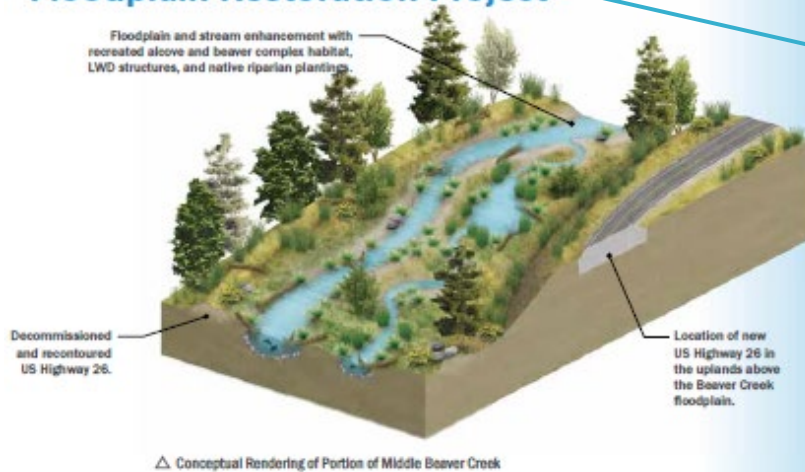
Action Effects on Limiting Factors	
Combined Impacts	SCORE
HD	5
HI	3
MD	3
MI	2
LD	2
LI	1

Treatment Group & Actions	Rating	Comments
Land and Water Preservation:		
1 Protection: (Acquisitions, Easements, Coop. Agreements)	N/A	
2 Land Management: (Grazing Plans, Fire management, etc.)	N/A	
Water Quality Improvements:		
3 Reduce - Mitigate Point or Non-Point Source Impacts	H	Water quality concerns from highway 26 and fine sediment introduction
4 Nutrients Additions (carcasses)	L	
5 Upland Vegetation Treatment - Management	L	
Sediment Reduction:		
6 Road Grading - Drainage Improvements	H	29.1 Tons of Sediment / Yr. from Forest Roads
7 Road Decommissioning or Abandonment	H	29.1 Tons of Sediment / Yr. from Forest Roads
Water Quantity:		
8 Water Management-Improve Irrigation Efficiency	N/A	
9 Acquire or Increase Instream Flow (Lease/Purchase; GW Storage)	N/A	
Riparian Restoration and Management:		
10 Remove Non-native Plants	L	
11 Off-Site Water Developments	L	
12 Riparian Buffer Strip, Planting	L	
13 Selective Thinning	L	
14 Beaver Re-introduction or Management	M	Utilize existing beaver complexes
15 Riparian Fencing	M	Some fencing in place, extend projects where needed
Bank Restoration or Modification		
16 Bank Shaping and Stabilization	L	
17 Removal of Bank Armoring	H	Several bank armoring locations with Hwy 26
18 Restore Banklines with LWD - Bioengineering	L	
Instream Structures and Habitat Complexity:		
19 Boulder Placements	M	Increase and enhance habitat where limited
20 LWD Placements - Individual Whole Trees, Logjams, etc.	M	Increase and enhance habitat where limited
21 Weirs for Grade Control	L	

Actions Rankings	
Rank	SCORE
H	10
M	5
L	2
N/A	0

Project Scoring Inputs – Natural Process Score

Middle Beaver Creek Highway 26 Relocation and Floodplain Restoration Project



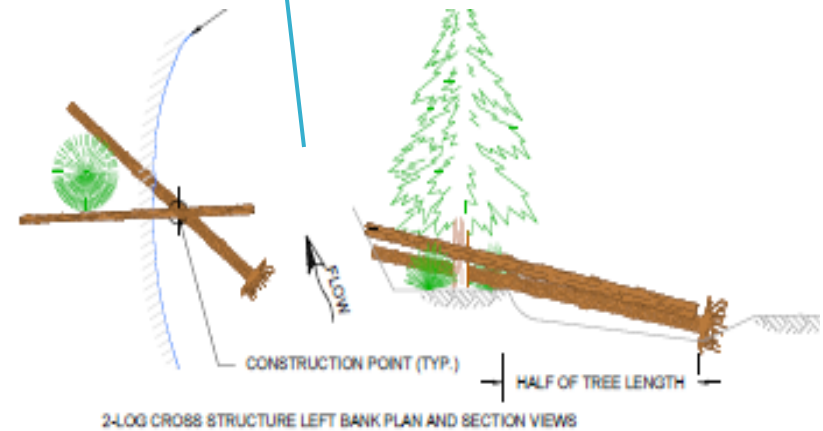
Natural Processes	SCORE
Full Restoration	15
Partial Restoration	10
Habitat Creation	5

Process-based Principles for Restoring River Ecosystems

TIMOTHY J. BEECHIE, DAVID A. SEAR, JULIAN D. OLDEN, GEORGE R. PESS, JOHN M. BUFFINGTON, HAMISH MOIR, PHILIP RONI, AND MICHAEL M. POLLOCK

Process-based restoration aims to reestablish normative rates and magnitudes of physical, chemical, and biological processes that sustain river and floodplain ecosystems. Ecosystem conditions at any site are governed by hierarchical regional, watershed, and reach-scale processes controlling hydrologic and sediment regimes; floodplain and aquatic habitat dynamics; and riparian and aquatic biota. We outline and illustrate four process-based principles that ensure river restoration will be guided toward sustainable actions: (1) restoration actions should address the root causes of degradation, (2) actions must be consistent with the physical and biological potential of the site, (3) actions should be at a scale commensurate with environmental problems, and (4) actions should have clearly articulated expected outcomes for ecosystem dynamics. Applying these principles will help avoid common pitfalls in river restoration, such as creating habitat types that are outside of a site's natural potential, attempting to build static habitats in dynamic environments, or constructing habitat features that are ultimately overwhelmed by unconsidered system drivers.

Keywords: river restoration, ecosystem dynamics, ecosystem processes



Project Scoring Inputs – Climate Change Score

RIVER RESEARCH AND APPLICATIONS

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RESTORING SALMON HABITAT FOR A CHANGING CLIMATE

T. BEECHIE^{a*}, H. IMAKI^a, J. GREENE^a, A. WADE^b, H. WU^{c,d}, G. PESS^a, P. RONI^a, J. KIMBALL^c, J. STANFORD^c,
P. KIFFNEY^a AND N. MANTUA^f

^a Northwest Fisheries Science Center, National Marine Fisheries Service, Seattle, Washington, USA

^b National Center for Ecological Analysis and Synthesis, University of California Santa Barbara, Santa Barbara, California, USA

^c Earth System Science Interdisciplinary Center, University of Maryland, College Park, Maryland, USA

^d NASA Goddard Space Flight Center, Greenbelt, Maryland, USA

^e Flathead Lake Biological Station, University of Montana, Missoula, Montana, USA

^f School of Aquatic and Fishery Sciences, University of Washington, Seattle, Washington, USA

Climate Change Score	
Variable	Value
Full Moon	2
Half Moon	1
No Impacts	0

Effects on Climate Change	
SCORE	0-8

Restoration Actions Table		Climate Change Variables and Values (based on Beechie, et. al., 2012)								TOTAL Value
		Ameliorates Temperature Increase	Value	Ameliorates Base Flow Decrease	Value	Ameliorates Peak Flow Increase	Value	Increases Salmon Resilience	Value	
Land and Water Preservation:										
1	Protection: (Acquisitions, Easements, Cooperative Agreements)	Full Moon	2	Full Moon	2	Full Moon	2	Full Moon	2	8
2	Land Management: (Grazing Plans, Fire management, etc.)	Full Moon	2	Full Moon	2	Full Moon	2	Full Moon	2	8
Water Quality Improvements:										
3	Reduce - Mitigate Point or Non-Point Source Impacts	No Impacts	0	No Impacts	0	No Impacts	0	Full Moon	2	2
4	Nutrients Additions (carcasses)	No Impacts	0	No Impacts	0	No Impacts	0	Half Moon	1	1
5	Upland Vegetation Treatment - Management	No Impacts	0	Half Moon	1	Half Moon	1	No Impacts	0	2
Sediment Reduction:										
6	Road Grading - Drainage Improvements	No Impacts	0	No Impacts	0	Full Moon	2	No Impacts	0	2
7	Road Decommissioning or Abandonment	No Impacts	0	No Impacts	0	Full Moon	2	No Impacts	0	2

Project Scoring Inputs – Project Scale and Connectivity Score

Project Scale and Connectivity	
Rank	SCORE
Excellent	15
Good	10
Fair	5
Poor	0



Project Scoring Results

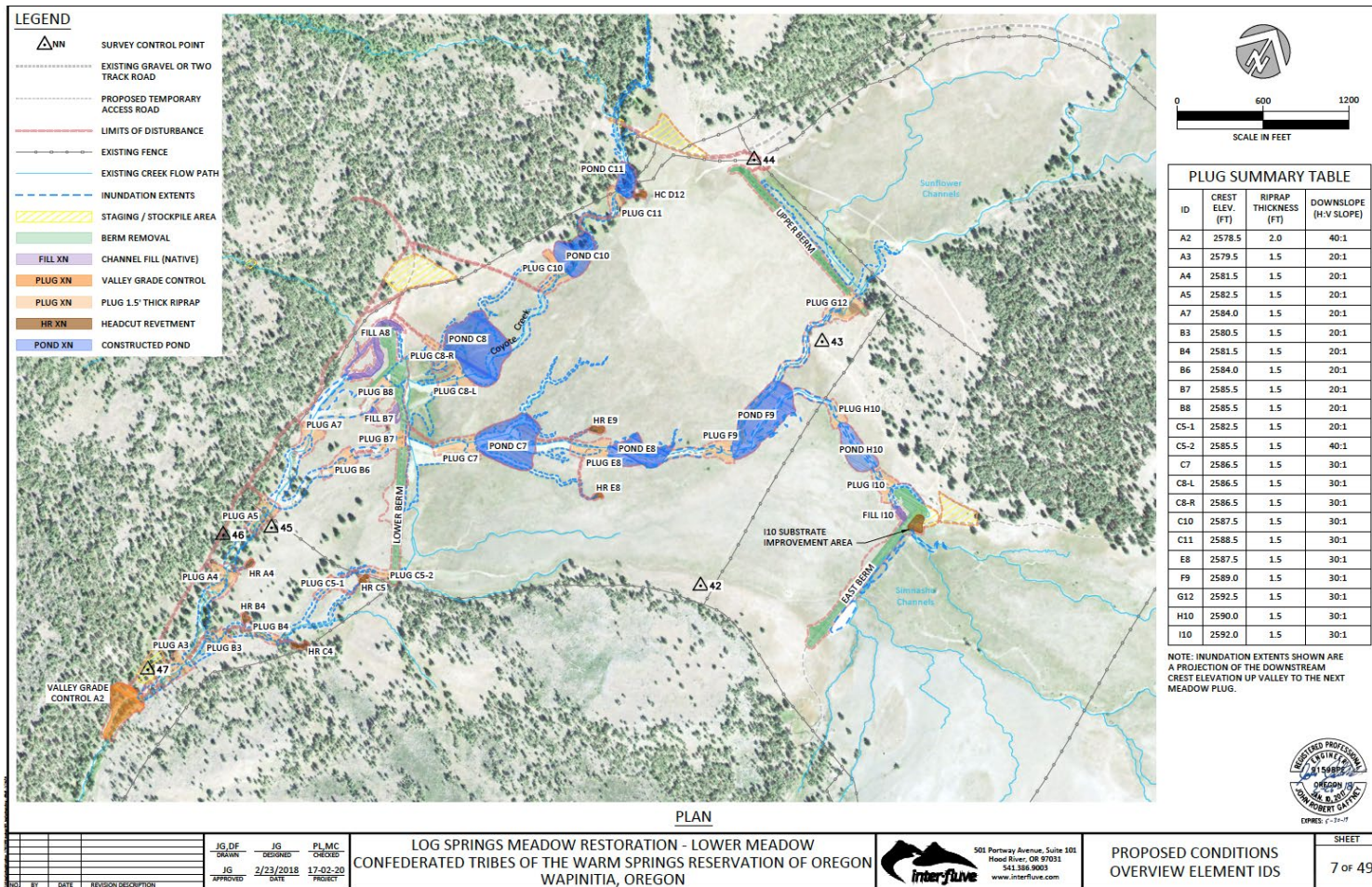
- 40 projects entered into the scoring matrix
- Scores sum all biological and physical scoring categories
- The highest scoring project scored 129 points (Middle Beaver Creek Hwy 26 Relocation Project)
- The lowest scoring project scored 31 points (Coyote Creek S-570 Road Decommissioning, Beaver Dam Analog Installation, and Planting Project)

Prioritization Matrix – Project Scoring Results

TIER	PROJECT OPPORTUNITY: Watershed, Stream, River Miles, other descriptors	PROJECT SCORE	PROJECT RANK
Tier I	Middle Beaver Creek – Highway 26 Relocation Project	129	1
Tier I	Lower Shitike Creek – Reach One - Mouth to Highway 26 Bridge Project	126	2
Tier I	Lower Shitike Creek – Reach Two - Highway 26 Bridge to Hollywood Boulevard Pro	126	2
Tier I	Lower Warm Springs River – Floodplain Restoration and In-Stream Enhancement P	120	4
Tier I	Middle Beaver Creek – Floodplain Restoration and In-Stream Enhancement Project	103	5
Tier I	Lower Shitike Creek – Reach Three - Hollywood Boulevard to Upper Extents of Park	103	5
Tier I	Middle Beaver Creek – Floodplain Restoration and In-Stream Enhancement Project	100	7
Tier I	Upper Mill Creek – Rock Quarry Project	98	8
Tier I	Upper Mill Creek – Potters Pond Project - Phase 2	98	8
Node	Coyote / Quartz Creek – Beaver Creek Confluence Project	85	10
Tier I	Upper Beaver Creek – Floodplain Restoration and In-Stream Enhancement Project	81	11
Tier I	Lower Shitike Creek – Reach Four - Upper Extents of Park to Shitike Headworks Pro	80	12
Tier I	Lower Shitike Creek – P-670 Road Removal, Spring Development, and In-Stream En	78	13
Tier I	Lower Shitike Creek – Headworks Fish Passage, Floodplain Restoration, and In-Stre	76	14
Tier I	Hehe Butte – Middle Warm Springs River - Floodplain and Side Channel Reconnect	76	14
Tier II	Nena Creek – Upper Nena Creek Holistic Restoration Project	74	16
Tier III	Coyote Creek – Log Springs Restoration Project	70	17
Node	Quartz Creek – Confluence with Beaver Creek to S-100 Road Project	70	17
Tier I	Lower Beaver Creek – Beaver Creek / Warm Springs River Confluence Project	69	19
Tier I	South Fork Warm Springs River – B-200 Road Removal, Wetland Restoration, and F	67	20

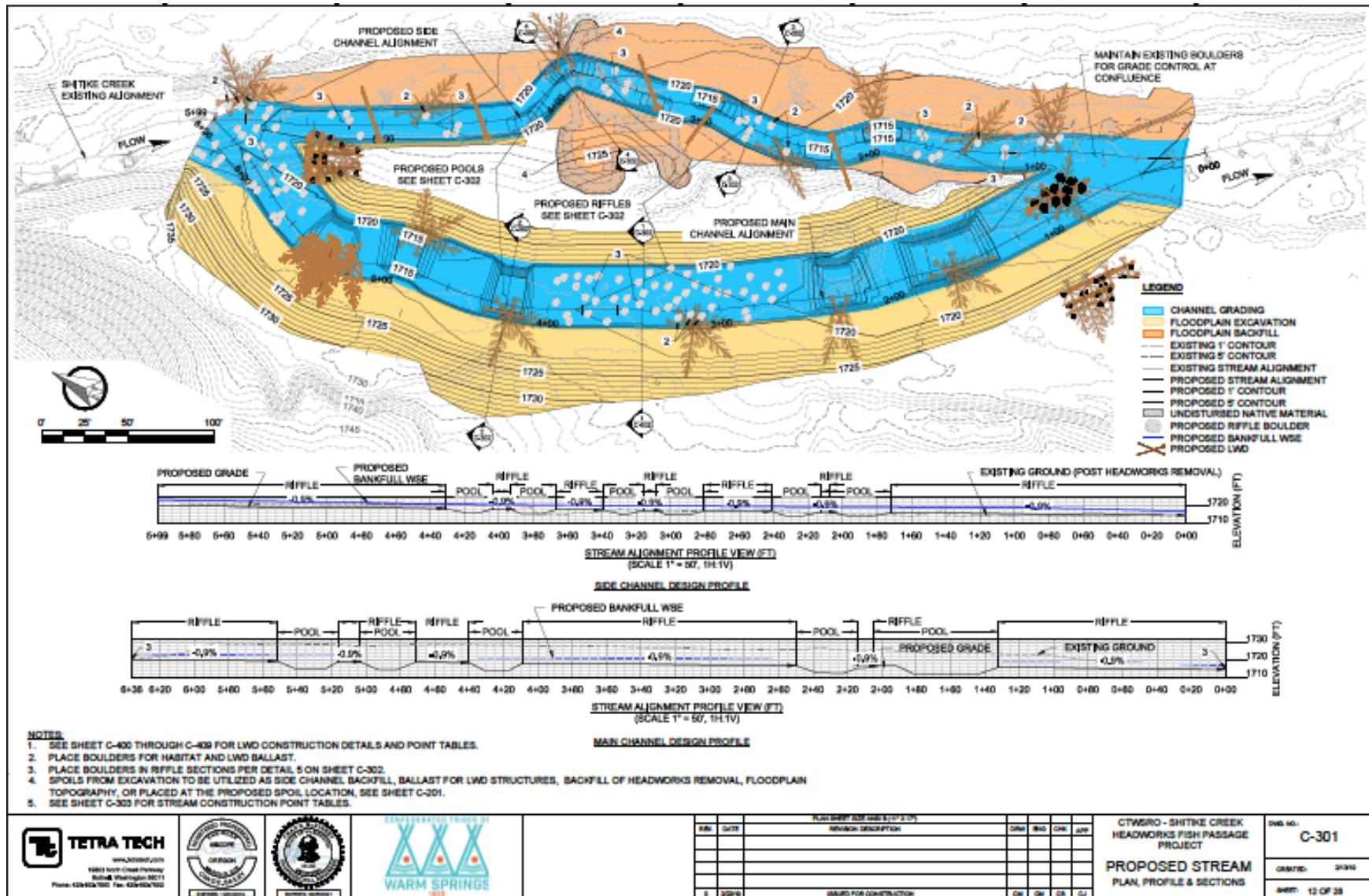
Where are we going from here

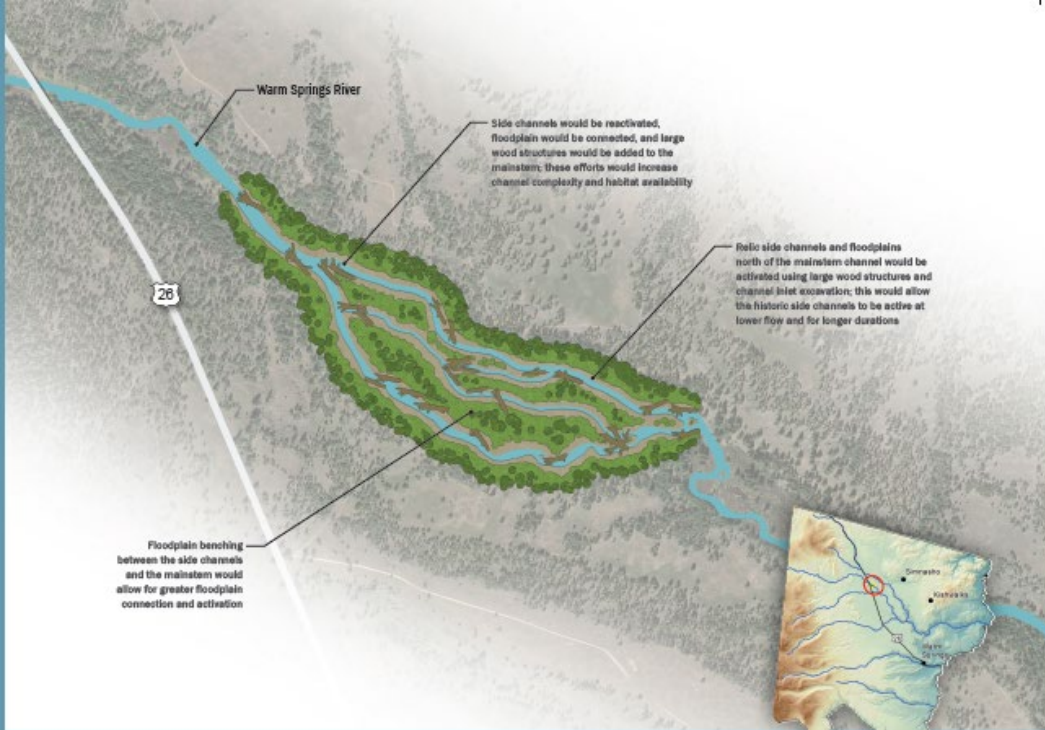
2020 Proposed meadow restoration to reduce sediment inputs into critical habitats



2021

Removal of a known lamprey barrier in lower Shitike Creek





2022 More LWD Placements in the Warm Springs River and Beaver Creek



A close-up photograph of a large rainbow trout in dark water. The fish has a silvery body with dark spots and a prominent pinkish-red lateral band. A colorful fly lure with blue, green, and orange feathers is caught in its mouth. Two hands are visible, supporting the fish from above.

Stay tuned

Lots of important habitat work ahead

Scott Turo
Fish Habitat Program Supervisor
541-553-2025
scott.turo@ctwsbnr.org

Questions?