Oregon Middle Columbia River Steelhead Recovery Plan
Appendices A through J

APPENDIX A

Participants
Conservation and Recovery Plan for Oregon Steelhead Populations
Middle Columbia River Steelhead Distinct Population Segment

Sounding Board
Planning Team
Limiting Factors and Threats Expert Panel
Deschutes/Fifteenmile Management Action Team
John Day Basin Management Action Team
Umatilla/Walla Walla Management Action Team

Participants--Oregon Mid-Columbia Steelhead Recovery Plan

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Brett Brownscombe	Oregon Trout
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Rich Carmichael	ODFW (State of Oregon Recovery Plan Coordinator)
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Gary Wade	NOAA
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Umatilla/Walla Walla Management Action Team

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Appendix B

Oregon Mid-Columbia Steelhead Viability Assessments

Viability assessments following the format provided by the ICTRT for the following populations:

Fifteenmile Creek Winter Steelhead
Deschutes River Eastside Summer Steelhead
Deschutes River Westside Summer Steelhead
Crooked River Summer Steelhead
Lower Mainstem John Day River Summer Steelhead
North Fork John Day River Summer Steelhead
Middle Fork John Day River Summer Steelhead
South Fork John Day River Summer Steelhead
Upper Mainstem John Day River Summer Steelhead
Umatilla River Summer Steelhead
Walla Walla River Summer Steelhead

Fifteenmile Creek Winter Steelhead Population

The Fifteenmile Creek winter steelhead population (Figure 1) is one of five extant populations in the Cascades Eastern Slope Tributaries MPG within the Mid-Columbia steelhead DPS. The Fifteenmile Creek population is the only population in the DPS that is classified as an entirely winter life history type.

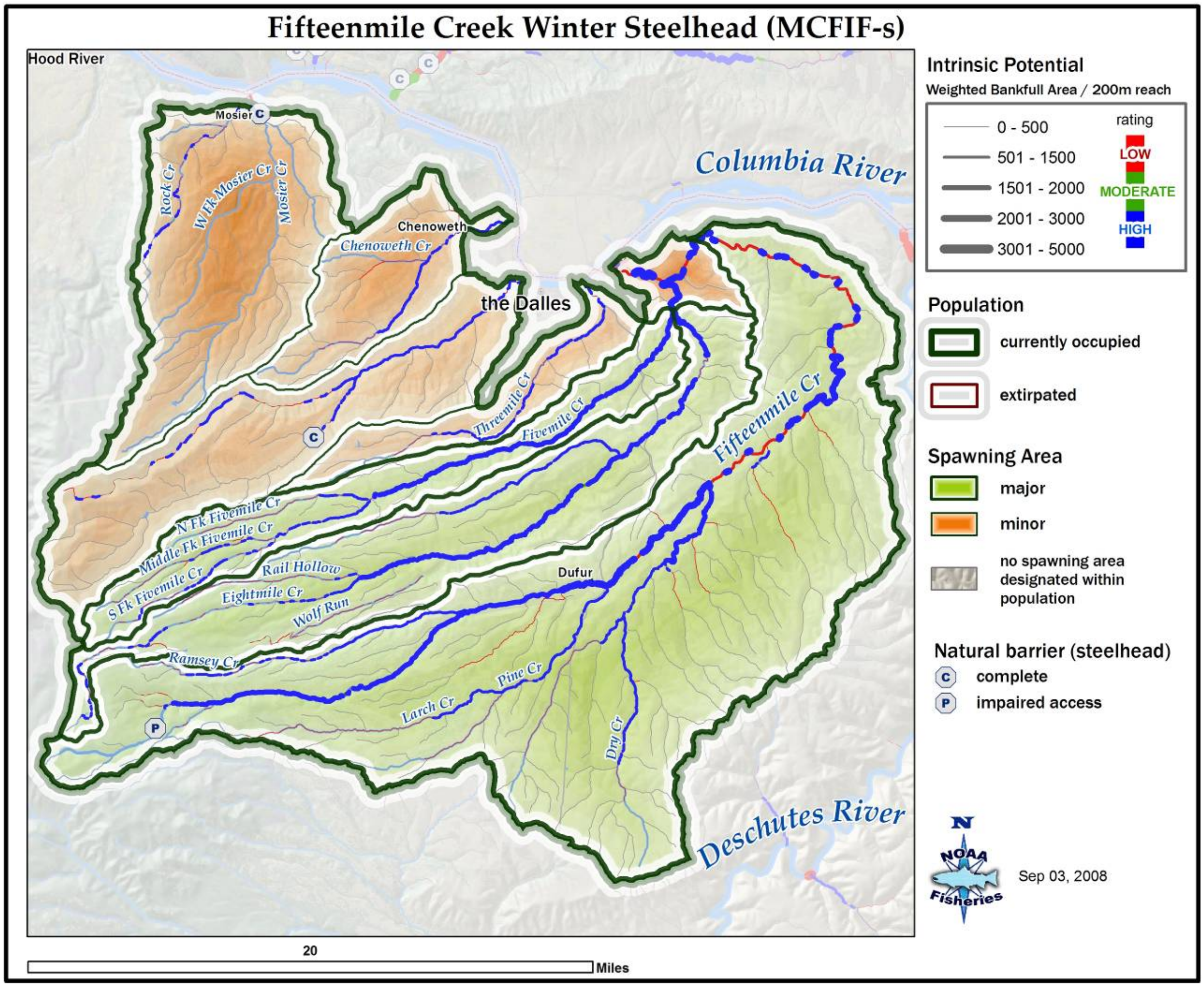

Figure 1. Fifteenmile Creek winter steelhead population boundary and major (MaSA) and minor (MiSA) spawning areas.

The Interior Columbia Technical Recovery Team (ICTRT) classified the Fifteenmile Creek population as "basic" in size and complexity (Table 1). A steelhead population classified as basic has a mean minimum abundance threshold of 500 natural-origin spawners with sufficient intrinsic productivity (≥ 1.56 recruits per spawner at the abundance threshold level) to achieve a 5% or less risk of extinction over a 100-year timeframe. In order for the Fifteenmile Creek population to achieve a 1% or less risk ("very low risk") of extinction over 100 years, productivity would need to be at or greater than 2.00 recruits per spawner at the minimum abundance threshold.

Table 1. Fifteenmile Creek winter steelhead population basin statistics and intrinsic potential analysis summary.

Drainage area (km^2)	1,420
Stream lengths km (total) [a]	638
Stream lengths km (below natural barriers) [a]	495
Branched stream area weighted by intrinsic potential (km^2)	1.816
Branched stream area km^2 (weighted and temp. limited) [b]	1.384
Total stream area weighted by intrinsic potential (km^2)	2.006
Total stream area weighted by intrinsic potential (km^2) temp limited [b]	1.423
Size / Complexity category	Basic / “C” (trellis pattern)
Number of major spawning areas (MaSAs)	3
Number of minor spawning areas (MiSAs)	5

a. All stream segments ≥ 3.8m bankfull width were included.
b. Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was > 22°C.

Current Abundance and Productivity

Current (1985 to 2005) total spawner abundance (number of adult spawners in natural production areas) has ranged from 231 in 1998 to 1,922 in 2004 (Figure 2). Estimates of abundance of adult steelhead spawners in the Fifteenmile Creek subbasin are based on redds observed during single pass spawning ground surveys conducted annually by the Oregon Department of Fish and Wildlife (ODFW) and U.S. Forest Service (USFS) personnel in selected survey units in upper Fifteenmile, Ramsey, and Eightmile creeks from 1985 through 2002. Since 2003, spawning ground surveys have been conducted in three passes over the duration of annual spawning activity in one-mile survey sites selected randomly from five-mile survey units stratified across the currently known spawning habitat in Fifteenmile, Ramsey, Eightmile, and Fivemile creeks. For this analysis, observations of redds and the locations of surveys have been compiled from DePinto et al. (2003), Glenney et al. (2004) and unpublished data (R. French, ODFW, personal communication 2005). Prior to 2003, we used redd densities in surveyed reaches to estimate redd densities in unsurveyed reaches. The ICTRT intrinsic potential analyses (ICTRT 2007) were used to estimate redds per weighted m^2 in surveyed reaches. To estimate total redds in the population, we multiply the number of redds per weighted m^2 in surveyed reaches by the total weighted m^2 of currently used habitat in the drainages where reaches were surveyed (ICTRT 2007). Historical intrinsic potential is estimated using a simple GIS-based model that accounts for differences across stream reaches (in terms of stream width, gradient, and valley width) and is further weighted by habitat quality.

For the 2003 and later years, observations of redds were expanded by the sample rate, both temporally and spatially, to estimate each season’s total redds (redds/total spawning area/year). For years when streams in the Fifteenmile Creek subbasin were not surveyed (most notably Fivemile Creek prior to 2003) assumptions were made that spawning activity in unsurveyed streams was generally evenly distributed and synchronous with the entire population. Average proportional relations relative to the Fifteenmile Creek mainstem were used to estimate spawning activity in unsurveyed streams (Fivemile Creek redds represent approximately 15% of the Fifteenmile Creek mainstem redds).

The 2003-2005 multiple pass surveys have shown that spawning times can vary across years. Because the spawning ground surveys prior to 2003 were conducted once per season, variability in the time of spawning may be masked. However, spot checks were conducted to monitor the level of spawning activity to determine when to conduct the surveys and recent investigations have shown that redd life (the length of time new redds remain visible) is sufficiently long to ensure that the observations from the historic single-pass surveys represent total spawning activity for each season (R. French, personal communication). Conversion of an annual total redd count to the adult population from 1985 to present assumes there are 2.1 fish per redd. This estimate was developed based on data from Deer Creek, a tributary to the Wallowa River (R. Carmichael, ODFW, personal communication,).

To estimate the abundance of adult progeny on the spawning grounds each season, consideration of removals of natural-origin fish for hatchery broodstock and natural spawning hatchery-origin fish must be accounted for. However, no steelhead hatchery program exists in the Fifteenmile Creek subbasin and hatchery steelhead are not released in steelhead habitat (Anonymous 2004). Further, hatchery strays in the Fifteenmile Creek subbasin have rarely been observed and the proportion is near 0%. Consequently for this analysis, the fraction of hatchery fish in the spawning population was assumed to be very low and mathematically assigned a value of zero.

Virtually no spawning steelhead in the Fifteenmile Creek subbasin have been sampled for age-at-return and no population specific information exists to assign natural-origin spawning fish into cohorts to estimate abundance of progeny. Therefore, age-at-return information from the closest natural-origin steelhead population with similar winter run traits was used to apportion Fifteenmile Creek steelhead spawners into brood years. Year specific age-at-return data for Hood River natural-origin winter steelhead sampled at Powerdale Dam were used. For those years with inadequate sample sizes, an average age-at-return by spawning year was applied.

Recent year natural spawners include only natural-origin fish. Hatchery strays in the Fifteenmile Creek population have rarely been documented.

Abundance in recent years has been moderately variable. The 10-year (1996-2005) geometric mean abundance of natural-origin spawners was 703 (Table 2). During the period 1985-1999, recruits per spawner (R/S, in terms of spawner to spawner) in the Fifteenmile Creek population ranged from 0.37 in 1987 to 5.58 in 1998. The annual R/S estimates were adjusted to reflect average smolt-to-adult return rates (SAR). The 15-year (1985-1999) geometric mean productivity was 1.82 R/S, adjusted for SAR and delimited at 75% (375 spawners) of the abundance threshold.

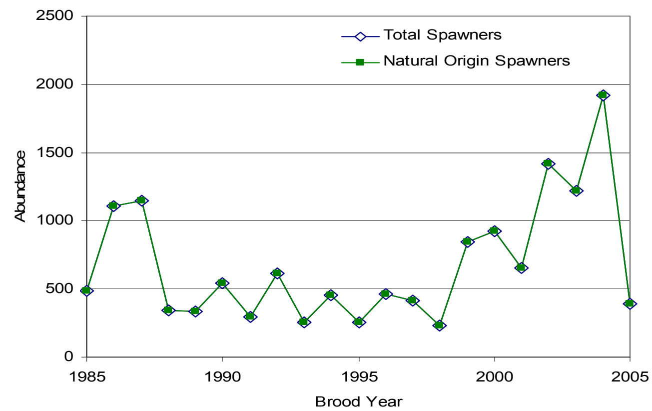

Figure 2. Fifteenmile Creek winter steelhead population spawner abundance estimates (1985-2005).

Table 2. Fifteenmile Creek winter steelhead population abundance and productivity estimates.

Abundance/Productivity Statistics	Estimate	(Range)	
Abundance: natural-origin spawners (10-year geometric mean, range)	703	(231-1,922)	
Proportion: natural-origin spawners (10-year geometric mean, range)	1.0	No obs. strays	
	Estimate	**(90% CI)[b]**	**SE**
Intrinsic productivity (15-year R/S, SAR adjusted and delimited) [a]	1.82	(1.23-2.68)	0.20
Productivity (15-year Beverton-Holt fit, SAR adjusted)	n/a		(n/a)
Trend Statistics (1985-2005)	**Estimate**	**(95% CI)**	**P>1.0**
ln(natural-origin spawner abundance)	1.03	(0.98-1.15)	
Population growth rate (λ): Hatchery effectiveness = **1.0**	1.03	(0.83-1.28)	0.65
Population growth rate (λ): Hatchery effectiveness = **0.0**	1.03	(0.83-1.28)	0.65

a. Delimited productivity excludes any recruit/spawner pair where the spawner number exceeds 75% of the abundance threshold. This approach attempts to remove density dependence effects that may influence the productivity estimate.
b. Lower end of the 90% CI on productivity is used in evaluating the impact of parameter uncertainty on risk.

The Fifteenmile Creek winter steelhead population is at **Low Risk** based on current abundance and productivity. The point estimate for abundance and productivity resides above the 1% risk curve, but the population is not considered to be at very low risk since the 98% confidence interval (CI) extends below the 25% risk curve (Figure 3). However, since the 90% CI is above the 25% risk curve, the population is rated at low risk. Results should be viewed cautiously, as estimates are based on only 15 years of data.

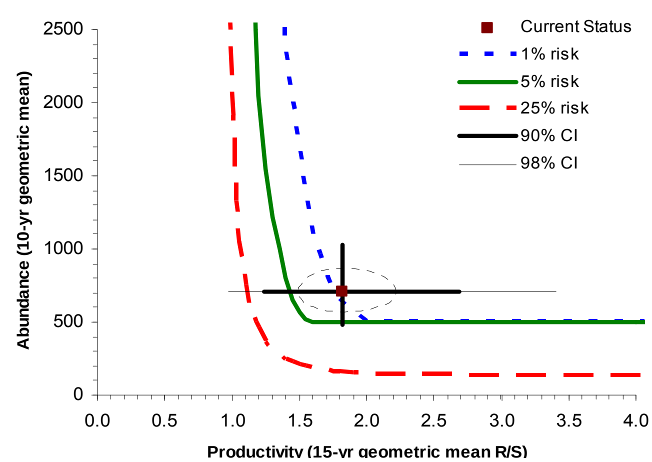

Figure 3. Fifteenmile Creek winter steelhead population current abundance/productivity (A/P) compared to DPS viability curve. Ellipse = 1 SE about the point estimate. Error bars = 90% CI for A, 90% and 98% CIs for P (point estimate >1% risk curve; the uncertainty test is <1% probability the combined A/P is at high risk).

Both of the recent abundance trend metrics for this population indicate an average annual increase of approximately 3% per year over the period, driven largely by a relatively steady increase from 1999 through the 2004 return (Figure 2, Table 2). Abundance in 2005 decreased to similar levels observed from 1988 through 1998.

Spatial Structure and Diversity

The ICTRT has identified three major spawning areas (MaSAs) and five minor spawning areas (MiSAs) within the Fifteenmile Creek population boundaries. The population boundary extends outside the Fifteenmile Creek subbasin to encompass the Rock Creek, Mill Creek, and Threemile Creek drainages which directly enter the Columbia River downstream from Fifteenmile Creek (Figure 4). These drainages account for four of the five MiSAs. Current spawning distribution is similar to historic with major production areas in Fifteenmile, Ramsey, Eightmile and Fivemile creeks.

Spawners within the Fifteenmile Creek population include only natural-origin fish. Very few strays have been observed in the population and there is no hatchery program operated within the population. Additionally, there are few sources of winter steelhead strays in the interior Columbia River basin.

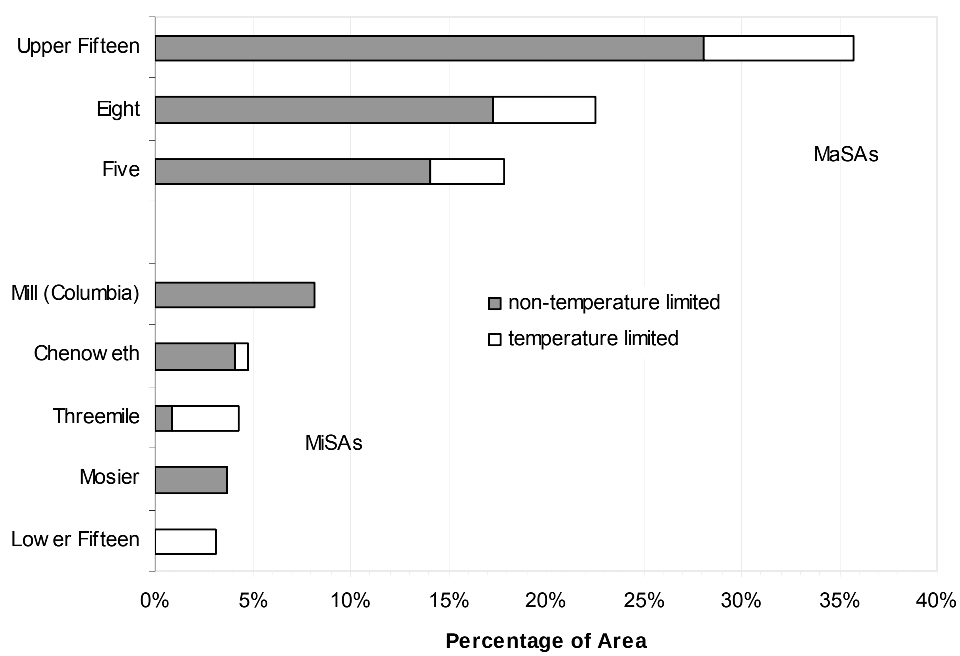

Figure 4. Fifteenmile Creek winter steelhead population distribution of intrinsic potential habitat across major (MaSAs) and minor spawning areas (MiSAs). White bars represent current temperature limited areas that could potentially have had historical temperature limitations

Factors and Metrics

A.1.a Number and spatial arrangement of spawning areas

The Fifteenmile Creek population has three MaSAs and five MiSAs distributed in a trellis pattern. Historic major production areas included Fifteenmile, Ramsey, Eightmile and Fivemile creeks. Based on the ODFW current spawning distribution database, all three MaSAs and all five MiSAs are now occupied. Current distribution is similar to the historic intrinsic potential distribution, with reductions primarily in the southeast tributaries of the Fifteenmile MaSA. The Fifteenmile Creek population rates at **very low risk** because it has three occupied MaSAs and five MiSAs that equate to greater than 75% of one MaSA.

A.l.b. Spatial extent or range of population

The current spawner distribution mirrors the historic distribution with all MaSAs currently occupied (Figure 5). The rating for this metric is **very low risk** because the current spawning distribution mirrors the historic distribution. Spawning ground survey data are available for Fifteenmile, Ramsey, and Eightmile creeks for 1985-2005. We will conduct additional analyses at a later date to assess occupancy based on this recent survey data.

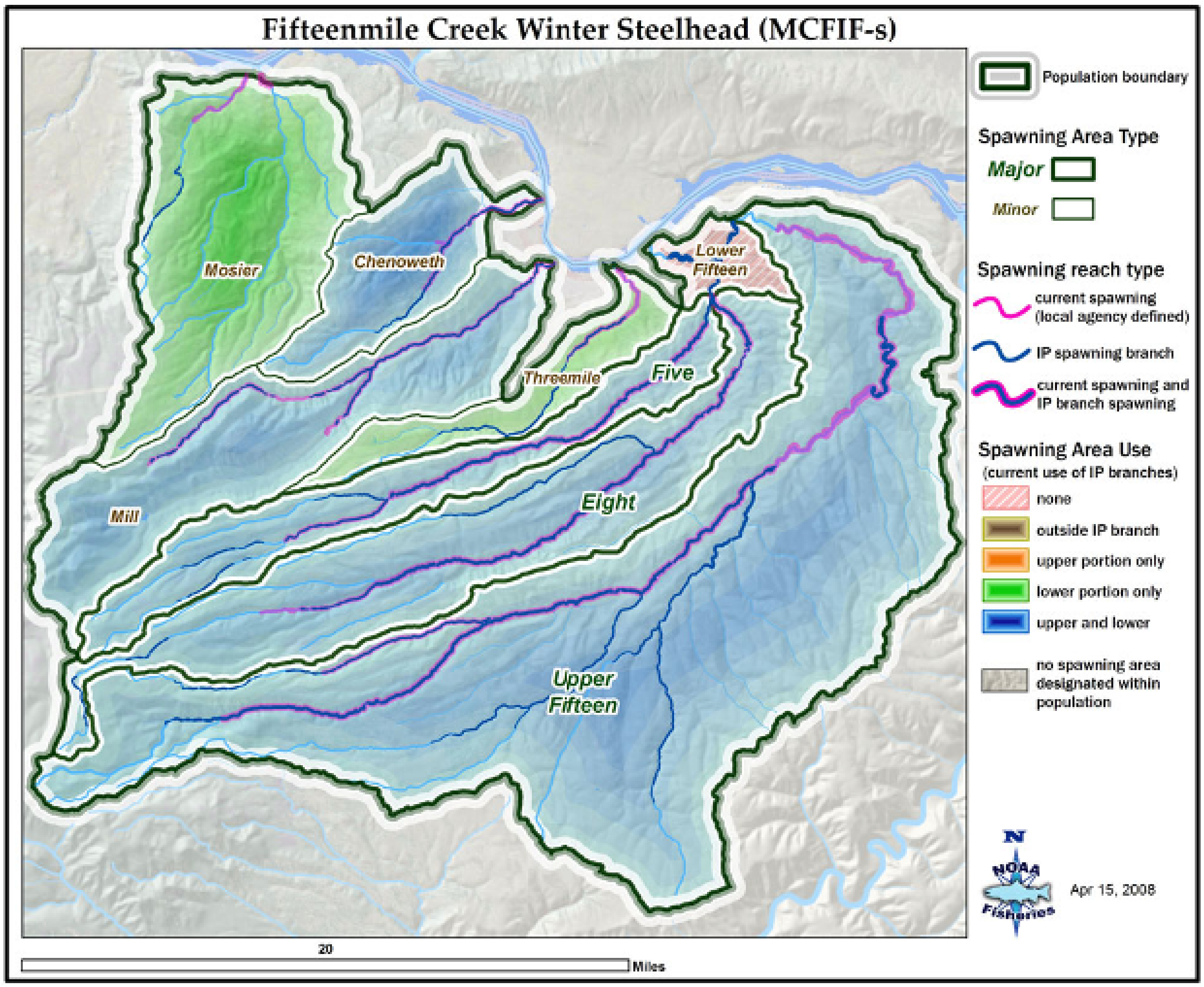

Figure 5. Fifteenmile Creek winter steelhead population current spawning distribution and spawning area occupancy designations.

A.1.c. Increase or decrease in gaps or continuities between spawning aggregates

There has been little change in gaps between current and historical distribution. The population is rated at **very low risk** because all historical MaSAs are occupied, gap distance and continuity has changed little, and there has been no increase in distance between this population and other populations in the Mid-Columbia DPS.

B.1.a. Major life history strategies

There are limited data to allow any direct comparisons between historic life history strategies and current strategies. Flow and temperature changes have likely influenced movement pathways and continuity of habitat for juvenile steelhead. Some middle and lower mainstem reaches become uninhabitable during low flow summer periods. We infer that these habitat changes have truncated spawn timing and somewhat limited juvenile rearing diversity. Although these changes have had some influence on life history strategies, they have not likely influenced major strategies. The anadromous form of *O. mykiss* currently persists in the population and the winter run characteristics have been maintained. We hypothesize that all historic major life history pathways are present, although the mean and variability may have shifted slightly. The rating is **low risk** for this metric.

B.1.b. Phenotypic variation

We have no direct evidence for loss or substantial change in phenotypic traits. However, changes in flow patterns and temperature profiles within Fifteenmile Creek subbasin have likely reduced variation in both juvenile migration timing and adult spawn timing. We hypothesize that low flows and elevated water temperatures result in a narrower window for successful smolt out-migration as well as truncation of adult spawn timing. However, the magnitude of the changes is likely small. Based on inference from habitat changes we have rated the Fifteenmile Creek population at **low risk**.

B.1.c. Genetic variation

Genetics data consist of samples from two locations within the Fifteenmile Creek population—Eightmile and Fifteenmile creeks. This genetics information indicates that the Fifteenmile Creek population is well differentiated from other populations in the Cascades Eastern Slope Tributaries MPG. Samples within the population from Eightmile Creek are also substantially differentiated from Fifteenmile Creek indicating within-population variation. We have rated this metric as **low risk**. Additional samples collected in 2005 from multiple locations within the population will provide a more robust dataset to assess this metric in the future.

B.2.a. Spawner composition

(1) *Out-of-DPS spawners:* Out-of-DPS winter steelhead strays would originate from the Hood River hatchery program, from releases into the White Salmon River, and from other hatcheries downstream of Hood River. We have documented very few strays, thus the rating is **low risk**.

(2) *Out-of-MPG spawners from within the DPS:* There are no out-of-MPG within-DPS winter hatchery programs, thus the rating is **very low risk**.

(3) *Out-of-population spawners from within the MPG:* The only source of out-of-population within-MPG strays would be from the Klickitat River winter steelhead hatchery program. Since very few strays have been documented and their source is unknown, we have rated this metric as **low risk**.

(4) *Within-population hatchery spawners:* There is no within population hatchery program. This metric rated **very low risk**.

The overall spawner composition rating is **low risk**.

B.3.a. Distribution of population across habitat types

The intrinsic potential distribution encompassed four ecoregions, of which three accounted for 10% or more of the distribution (Figure 6). Although there have been reductions in the proportional distribution of the Umatilla Plateau ecoregion, these reductions were not substantial. The population rates at **low risk**.

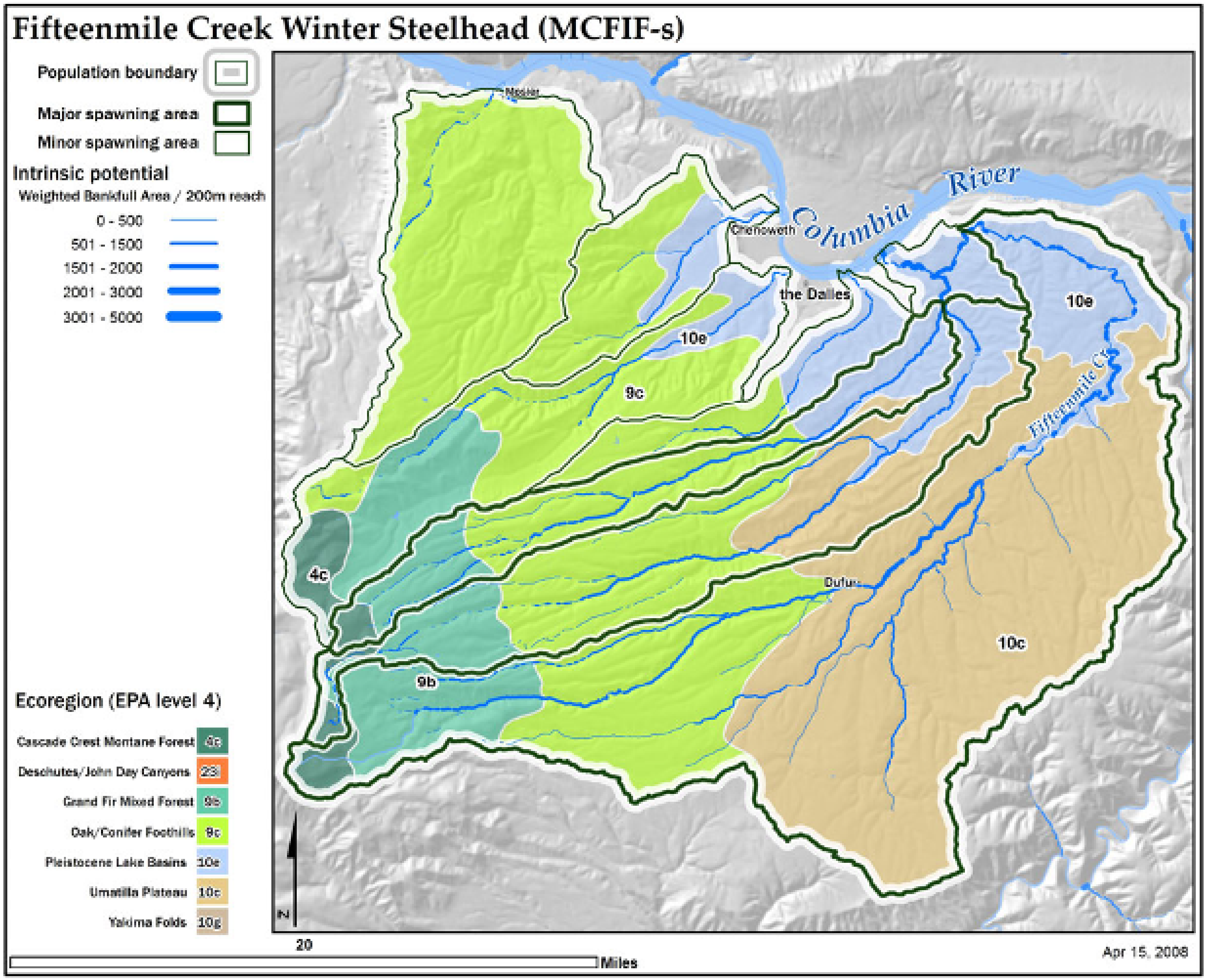

Figure 6. Fifteenmile Creek winter steelhead population spawning distribution across EPA level IV ecoregions.

Table 3. Fifteenmile Creek winter steelhead population proportion of current spawning areas across EPA level IV ecoregions.

Ecoregion	% of historical spawning area (non-temp. limited)	% of currently occupied spawning area (non-temp. limited)
Grand Fir Mixed Forest	7.8	4.1
Oak/Conifer Foothills	36.4	41.2
Pleistocene Lake Basins	32.6	39.7
Umatilla Plateau	23.3	15.0

B.4.a. Selective change in natural processes or selective impacts

Hydropower system: This population passes one dam in its seaward and spawning migrations, thus impacts on this population are relatively low. No traits are selectively affected by hydropower activity to the degree that they raise the risk level for this population. The rating is **low risk** for all traits.

Harvest: Harvest has the potential to affect migration timing, maturation timing and size. However, recent harvest rates for A-run steelhead in the Columbia River mainstem are generally less than 10% annually. Although some harvest may be size-selective for larger fish, the selective mortality would affect slightly more than 2% of the total population. There may be some very slight advantage for earlier returning fish as a result of the timing of the Chinook salmon fishery. While heritability of adult migration timing is high, the impacts are slight enough to be negligible. There is no recreational fishery in the subbasin. No phenotypic traits appear to be at risk as a result of harvest activity and the rating is **low risk**.

Hatcheries: There are no steelhead hatchery programs operated within the population, therefore, there are no selective effects. The rating is **very low risk**.

Habitat: Altered flow profiles and increased temperatures in tributary spawning and rearing areas, which have been in place for many generations and are ongoing, likely impose some selection on juvenile and adult migration timing. However, the magnitude of the impact on any trait is negligible, thus the rating is **low risk** for all traits.

Other: A population of Caspian terns in the estuary has been artificially enhanced by a combination of increased habitat (created by dredge spoils) and artificially increased food availability (large-scale releases of hatchery smolts). These terns appear to exert a size-selective predation pressure that is felt most strongly by the large steelhead smolts. The rate of predation is highest in May during nesting season. This pressure may affect smolt migration timing.

> *Juvenile migration timing:* Steelhead smolts pass through the estuary from April to June. The relatively high predation (10%) on smolts in May could select for earlier and later out-migrants. However, heritability of this trait has not been assessed, so we assume a moderate to low heritability. Because this predation occurs at the peak of migration, the impact of this selection is **low risk**.

No single trait has a moderate risk rating for any selective activity. Therefore, the overall selectivity rating for this population is **low risk.**

Spatial Structure and Diversity Summary

The integrated spatial structure/diversity rating is **Low Risk** (Table 4) for the Fifteenmile Creek population. There has been little change in distribution relative to the historic distribution. The absence of major reductions in distribution resulted in a rating of very low risk for spatial structure metrics. We hypothesize that there have been minor reductions in life history diversity and phenotypic variation, but these changes are not severe enough to raise risk levels to moderate. There are few hatchery fish in the population resulting in low risk for spawner composition.

Table 4. Fifteenmile Creek winter steelhead population spatial structure and diversity risk rating.

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
A.1.a	VL (2)	VL (2)	Very Low Risk (Mean = 2)	Very Low Risk (Mean = 2)	**Low Risk**
A.1.b	VL (2)	VL (2)			
A.1.c	VL (2)	VL (2)			
B.1.a	L (1)	L (1)	Low Risk (1)	Low Risk (Mean = 1)	
B.1.b	L (1)	L (1)			
B.1.c	L (1)	L (1)			
B.2.a(1)	L (1)	Low Risk (1)	Low Risk (1)		
B.2.a(2)	VL (2)				
B.2.a(3)	L (1)				
B.2.a(4)	VL (2)				
B.3.a	L (1)	L (1)	L (1)		
B.4.a	L (1)	L (1)	L (1)		

Overall Viability Rating

The Fifteenmile Creek winter steelhead population currently meets ICTRT viability criteria and is rated as a **VIABLE** population (Figure 7). Overall abundance and productivity is rated at **Low Risk.** The 10-year geometric mean abundance of natural-origin spawners is 703, which exceeds the minimum abundance threshold of 500. The 15-year geometric mean productivity (1.82 R/S; Table 6) exceeds the 1.56 R/S required at the minimum abundance threshold. Overall spatial structure and diversity is also rated at **Low Risk.** A relatively small increase in productivity and a substantial reduction in the CI are required to move this population into "highly viable" status. Additional data will likely decrease the standard error and move the 98% CI out of the high risk region. These results should be viewed with caution, as abundance and productivity estimates for the Fifteenmile Creek population are based on only 15 years of R/S data. Monitoring should be continued to allow analysis of a longer time series.

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	**HV**	**HV**	**V**	**M**
	Low (1-5%)	**V**	**V Fifteenmile Creek**	**V**	**M**
	Moderate (6 – 25%)	**M**	**M**	**M**	**HR**
	High (>25%)	**HR**	**HR**	**HR**	**HR**

Figure 7. Fifteenmile Creek winter steelhead population risk ratings integrated across the four viable salmonid population (VSP) metrics. ***Viability Key: HV – Highly Viable; V – Viable; M – Maintained; HR – High Risk; Shaded cells - does not meet viability criteria (darkest cells are at greatest risk).***

Data Summary – Fifteenmile Creek Winter Steelhead Population

Data type: Expansions from multiple pass surveys in major tributary spawning reaches. Annual index area counts expanded to total population abundances using ratio of total to index area weighted intrinsic habitat (ICTRT 2007, Appendix C). Assumed 2.1 fish per redd.
SAR: Mid-Columbia steelhead composite series (see *Methods* section).

Table 5. Fifteenmile Creek winter steelhead population abundance and productivity data used for curve fits and R/S analysis. Bolded values were used in estimating the current productivity (Table 6).

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	SAR Adj. Factor	Adj. Rtns	Adj. R/S
1985	484	1.0	484	383	0.79	0.46	176	0.36
1986	1109	1.0	1109	470	0.42	0.94	443	0.40
1987	1144	1.0	1144	424	0.37	2.18	922	0.81
1988	**340**	**1.0**	**340**	**529**	**1.56**	**0.99**	**524**	**1.54**
1989	**333**	**1.0**	**333**	**252**	**0.76**	**0.96**	**242**	**0.73**
1990	542	1.0	542	423	0.78	2.83	1196	2.21
1991	**291**	**1.0**	**291**	**265**	**0.91**	**2.33**	**618**	**2.12**
1992	611	1.0	611	446	0.73	1.88	838	1.37
1993	**257**	**1.0**	**257**	**443**	**1.72**	**1.18**	**524**	**2.04**
1994	456	1.0	456	344	0.75	1.07	369	0.81
1995	**257**	**1.0**	**257**	**569**	**2.21**	**1.23**	**697**	**2.71**
1996	465	1.0	465	1216	2.62	1.03	1255	2.70
1997	412	1.0	412	830	2.01	0.76	633	1.54
1998	**231**	**1.0**	**231**	**1292**	**5.58**	**0.49**	**633**	**2.74**
1999	844	1.0	844	1385	1.64	0.52	717	0.85
2000	925	1.0	925					
2001	655	1.0	655					
2002	1421	1.0	1421					
2003	1220	1.0	1220					
2004	1922	1.0	1922					
2005	388	1.0	388					

Table 6. Fifteenmile Creek winter steelhead population geometric mean abundance and productivity estimates (values used for current productivity area shown in boxes).

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
delimited	median	75% threshold	median	75% threshold	1988-1999	1985-1999	geomean
Point Est.	1.73	1.68	1.77	1.82	1.10	1.04	703
Std. Err.	0.25	0.29	0.17	0.20	0.06	0.11	0.21
count	7	6	7	6	12	15	10

Table 7. Fifteenmile Creek winter steelhead population stock-recruitment curve fit parameter estimates. Biologically unrealistic or highly uncertain values are highlighted in grey.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	1.17	0.21	n/a	n/a	0.40	0.44	37.1	1.27	0.21	n/a	n/a	0.38	0.33	34.8
Const. Rec	533	72	n/a	n/a	n/a	n/a	28.2	579	78	n/a	n/a	n/a	n/a	27.9
Bev-Holt	50.00	386.27	547	135	0.16	0.66	31.3	7.59	13.49	709	293	0.26	0.05	30.8
Hock-Stk	2.41	15.98	221	1465	0.16	0.65	31.3	2.56	29.41	226	2595	0.27	-0.04	31.1
Ricker	2.70	0.78	0.00161	0.00049	0.17	0.64	32.1	2.58	0.73	0.00137	0.00048	0.27	0.03	31.4

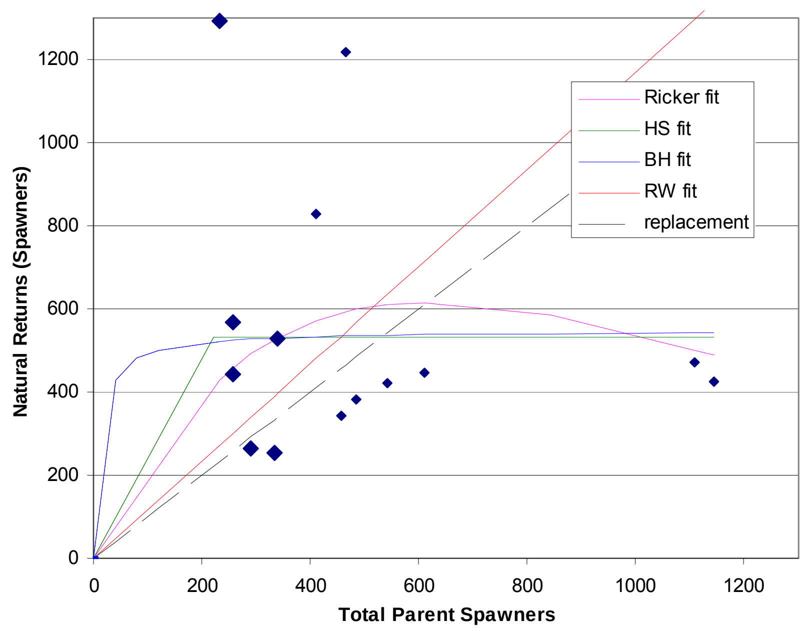

Figure 8. Fifteenmile Creek winter steelhead population stock recruitment curves. Bold points were used in estimating the current productivity. Data were not adjusted for marine survival.

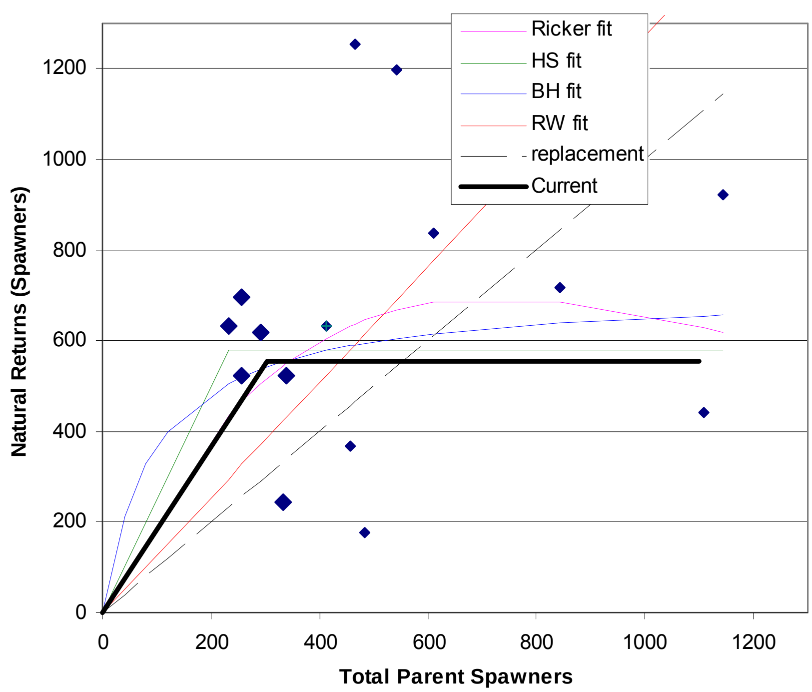

Figure 9. Fifteenmile Creek winter steelhead population stock recruitment curves. Bold points were used in estimating the current productivity. Data were adjusted for marine survival. Function labeled "Current" is a Hockey Stick function derived by fixing the slope of the ascending limb at the geometric mean productivity at low to moderate abundance (Table 2) and fitting a capacity estimate to the data series.

Deschutes River Eastside Summer Steelhead Population

The Deschutes River Eastside summer steelhead population (Figure 1) is one of five extant populations in the Cascades Eastern Slope Tributaries MPG within the Mid-Columbia steelhead DPS.

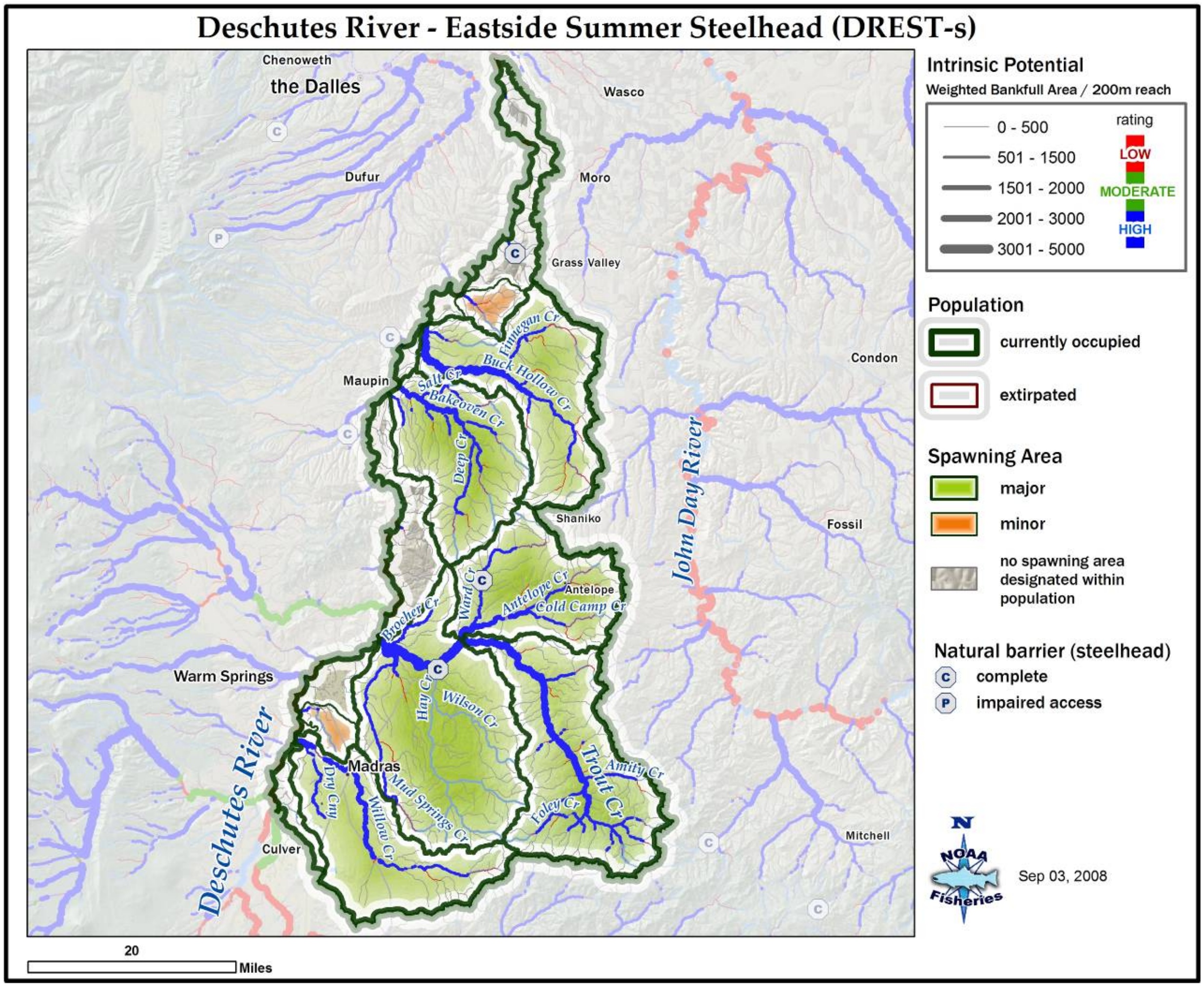

Figure 1. Deschutes River Eastside summer steelhead population boundary and major (MaSA) and minor (MiSA) spawning areas.

The Interior Columbia Technical Recovery Team (ICTRT) classified the Deschutes River Eastside population as "intermediate" in size and complexity (Table 1). A steelhead population classified as intermediate has a mean minimum abundance threshold of 1,000 natural-origin spawners with a sufficient intrinsic productivity (≥ 1.35 recruits per spawner at the abundance threshold level) to achieve a 5% or less risk ("low risk") of extinction over a 100-year timeframe. In order for the Deschutes River Eastside population to achieve a 1% or less risk ("very low risk") of extinction over 100 years, productivity would need to be at or greater than 1.64 recruits per spawner at the minimum abundance threshold.

Table 1. Deschutes River Eastside summer steelhead population basin statistics and intrinsic potential analysis summary.

Drainage area (km^2)	3,889
Stream lengths km (total) [a]	974
Stream lengths km (below natural barriers) [a]	884
Branched stream area weighted by intrinsic potential (km^2)	2.780
Branched stream area km^2 (weighted and temp. limited) [b]	1.772
Total stream area weighted by intrinsic potential (km^2)	4.082
Total stream area weighted by intrinsic potential (km^2) temp limited [b]	2.253
Size / Complexity category	Intermediate / "B" (dendritic structure)
Number of major spawning areas (MaSAs)	6
Number of minor spawning areas (MiSAs)	2

a. All stream segments ≥ 3.8m bankfull width were included.
b. Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was > 22^{o}C.

Current Abundance and Productivity

Current (1990 to 2005) total spawner abundance (number of adult spawners in natural production areas) has ranged from 583 in 1993 to 9,801 in 2001 (Figure 2). Current abundance of natural-origin adult spawners ranged from 299 in 1993 to 8,274 in 2001 (Figure 2). We examined two approaches for estimating the abundance of natural-origin and hatchery-origin steelhead in the Deschutes River Eastside population and selected one for this viability assessment. The first approach is similar to that used by Chilcote (2001) who conducted stock recruitment analyses for the combined Deschutes River Eastside and Westside populations. This method used the following information: estimated number of steelhead that pass above Sherars Falls (from mark-recapture estimates); the number of fish recovered in fisheries and traps above Sherars Falls; and estimated fall back rate for hatchery fish. We conducted similar analyses for the Deschutes River Eastside population with the additional step of subtracting out the Westside population abundance estimates. We found that this approach yielded, what appeared to be, extremely high abundance estimates of both natural-origin and hatchery-origin spawners for the Deschutes River Eastside population. Using this method resulted in a high number of spawners in the mainstem Deschutes River that was not consistent with the two years of redd observations data. We were unable to adequately quantify Sherars Falls fallback rates for natural-origin and hatchery-origin fish. The Sherars Falls mark-recapture subtraction approach is very sensitive to the fall back estimates, so in the absence of accurate estimates, we chose to use an alternative approach.

We chose to assess abundance and productivity based on estimates of spawners in the tributary production areas including Buck Hollow, Bakeoven, and Trout creeks. We acknowledge that this approach does not account for mainstem abundance and productivity. However, we believe this approach provides a better representation of the abundance and productivity for the Deschutes River Eastside population.

Estimates of the abundance of steelhead in the tributary production areas of the Eastside population are based on single pass index spawning ground surveys in the major spawning areas (MaSAs) of Trout, Bakeoven, and Buck Hollow creeks. Annual observations of redds begin with the 1990 spawning year in Bakeoven and Buck Hollow creeks, and 1993 in Trout Creek (excluding 1994). Spawning also occurs in the mainstem, but only two surveys have been conducted in the mainstem downstream of Trout Creek and this portion of the Eastside population is not included in this assessment.

To estimate spawning abundance, observed redd densities (redds/m^2) were extrapolated to unsurveyed areas of currently occupied spawning habitat. Variability in spawning habitat quality and capacity are incorporated in the abundance estimate by using the ICTRT's historical intrinsic potential (ICTRT 2007) to expand redd observations per unit survey area to unsurveyed areas. The number of redds per weighted m^2 of intrinsic habitat in the index survey areas are multiplied by the total m^2 of weighed intrinsic habitat within each tributary production area. Total redds are determined as the sum of redds in Bakeoven, Buck Hollow, and Trout creeks. In Trout Creek in 1990-1992 and 1994, when surveys were not conducted, the Trout Creek abundance was assumed to be 1.44 times the sum of the Buck Hollow and Bakeoven Creek abundance estimates, based on the proportion of spawning habitat in Trout Creek relative to all three tributaries. Redds are expanded to fish by multiplying total redds by 2.1 fish per redd (R. Carmichael, Oregon Department of Fish & Wildlife, personal communication). This estimate was derived for summer steelhead in Deer Creek, a tributary of the Wallowa River.

Abundance of progeny by spawning year was estimated by apportioning the total spawning abundance estimate into hatchery and natural-origin fish. For years when at least ten fish were examined for the presence of adipose fins in each stream, the marked fish proportion was used for the hatchery fraction. Field observers believe that these estimates may be biased low because of difficulties observing adipose fins on live fish at a distance (R. French, Oregon Department of Fish & Wildlife, personal communication). For years when fewer than ten fish were observed, the hatchery fraction was estimated based on the average ratio of the percentage of hatchery fish at Sherars Falls and the percentage of hatchery fish on the spawning grounds in Buckhollow and Bakeoven Creeks across all years. For Trout Creek we used the relationship of hatchery fraction between Trout Creek and Warm Springs National Fish Hatchery.

Virtually no spawning steelhead in the Deschutes River Eastside population have been sampled for age-at-return and no population specific information exists to assign natural-origin spawning fish into cohorts to estimate the abundance of progeny (Anonymous 2004). Age structure information used to estimate progeny by brood year was based on the average of a two-year sample of scales from natural-origin adult steelhead (N=100) collected in the lower Deschutes River (Olsen et al. 1991).

Recent year natural spawners include returns originating from naturally spawning parents, strays from the Deschutes Subbasin Round Butte Hatchery program, and a significant number of out-of-DPS hatchery strays from the Snake River basin. Origin of strays is based on recovery of coded-wire tagged fish in fisheries and at traps in the Deschutes River subbasin. Spawners originating from naturally spawning parents have comprised an average of 66% of naturally spawning fish since 1990. The percentage of natural-origin spawners has ranged from 21% to 88%.

Abundance in recent years has been moderately variable. The 10-year (1996-2005) geometric mean abundance of natural-origin spawners was 1,599. During the period 1990-1999, recruits per spawner (R/S, in terms of spawner to spawner) for steelhead in the Deschutes River Eastside population ranged from 0.24 in 1991 to 3.97 in 1996. The annual R/S estimates were adjusted to reflect the average smolt-to-adult return rate (SAR). The 10-year (1990-1999) geometric mean productivity was 1.89 R/S, adjusted for SAR and delimited at the median number of spawners (1,312; Table 2).

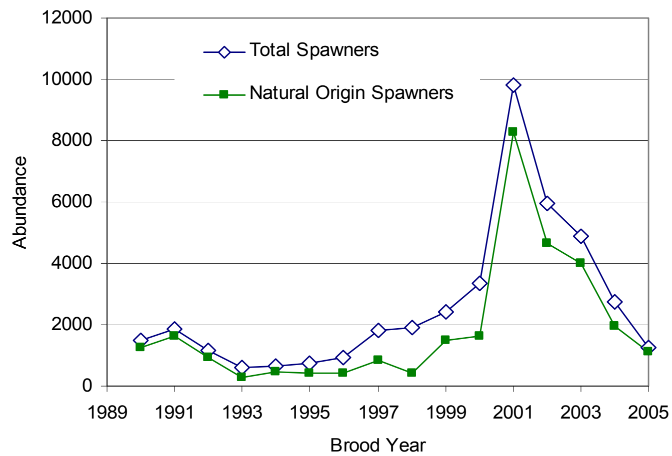

Figure 2. Deschutes River Eastside summer steelhead population spawner abundance estimates (1990-2005).

Table 2. Deschutes River Eastside summer steelhead population abundance and productivity estimates.

Abundance/Productivity Statistics	Estimate	(Range)	
Abundance: natural-origin spawners (10-year geometric mean, range)	1,599	(583-9,801)	
Proportion: natural-origin spawners (10-year geometric mean, range)	0.62	(0.21-0.88)	
	Estimate	**(90% CI)**[b]	**SE**
Intrinsic productivity (10-year R/S, SAR adjusted & delimited)[a]	1.88	(1.10-3.26)	0.24
Productivity (15-year Beverton-Holt fit, SAR adjusted)	3.94		3.83
Trend Statistics (1990-2005)	**Estimate**	**(95% CI)**	**P>1.0**
ln(natural-origin spawner abundance)	1.11	(1.01-1.23)	
Population growth rate (λ): Hatchery effectiveness = **1.0**	0.98	(0.53-1.79)	0.44
Population growth rate (λ): Hatchery effectiveness = **0.0**	1.09	(0.55-2.15)	0.68

a. Delimited productivity excludes any recruit/spawner pair where the spawner number exceeds the median escapement. This approach attempts to remove density dependence effects that may influence the productivity estimate.
b. Lower end of the 90% CI on productivity is used in evaluating the impact of parameter uncertainty on risk.

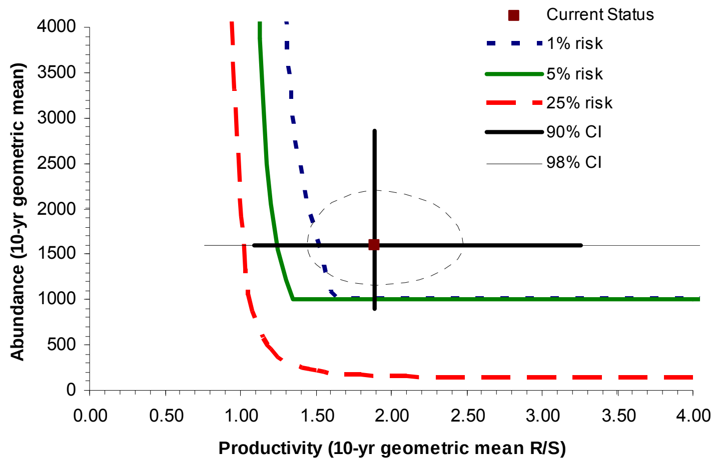

Figure 3. Deschutes River Eastside summer steelhead population current abundance/productivity (A/P) compared to the DPS viability curve. Ellipse = 1 SE about the point estimate. Error bars = 90% CI for A, 90% and 98% CIs for P (point estimate >1% risk curve, therefore the uncertainty test results in <1% probability the combined A/P is at high risk).

The Deschutes River Eastside population is at **Low Risk** based on current abundance and productivity. The point estimate for abundance and productivity resides above the 1% risk curve, but the population is not considered to be at very low risk since the lower end of the 98% confidence interval (CI) for productivity extends below the 25% risk curve. The 90% CI is above the 25% risk curve and the population is rated at low risk (Figure 3).

On average, the trend in annual spawners (Table 2) has been positive since 1990, the first year data were available to generate estimates for this population. Both hatchery-origin and natural-origin returns showed similar patterns over the time period (Figure 2). Relatively high numbers of spawners in return years 2001-2003 contributed significantly to the average trend. In more recent years, annual spawning estimates have generally been at the levels observed in the initial years of the series. Under the assumption that hatchery and natural-origin parents were equally effective in contributing to natural production for this population (hatchery effectiveness = 1.0), the point estimate of population growth rate (λ) was below 1.0, with a 40% chance that the actual estimate exceeded 1.0. The relative effectiveness of hatchery-origin spawners in the Deschutes River Eastside population is not known. An estimate of the population growth rate was calculated assuming that hatchery returns did not effectively contribute to natural production (hatchery effectiveness = 0.0; Table 2). The estimated population growth rate assuming that hatchery spawners are not contributing to natural production was 1.09 (78% probability of exceeding 1.0).

Spatial Structure and Diversity

The ICTRT has identified six major spawning areas (MaSAs) and two minor spawning areas (MiSAs) within the Deschutes River Eastside steelhead population (Figure 4). The population boundaries extend above the Pelton Reregulation Dam, and therefore include areas that are currently inaccessible. One MaSA (Willow Creek) and one MiSA (Campbell) exist in the inaccessible area. The intrinsic potential analysis rated most of the Deschutes River mainstem spawning habitat as low potential because of the width and confinement, although steelhead spawning has been observed in the mainstem. Spawning is distributed broadly throughout the population boundaries. Steelhead production is concentrated in Buck Hollow, Bakeoven and Trout creeks, with some spawning in the mainstem from Trout Creek to Buck Hollow Creek. Spawners within the Deschutes River Eastside population include natural-origin returns, hatchery returns from Deschutes River origin fish produced from Round Butte Hatchery, and out-of-DPS hatchery strays primarily from the Snake River basin. Hatchery-origin fish comprise a significant proportion of the natural spawners.

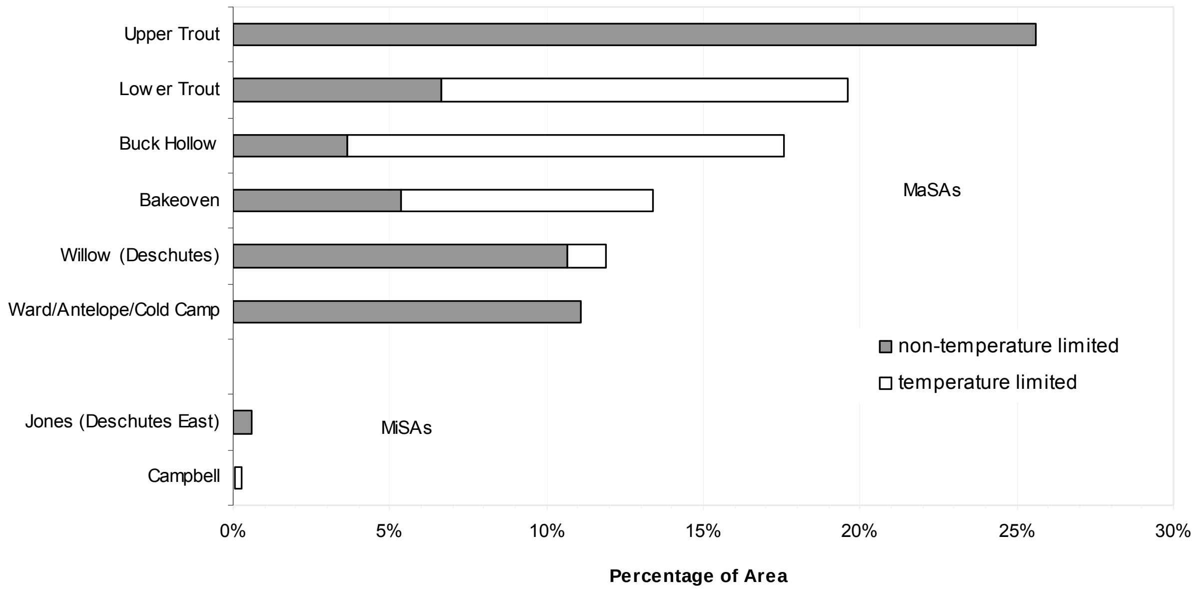

Figure 4. Deschutes River Eastside summer steelhead population distribution of intrinsic potential habitat across major and minor spawning areas. White bars represent current temperature limited areas that could potentially have had historical temperature limitations.

Factors and Metrics

A.1.a. Number and spatial arrangement of spawning areas

The Deschutes River Eastside population has six MaSAs and two MiSAs distributed in a dendritic pattern (Figure 5). The primary production areas include Buck Hollow, Bakeoven, and Trout creeks. Historically, Willow Creek was also a significant production area. Based on the Oregon Department of Fish and Wildlife (ODFW) current spawner distribution database, five of the six MaSAs and neither of the two MiSAs are currently occupied. The MaSA that does not meet the occupancy criteria is Willow Creek. This MaSA is unoccupied because it is inaccessible. The Deschutes River Eastside population rates at **very low risk** for this metric because it has five MaSAs occupied in a non-linear configuration.

A.l.b. Spatial extent or range of population

The current spawner distribution is restricted somewhat from the historical distribution. The Willow Creek MaSA is unoccupied because it is inaccessible. There is also loss of spawning in the Jones and Campbell MiSAs (Figure 5). The population is rated at **low risk** for this metric because greater than 75% (but less than 90%) of the historic MaSAs are currently occupied.

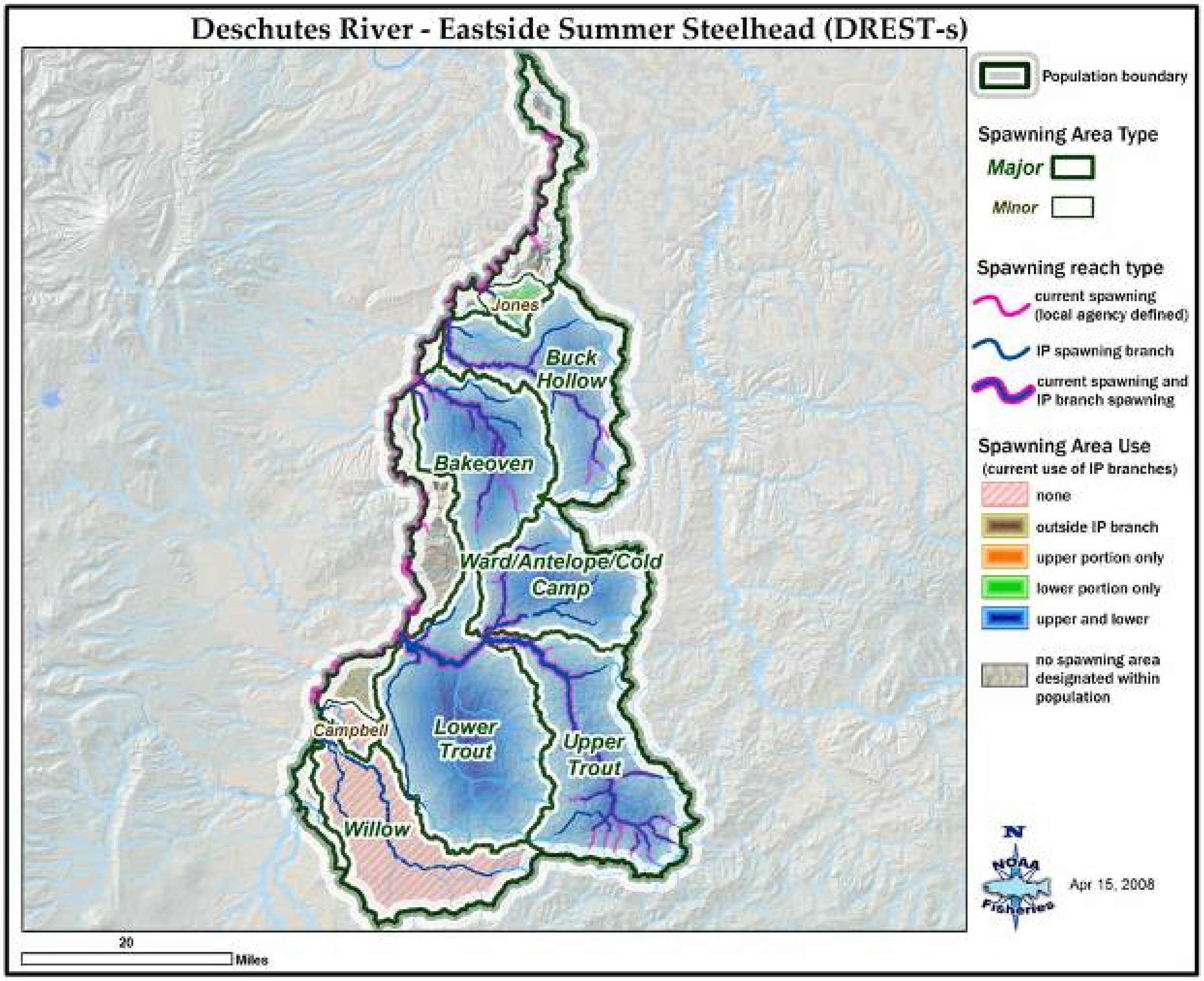

Figure 5. Deschutes River Eastside summer steelhead population current spawning distribution and spawning area occupancy designations.

A.1.c. Increase or decrease in gaps or continuities between spawning aggregates

The loss of spawning in the Willow Creek drainage has caused a significant increase in the gap distance between the uppermost spawning in the population and the middle production areas in Trout Creek. Currently, with the exception of the gap created by loss of spawning in Willow Creek, there is little difference in gaps and continuity between the historic and current distributions. We have rated the population at **low risk** for this metric.

B.1.a. Major life history strategies

There are no data to allow any direct comparison of historic and current major life history patterns, thus we must infer from habitat information. Flow and temperature changes within the major spawning tributaries have changed significantly relative to historic conditions with lower summer flows and higher temperatures. These changes have resulted in shifts in juvenile rearing patterns, with less summer rearing capacity in the tributaries and mandatory movement into either the mainstem or upper reaches for periods of summer rearing. Adult migration and spawn timing have likely been impacted by flow and temperature changes. Based on scale analyses of Deschutes River fish collected from the mainstem, the population demonstrates multiple ages at smolt migration and ocean residence time as well as repeat spawning. The habitat conditions, with mainstem rearing opportunities, do provide for opportunity for diverse life history strategies. We have rated the population at **low risk** for this metric.

B.1.b. Phenotypic variation

We have no direct observations to assess loss or substantial change in phenotypic traits, thus we must infer from habitat conditions and habitat changes through time. The flow and temperature changes in the tributaries have likely influenced both adult and juvenile migration timing and patterns. The loss of summer rearing opportunities forces juveniles to move downstream into the mainstem. Adult run-timing through the tributaries, as well as spawn timing, have likely been narrowed to some degree. We have rated this metric at **low risk** because two or more traits have likely changed and have reduced variability.

B.1.c. Genetic variation

There are limited genetics data for the Deschutes River Eastside population. The lower East Folley Creek samples were not significantly differentiated from other Eastside, Westside, or Round Butte Hatchery samples. However, the remaining samples from eastside tributaries show levels of differentiation between each other and between other populations that are consistent with a relatively unchanged structure. As a result of these data the population is rated at **low risk** for this metric. The ongoing genetics study that the U.S. Fish and Wildlife Service (USFWS) and co-managers are undertaking will yield additional and better information to assess this metric in the future.

B.2.a. Spawner composition

(1) *Out-of-DPS spawners*: There are a significant number of out-of-DPS strays spawning naturally in the Deschutes River Eastside population. Estimates for stray hatchery proportions are derived from observations in Buck Hollow, Bakeoven, and Trout creeks. Since 1990, we estimated that hatchery strays have comprised from 12-90% of the spawners in this population, with a mean of 34.4% annually. We have no direct estimate of the proportion of out-of-DPS and Round Butte Hatchery strays for this population. Assuming the same proportion of out-of-DPS strays as we did for the Deschutes River Westside population (based on observations at Warm Springs National Fish Hatchery), we estimate that an average of 29% of the spawners in the Deschutes River Eastside population were out-of-DPS strays. Given this proportion and the duration of the influence we have rated the population at **high risk** for this metric.

(2) *Out-of-MPG spawners from within the DPS*: There have been few out-of-MPG within-DPS strays recovered in the Deschutes River. The only source of this type of stray steelhead is from the Umatilla Hatchery program. We have rated this metric as **very low risk** due to the low proportion.

(3) *Out-of-population spawners from within the MPG*: Strays originating from the Round Butte Hatchery program are considered out-of-population within-MPG strays because their origin includes fish captured at the Pelton Reregulation Dam ladder and at Sherars Falls. The broodstock source likely includes both Westside and Eastside populations. Based on a total average hatchery proportion of 34.4% and the average proportion that Round Butte Hatchery strays make up of the total strays at Warm Springs National Fish Hatchery (15.5%), we estimated that Round Butte Hatchery strays comprise 5.4% of the naturally spawning fish annually. We have rated this metric as **moderate risk**.

(4) *Within-population hatchery spawners*: There are no within-population hatchery fish produced, thus we have rated this metric as **very low risk**.

The overall spawner composition rating is **high risk** due to the high proportion of out-of DPS strays that spawn naturally in this population.

B.3.a. Distribution of population across habitat types

The intrinsic potential distribution encompassed five ecoregions of which three accounted for greater than 10% of the distribution. The current distribution is not significantly reduced from the historic distribution (Figure 6, Table 3). We have rated this metric at **low risk** because there were three historic ecoregions occupied and no substantial reductions.

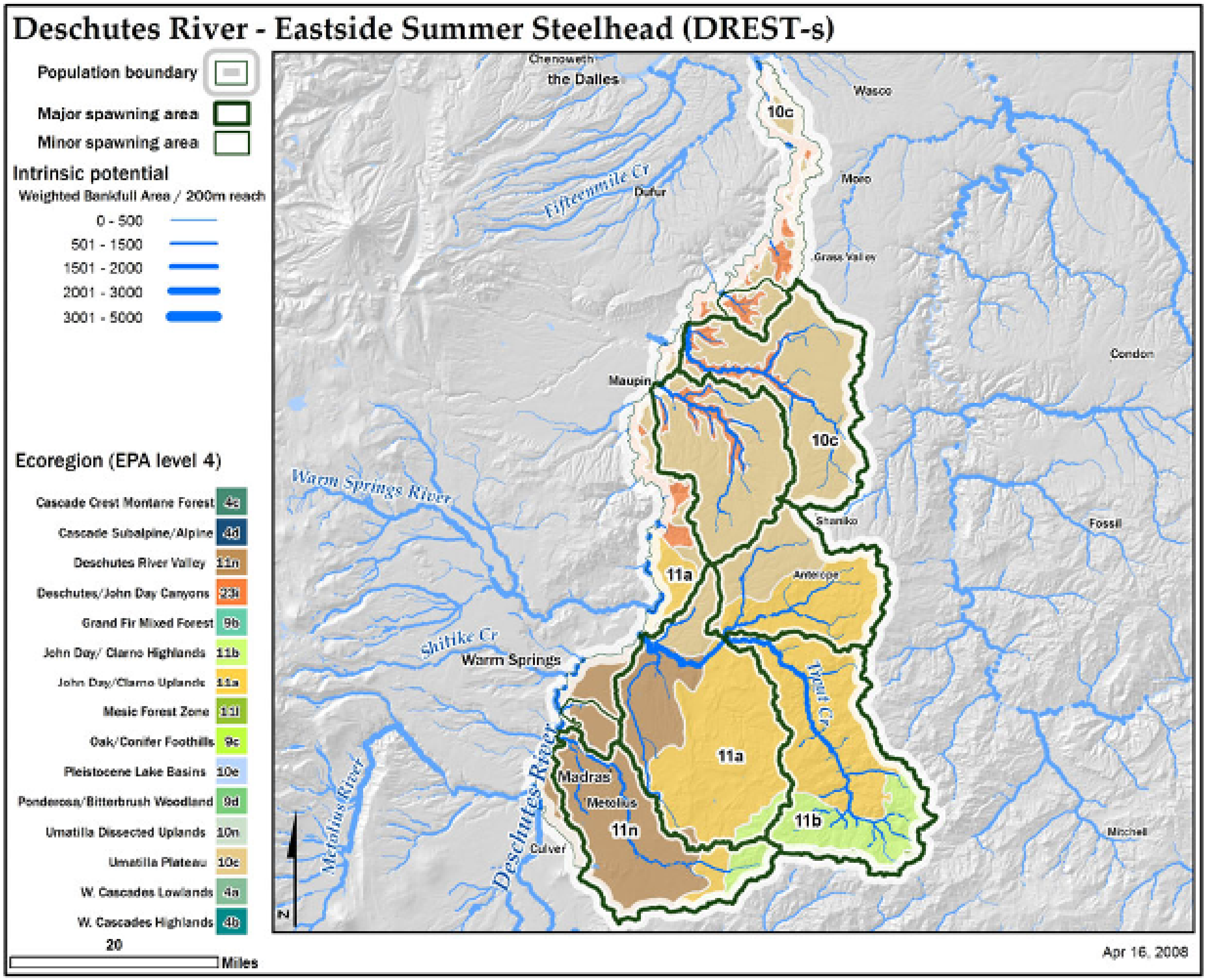

Figure 6. Deschutes River Eastside summer steelhead population spawning distribution across EPA level IV ecoregions.

Table 3. Deschutes River Eastside summer steelhead population proportion of current spawning areas across EPA level IV ecoregions.

Ecoregion	% of historical spawning area (non-temp. limited)	% of currently occupied spawning area (non-temp. limited)
Deschutes River Valley	23.5	10.4
Deschutes / John Day Canyons	35.0	42.3
John Day Clarno Highlands	4.2	4.2
John Day Clarno Uplands	28.4	34.3
Umatilla Plateau	9.0	8.8

B.4.a. Selective change in natural processes or selective impacts

Hydropower system: This population passes two dams in its seaward and spawning migrations, thus impacts on this population are relatively low. No traits are selectively affected by hydropower activity to the degree that they raise the risk level for this population. The hydropower rating is **low risk** for all traits.

Harvest: Harvest has the potential to affect migration timing, maturation timing and size. However, recent harvest rates for A-run steelhead in the Columbia River mainstem are generally less than 10% annually. Although some harvest may be size-selective for larger fish, the selective mortality would affect slightly more than 2% of the total population. There may be a very slight advantage for earlier returning fish as a result of the timing of the Chinook salmon fishery, and while heritability of adult migration timing is high, the impacts are slight enough to be negligible. There is no selective impact of the recreational fishery. No phenotypic traits appear to be at risk as a result of harvest activity and the rating is **low risk** for all traits.

Hatcheries: There are no steelhead hatchery programs operated within the population; therefore, the hatchery rating is **very low risk**.

Habitat: Altered flow profiles and increased temperatures in tributary spawning and rearing areas, which have been in place for many generations and are ongoing, likely impose some selection on juvenile and adult migration timing, as well as spawn timing. However, the magnitude of selective mortality is likely negligible; therefore the habitat rating for all traits is **low risk**.

Other: A population of Caspian terns in the estuary has been artificially enhanced by a combination of increased habitat (created by dredge spoils) and artificially increased food availability (large-scale releases of hatchery smolts). These terns appear to exert a size-selective predation pressure that primarily impacts the large steelhead smolts. The rate of predation is highest during tern nesting season in May. This pressure may affect smolt migration timing.

> *Juvenile migration timing:* Steelhead smolts pass through the estuary from April to June. The relatively high predation (10%) on smolts in May could select for earlier and later out-migrants. However, heritability of this trait has not been assessed, so we assume a moderate to low heritability. Because this predation occurs at the peak of migration, the impact of this selection is **low risk**.

No single trait has a moderate risk rating for any selective activity. Therefore, the overall selectivity rating for this population is **low risk.**

Spatial Structure and Diversity Summary

The integrated spatial structure/diversity rating is **Moderate Risk** for the Deschutes River Eastside population (Table 4). The rating for Goal A (allowing natural rates and levels of spatially mediated processes) was **low risk**. Although the overall rating for this goal was low, spawning distribution is reduced significantly from the historic distribution with loss of spawning in the Willow Creek drainage being the primary factor. The population remains broadly distributed with little change in gaps and good continuity within the currently accessible habitat.

The rating for Goal B (maintaining natural levels of variation) was **moderate risk**. Habitat changes in key tributary production areas have likely resulted in limitations to life history diversity and reduction in phenotypic expression. In addition, a significant proportion of natural spawners are out-of-DPS strays which resulted in a high risk rating for the spawner composition metric. Additional genetics information is needed to assess differentiation within and between populations, as well as to improve our understanding of the degree of introgression of out-of-DPS strays. The ongoing genetics work of the USFWS and co-managers will provide the information needed to better assess the genetic health of this population.

Table 4. Deschutes River Eastside summer steelhead population spatial structure and diversity risk rating.

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
A.1.a	VL (2)	VL (2)	Low Risk (Mean = 1.3)	Low Risk (Mean = 1.3)	**Moderate Risk**
A.1.b	L (1)	L (1)			
A.1.c	L (1)	L (1)			
B.1.a	L (1)	L (1)	Low Risk (1)	Moderate Risk (Mean = 0.5)	
B.1.b	L (1)	L (1)			
B.1.c	L (1)	L (1)			
B.2.a(1)	H (-1)	High Risk (-1)	High Risk (-1)		
B.2.a(2)	VL (2)				
B.2.a(3)	M (0)				
B.2.a(4)	VL (2)				
B.3.a	L (1)	L (1)	L (1)		
B.4.a	L (1)	L (1)	L (1)		

Overall Viability Rating

The overall rating for the Deschutes River Eastside summer steelhead population currently meets ICTRT viability criteria for **VIABLE** status (Figure 7). Overall abundance and productivity is rated at **Low Risk.** The 10-year geometric mean abundance of natural-origin spawners is 1,599, which is well above the minimum abundance threshold of 1,000. The 10-year geometric mean productivity (1.89 R/S; Table 6) exceeds the 1.35 R/S required at the minimum abundance threshold and puts the population into the very low risk region; however the 98% CI extends well below the 25% risk level. This wide standard error results in a low risk level for abundance/productivity. Overall spatial structure and diversity is rated at **Moderate Risk**. This is primarily a result of the influence of habitat changes on life history and phenotypic expression as well as the influence of out-of-DPS hatchery spawners.

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	**HV**	**HV**	**V**	**M**
	Low (1-5%)	**V**	**V**	**V Deschutes River Eastside**	**M**
	Moderate (6 – 25%)	**M**	**M**	**M**	**HR**
	High (>25%)	**HR**	**HR**	**HR**	**HR**

Figure 7. Deschutes River Eastside summer steelhead population risk ratings integrated across the four viable salmonid population (VSP) metrics. ***Viability Key: HV – Highly Viable; V – Viable; M - Maintained; HR – High Risk; Shaded cells - does not meet viability criteria (darkest cells are at greatest risk).***

Data Summary – Deschutes River Eastside Summer Steelhead Population

Data type: Expansions from single pass surveys in major tributary spawning reaches. Annual index area counts expanded to total population abundances using ratio of total to index area weighted intrinsic habitat (ICTRT 2007, Appendix C). Assumed 2.1 fish per redd.
SAR: Mid-Columbia steelhead composite series (see *Methods* section).

Table 5. Deschutes River Eastside summer steelhead population abundance and productivity data used for curve fits and R/S analysis. Bolded values were used in estimating the current productivity (Table 6).

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	SAR Adj. Factor	Adj. Rtns	Adj. R/S
1990	1466	0.87	1270	432	0.29	2.83	1224	0.83
1991	1862	0.88	1640	447	0.24	2.33	1044	0.56
1992	**1158**	**0.82**	**948**	**549**	**0.47**	**1.88**	**1033**	**0.89**
1993	**583**	**0.51**	**299**	**718**	**1.23**	**1.18**	**848**	**1.46**
1994	**635**	**0.70**	**442**	**893**	**1.41**	**1.07**	**956**	**1.51**
1995	**740**	**0.59**	**436**	**1815**	**2.45**	**1.23**	**2224**	**3.01**
1996	**953**	**0.43**	**407**	**3786**	**3.97**	**1.03**	**3907**	**4.10**
1997	1829	0.46	841	6448	3.53	0.76	4922	2.69
1998	1921	0.21	401	4542	2.36	0.49	2227	1.16
1999	2397	0.61	1472	3236	1.35	0.52	1675	0.70
2000	3341	0.49	1627					
2001	9801	0.84	8274					
2002	5957	0.78	4665					
2003	4888	0.82	3984					
2004	2754	0.71	1945					
2005	1274	0.87	1114					

Table 6. Deschutes River Eastside summer steelhead population geometric mean abundance and productivity estimates (values used for current productivity and abundance are shown in boxes).

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted	SAR adjusted	Nat. origin
delimited	median	75% threshold	median	75% threshold	1990-1999	1980-1999	geomean
Point Est.	1.52	1.62	1.89	1.88	1.10	n/a	1599
Std. Err.	0.36	0.21	0.27	0.24	0.11	n/a	0.32
count	5	3	5	3	10	n/a	10

Table 7. Deschutes River Eastside summer steelhead population stock-recruitment curve fit parameter estimates. Biologically unrealistic or highly uncertain values are highlighted in grey.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	1.20	0.36	n/a	n/a	0.22	0.87	33.1	1.38	0.28	n/a	n/a	0.22	0.68	24.9
Const. Rec	1461	454	n/a	n/a	n/a	n/a	33.8	1672	307	n/a	n/a	n/a	n/a	23.2
Bev-Holt	1.92	2.00	4209	7419	0.16	0.91	37.1	3.94	3.83	2680	1554	0.15	0.72	26.4
Hock-Stk	1.20	0.21	19855	0	0.22	0.87	37.4	1.38	0.14	19729	0	0.22	0.68	29.2
Ricker	1.64	1.19	0.00023	0.00049	0.16	0.90	37.1	2.86	1.21	0.00054	0.00029	0.14	0.74	26.2

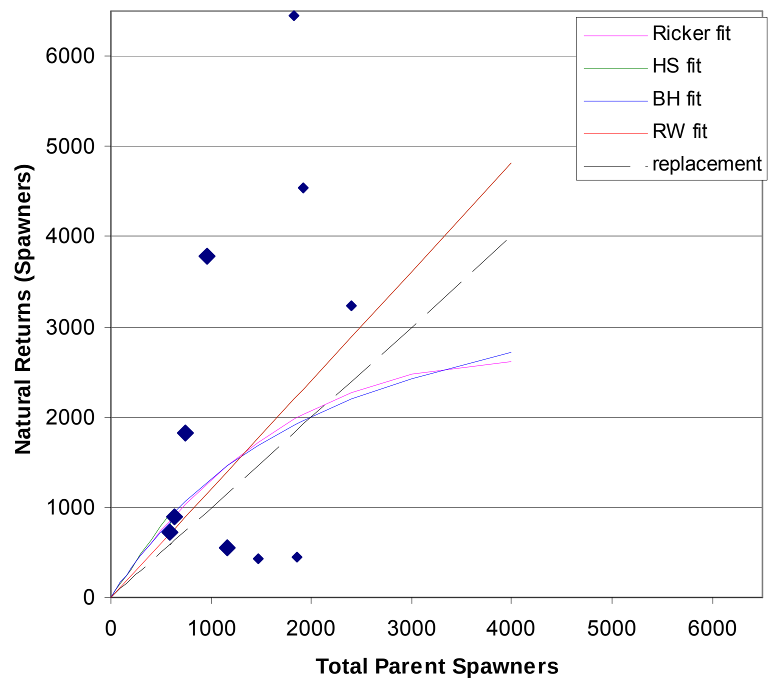

Figure 8. Deschutes River Eastside summer steelhead population stock recruitment curves. Bold points were used in estimating the current productivity. Data were not adjusted for marine survival.

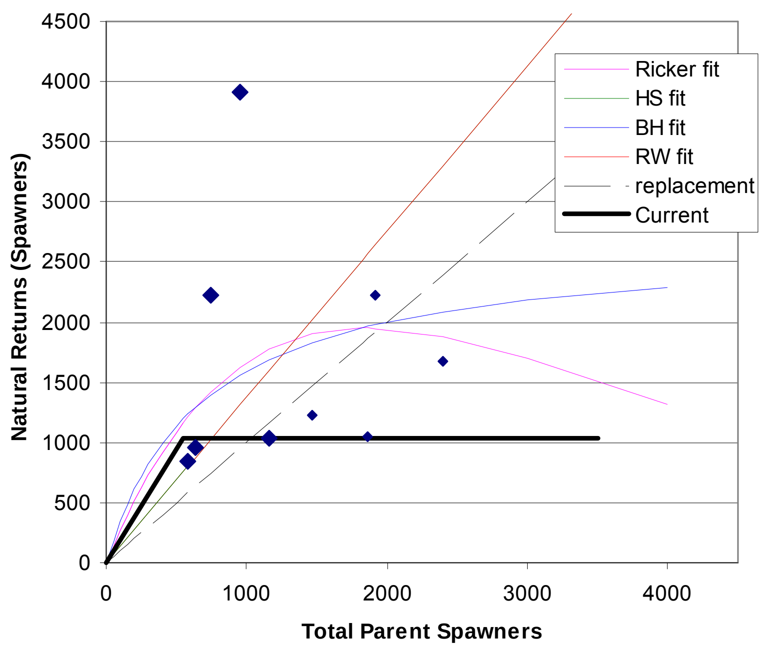

Figure 9. Deschutes River Eastside summer steelhead population stock recruitment curves. Bold points were used in estimating the current productivity. Data were adjusted for marine survival. Function labeled "Current" is a Hockey Stick function derived by fixing the slope of the ascending limb at the geometric mean productivity at low to moderate abundance (Table 2) and fitting a capacity estimate to the data series.

Deschutes River Westside Summer Steelhead Population

The Deschutes River Westside summer steelhead population (Figure 1, Figure 2) is one of five extant populations in the Cascades Eastern Slope Tributaries MPG within the Mid-Columbia steelhead DPS.

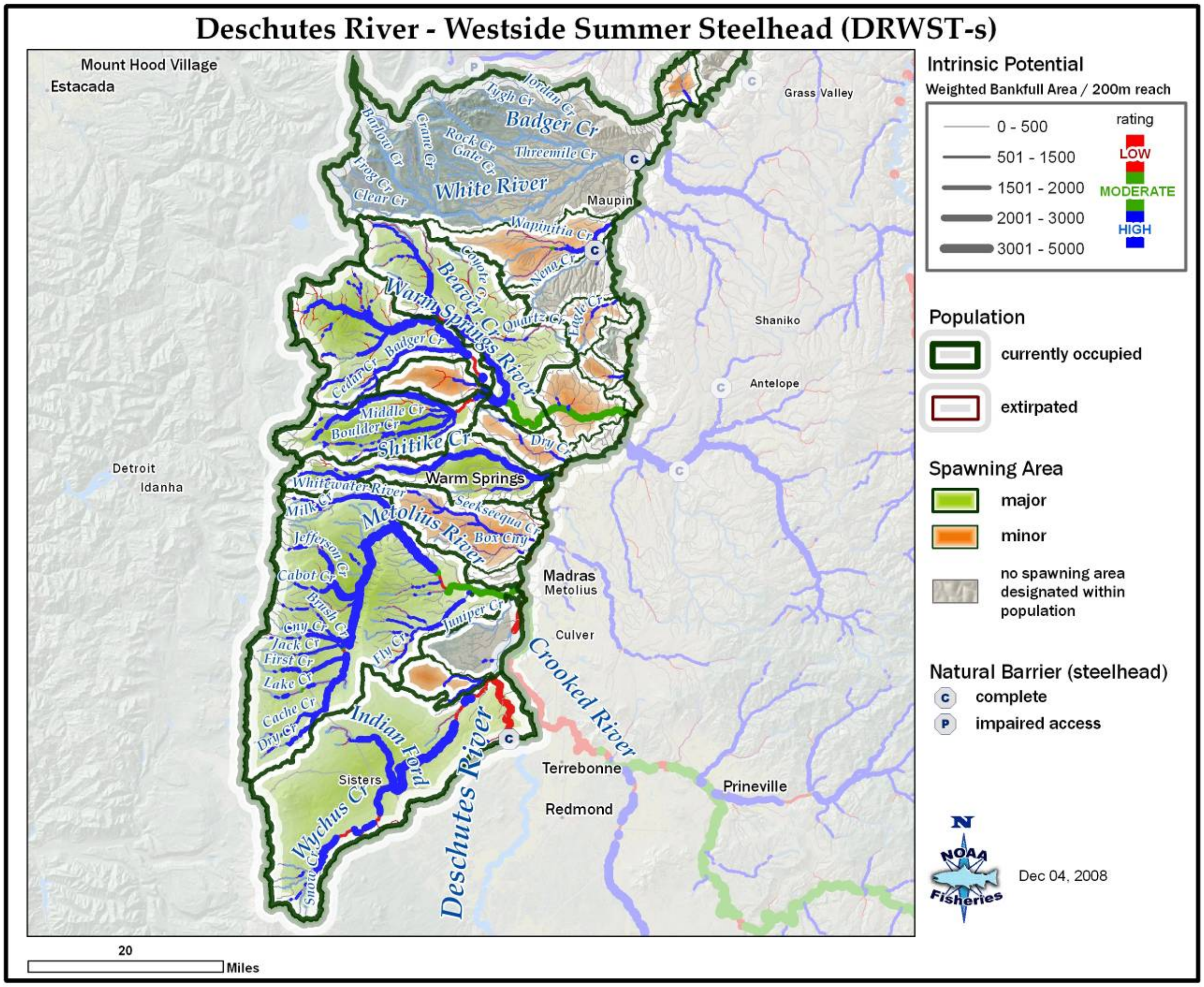

Figure 1. Deschutes River Westside summer steelhead population boundary and major (MaSA) and minor (MiSA) spawning areas - currently accessible population areas.

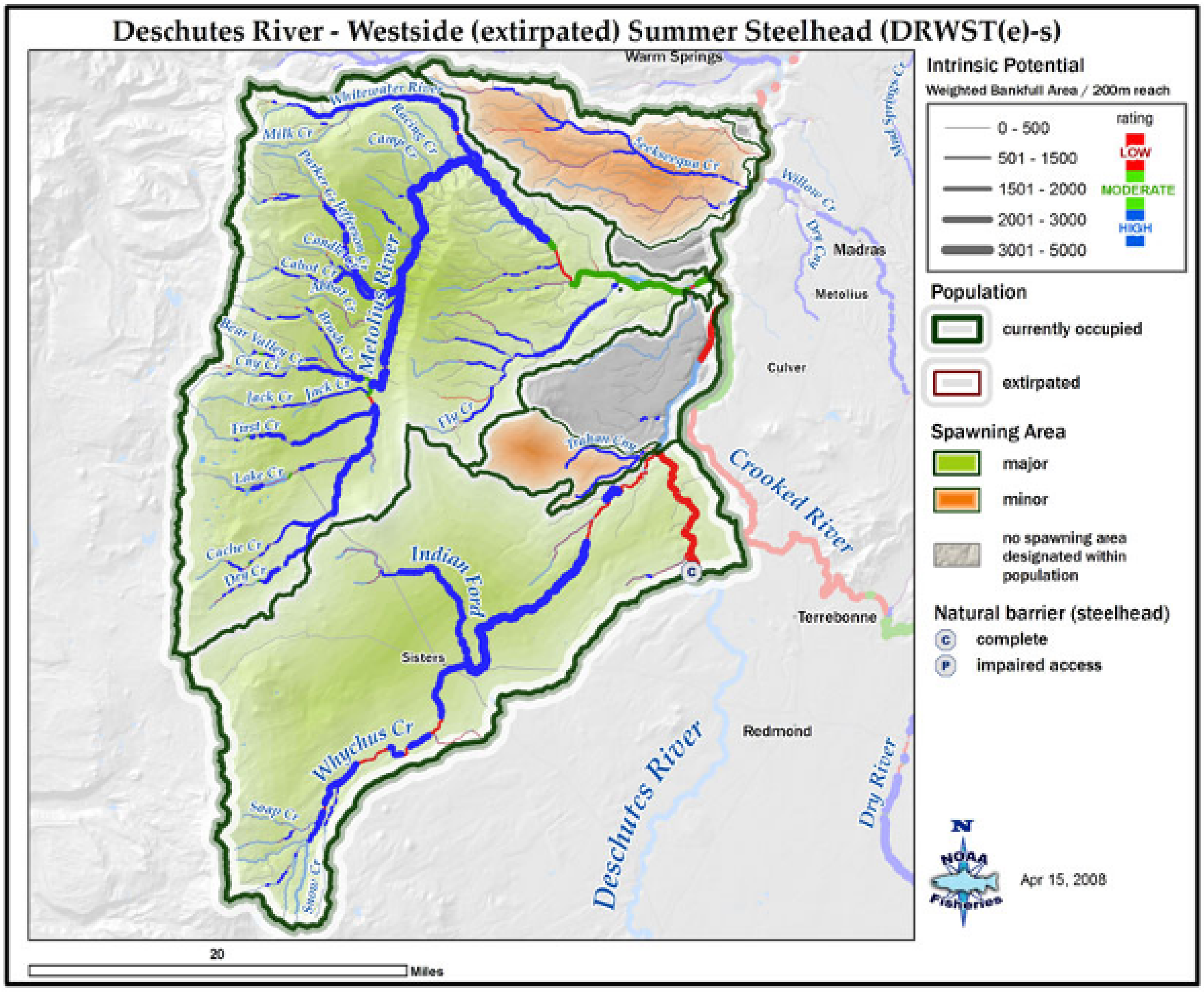

Figure 2. Deschutes River Westside summer steelhead population boundary and major (MaSA) and minor (MiSA) spawning areas - historically accessible areas.

The Deschutes River Westside population can be classified as either "large" or "intermediate" in size and complexity depending on whether the classification is based on historically accessible habitat or currently accessible habitat. These size category options exist because access to a considerable amount of habitat is blocked by the Pelton-Round Butte dams within the population, with current spawning only below the barrier (Table 3.1.3-1). A steelhead population classified as large has a mean minimum abundance threshold of 1,500 natural-origin spawners with sufficient intrinsic productivity (≥ 1.26 recruits per spawner at the abundance threshold level) to achieve a 5% or less risk ("low risk") of extinction over a 100-year timeframe. Alternatively, a steelhead population classified as intermediate has a mean minimum abundance threshold of 1,000 natural-origin spawners with sufficient intrinsic productivity (≥ 1.35 recruits per spawner at the abundance threshold) to achieve a 5% risk of extinction over 100 years. In this assessment we evaluate the population with the abundance/productivity (A/P) criteria for an intermediate sized population that assesses only the habitat below the Pelton Reregulation Dam. However, for the spatial structure/diversity (SS/D) assessment we evaluated the population based on the historic distribution and characteristics. Viable status for this population could not be achieved using A/P criteria for a large population because current capacity is not adequate to meet abundance criteria.

Table 1. Deschutes River Westside summer steelhead population basin statistics and intrinsic potential analysis summary.

Metric	All areas	Currently Accessible areas
Drainage area (km^2)	6,060	3,619
Stream lengths km (total) [a]	2,230	1,511
Stream lengths km (below natural barriers) [a]	1,474	937
Branched stream area weighted by intrinsic potential (km^2)	5.51	2.65
Branched stream area km^2 (weighted and temp. limited) [b]	5.01	2.24
Total stream area weighted by intrinsic potential (km^2)	8.25	4.56
Total stream area weighted by intrinsic potential (km^2) temp limited [b]	6.61	3.18
Size / Complexity category	Large / "B" (dendritic)	Intermediate / "B" (dendritic)
Number of major spawning areas (MaSAs)	6	4
Number of minor spawning areas (MiSAs)	9	7

a. All stream segments ≥ 3.8m bankfull width were included.
b. Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was > 22°C.

Current Abundance and Productivity

Current (1978 to 2005) total spawner abundance (number of adult spawners in natural production areas) has ranged from 154 in 1996 to 1,548 in 2003 (Figure 3). Current abundance of natural-origin adult spawners ranged from 108 in 1996 to 1,283 in 2003 (Figure 3). Abundance estimates for the Deschutes River Westside population of adult spawning steelhead are the sum of abundance estimates for three components of the population:

- natural-origin fish upstream of the Warm Springs National Fish Hatchery (NFH) barrier dam at river kilometer (rkm) 16 in the Warm Springs River
- natural-origin and hatchery fish that ascend Shitike Creek
- natural-origin and hatchery-origin fish that remain in the mainstem Deschutes River and spawn from above the mouth of Trout Creek upstream to Pelton Reregulation Dam

The data series begins in the 1978 spawning year with census counts at Warm Springs NFH and in the 1982 spawning year with single pass spawning ground surveys in Shitike Creek index survey units in that cover 67% of the currently used spawning habitat. For the mainstem, single pass aerial surveys were conducted in 1995 and 2001 (Pribyl 1995 and 2001), and multiple pass surveys were conducted in 1996 and 1997 (Zimmerman and Reeves 2000).

To estimate spawning abundance in Shitike Creek, observed redd densities (redds/m^2) in surveyed reaches were used to estimate redd densities in unsurveyed areas. Variability in habitat quality and capacity throughout reaches in Shitike Creek is accounted for by using the ICTRT's historical intrinsic potential. The ICTRT intrinsic potential analyses were used to estimate redds per weighted m^2 of habitat in surveyed reaches. To estimate total redds in the population we multiplied the number of redds per weighted m^2 in surveyed reaches by the total weighted m^2 of currently occupied habitat in Shitike Creek (ICTRT 2007). Historical intrinsic potential is estimated using a simple GIS-based model that accounts for differences across stream reaches in terms of stream width, gradient, and valley width that are further weighted by habitat quality. An expansion of 2.1 fish per redd was used to estimate annual spawner abundance (R. Carmichael, Oregon Department of Fish & Wildlife, personal communication). This estimate was derived for summer steelhead in Deer Creek, a tributary of the Wallowa River. For the 1978-1981 spawning years when spawning ground surveys were not conducted in Shitike Creek, the Shitike Creek abundance was assumed to represent 1.6% of the Sherars Falls escapement based on the average proportional relation between Shitike Creek and Sherars Falls escapement from 1982 to present.

Abundance estimates for the mainstem Deschutes River upstream of Trout Creek also assume 2.1 fish per redd. For years when spawning ground surveys were not conducted in the mainstem, an average relative proportion of observed spawning activity per number of fish escaping above Sherars Falls was applied to the Sherars Falls escapement (1.2%).

Abundance of progeny by spawning year is estimated by apportioning the total spawning abundance estimate into hatchery- and natural-origin fish. The proportion of hatchery fish entering Shitike Creek to spawn and hatchery fish remaining in the mainstem upstream of Trout Creek is assumed to be identical to the proportion of hatchery fish observed at the Warms Springs NFH barrier.

Virtually no spawning steelhead in the Deschutes River Westside population have been sampled for age-at-return, and no population specific information exists to assign natural-origin spawners into cohorts to estimate abundance of progeny (Anonymous 2004). Age structure information used to estimate progeny by brood year is based on the average of a two-year sample of scales from natural-origin adult steelhead (N=100) collected in the lower Deschutes River (Olsen, et al., 1991).

Recent year natural spawners include returns originating from naturally spawning parents, strays from the Deschutes Subbasin Round Butte Hatchery program, and a significant number of out-of-DPS hatchery strays from the Snake River. Natural-origin spawners have comprised an average of 82% of naturally spawning fish since 1978. The percentage of natural-origin spawners has ranged from 57% to 97%.

Abundance in recent years has been moderately variable. The 10-year (1996-2005) geometric mean abundance of natural-origin spawners was 456 (Table 2). During the period 1980-1999, recruits per spawner (R/S, in terms of spawner to spawner) for steelhead in the Deschutes River Westside population ranged from 0.24 in 1987 to 3.72 in 1996. The annual R/S estimates were adjusted to reflect the average smolt-to-adult return rate (SAR). The 20-year (1979-1998) geometric mean productivity was 1.05 R/S, adjusted for SAR and delimited at 75% (750 spawners) of the minimum abundance threshold (Table 2).

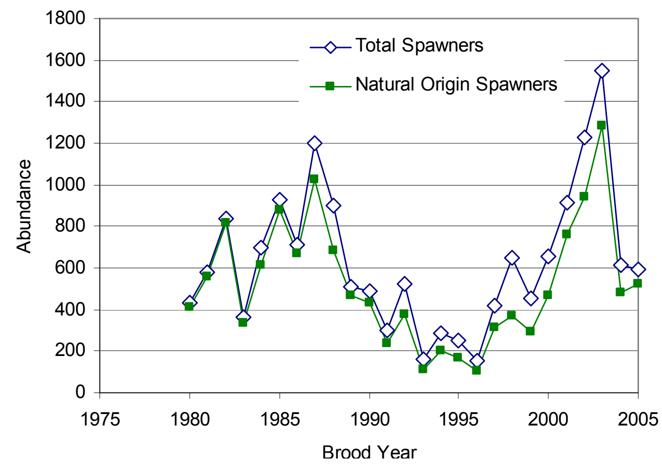

Figure 3. Deschutes River Westside summer steelhead population spawner abundance estimates (1978-2005).

Table 2. Deschutes River Westside summer steelhead population abundance and productivity estimates.

Abundance/Productivity Statistics	**Estimate**	**(Range)**	
Abundance: natural-origin spawners (10-year geometric mean, range)	456	(108-1283)	
Proportion: natural-origin spawners (10-year geometric mean, range)	0.75	(0.57-0.97)	
	Estimate	**(90% CI)[b]**	**SE**
Intrinsic productivity (20-year R/S, SAR adjusted & delimited) [a]	1.05	(0.81-1.37)	0.15
Productivity (20-year Beverton-Holt fit, SAR adjusted)	n/a		n/a
Trend Statistics (1980-2005)	**Estimate**	**(95% CI)**	**P>1.0**
ln(natural-origin spawner abundance)	0.99	(0.96-1.17)	
Population growth rate (λ): Hatchery effectiveness = **1.0**	0.97	(0.78-1.20)	0.35
Population growth rate (λ): Hatchery effectiveness = **0.0**	1.02	(0.81-1.29)	0.58

a. Delimited productivity excludes any recruit/spawner pair where the spawner number > 75% of the population's minimum abundance threshold. This approach attempts to remove density dependence effects that may influence the productivity estimate.
b. Lower end of the 90% CI on productivity is used in evaluating the impact of parameter uncertainty on risk.

The Deschutes River Westside population is at **High Risk** based on current abundance and productivity. The point estimate for abundance and productivity resides below the 25% risk curve (Figure 4). The upper end of the 90% confidence interval (CI) for productivity extends slightly above the 25% risk curve but is not significant enough to lower the risk rating.

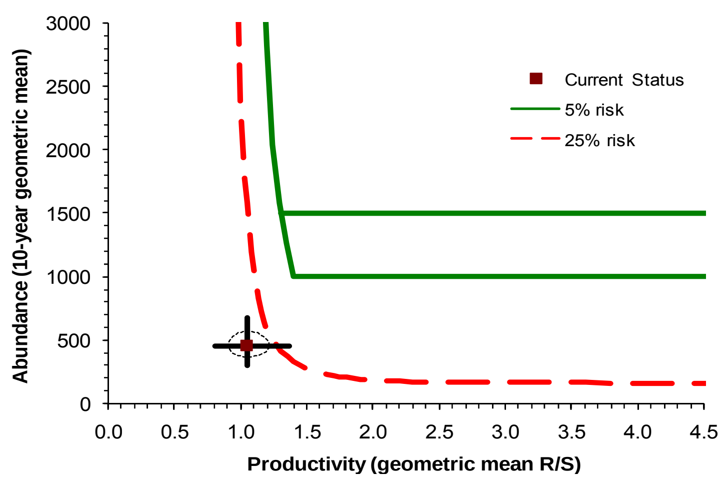

Figure 4. Deschutes River Westside summer steelhead population current abundance/productivity (A/P) compared to the DPS viability curve. Ellipse = 1 SE about the point estimate. Error bars = 90% CI for A/P.

The average trend in abundance over the most recent 20 years has been just below 1.0 based on both the trend in ln(natural-origin spawner abundance) and the population growth rate metric (λ) with no adjustment for relative hatchery-origin spawner effectiveness (Table 2). The pattern in returns from 1991 through 2005 is similar to the pattern for several other Mid-Columbia DPS steelhead populations, including the Deschutes River Eastside; an increasing trend beginning in 1996 followed by an abrupt decrease to levels observed in the early 1990s. The estimated proportion of hatchery-origin spawners has been relatively constant at 25% over this time period (Table 2). The relative effectiveness of hatchery-origin spawners in contributing to natural production in this population is not known. The estimated population growth rate calculated for this population is sensitive to the input value for relative hatchery effectiveness. Setting the value to 0.0, the opposite extreme from 1.0, results in an estimated annual growth rate of 1.02 (0.58 probability of exceeding 1.0).

Spatial Structure and Diversity

The ICTRT has identified six major spawning areas (MaSAs) and nine minor spawning areas (MiSAs) in the historically accessible habitat within the Deschutes River Westside steelhead population (Figure 5). In the currently accessible habitat there are four MaSAs and seven MiSAs (Figure 6). The Metolius River is identified as a MaSA in the historically accessible habitat; however there is considerable uncertainty regarding the magnitude of historical steelhead production in this river. Recent conclusions reached by Cramer and Beamsderfer (2001) suggest that the primary *O mykiss* life history form in the Metolius River was resident and it is likely that little steelhead production occurred. When we conducted the spatial structure/diversity assessment, we did not consider the Metolius River as a MaSA due to the uncertainty in historical use. Current distribution is reduced significantly from the historic distribution as a result of loss of accessibility to the Whychus Creek drainage.Spawning is currently concentrated in the Warm Springs River and Shitike Creek, as well as in the mainstem Deschutes River between Trout Creek and Pelton Reregulation Dam.

Spawners within the Deschutes River Westside population include natural-origin returns, hatchery returns of Deschutes River origin fish produced from Round Butte Hatchery, and out-of-DPS hatchery strays primarily from the Snake River basin. Hatchery-origin fish comprise a significant proportion of the natural spawners in Shitike Creek and the Deschutes River mainstem. Hatchery fish are removed from returns to the Warm Springs River at Warm Springs NFH, which reduces the proportion of naturally spawning hatchery fish in the population.

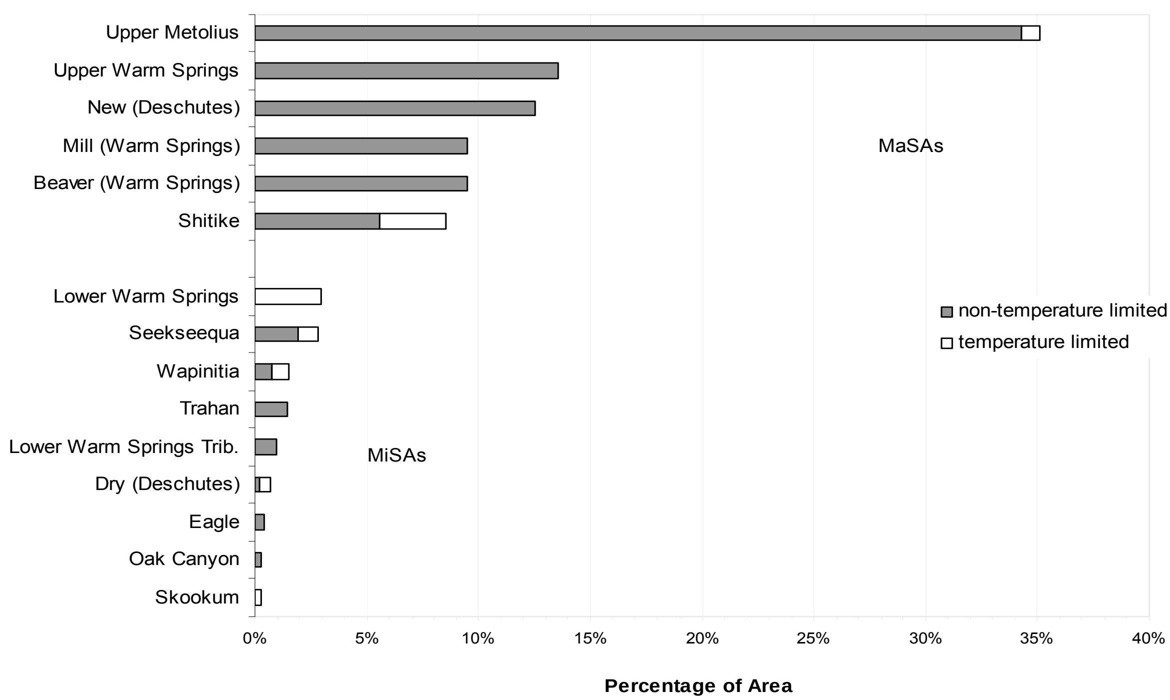

Figure 5. Deschutes River Westside summer steelhead population distribution of intrinsic potential habitat across major (MaSAs) and minor spawning areas (MiSAs). White bars represent current temperature limited areas that could potentially have had historical temperature limitations. This figure is based on *historically* accessible areas within the population.

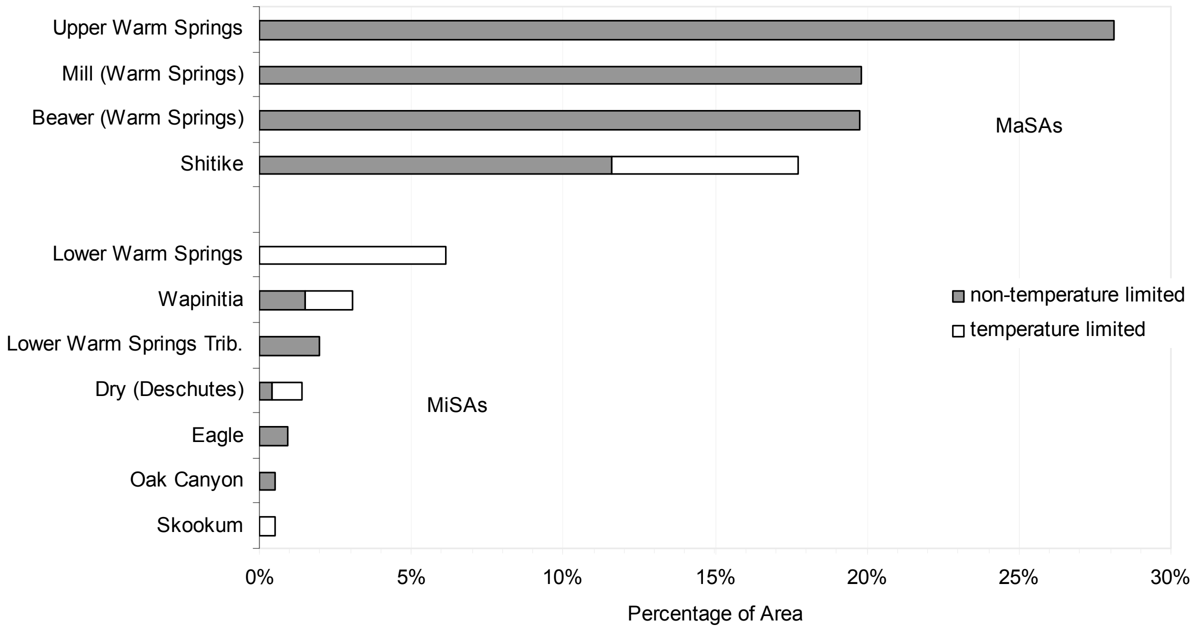

Figure 6. Deschutes River Westside summer steelhead population distribution of intrinsic potential habitat across major (MaSAs) and minor spawning areas (MiSAs). White bars represent current temperature limited areas that could potentially have had historical temperature limitations. This figure is based on *currently* accessible areas within the population.

Factors and Metrics

A.1.a. Number and spatial arrangement of spawning areas

The Deschutes River Westside population has five MaSAs and nine MiSAs distributed in a dendritic pattern. The historic primary production areas include the Warm Springs River, Shitike Creek, Whychus Creek, and the Deschutes River mainstem. Based on the Oregon Department of Fish and Wildlife (ODFW) current spawner distribution database, four of the five historic MaSAs are currently occupied and four of the nine MiSAs are occupied. The Deschutes River Westside population is rated at **very low risk** for this metric.

A.l.b. Spatial extent or range of population

The current spawner distribution is reduced substantially from the historic intrinsic distribution. One of the five historic MaSAs (Whychus) is currently unoccupied. In addition, only four of the nine MiSAs are occupied (Figures 7 and 8). The population is rated at **low risk** because 80% of the MaSAs are occupied. There are index spawning surveys conducted in the Warm Springs River drainage and the Shitike Creek drainage. Results of these surveys will be evaluated for future viability assessments.

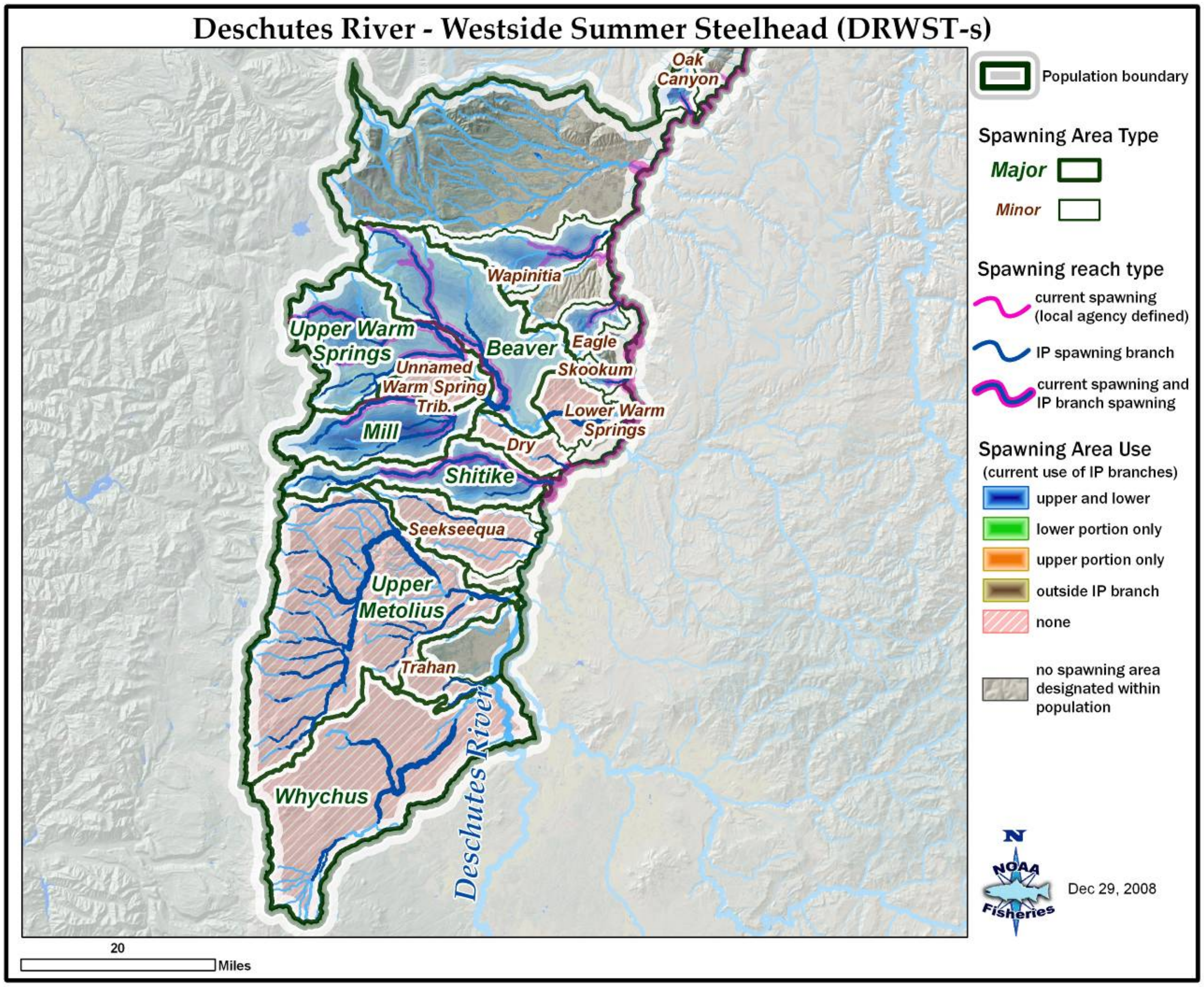

Figure 7. Deschutes River Westside summer steelhead population current spawning distribution and spawning area occupancy designations. This figure is based on currently accessible areas.

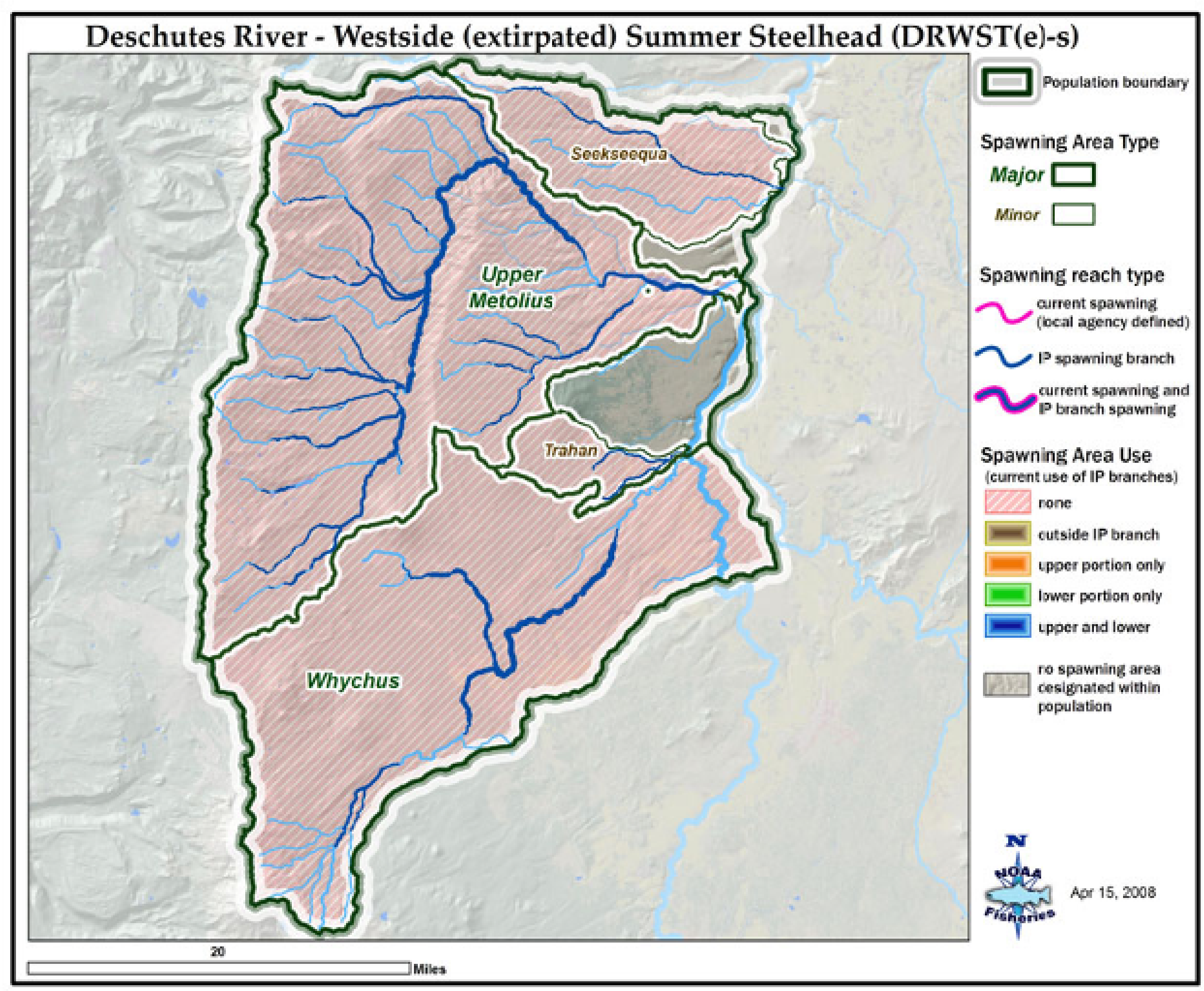

Figure 8. Deschutes River Westside summer steelhead population current spawning distribution and spawning area occupancy designations. This figure is based on historically accessible areas.

A.1.c. Increase or decrease in gaps or continuities between spawning aggregates

There has been a substantial change in gaps between, and continuity within, the spawning areas in the Deschutes River Westside population. The loss of occupancy in the Whychus MaSA has resulted in loss of production in the entire upper area of the population. The population is rated at **moderate risk** for this metric.

B.1.a. Major life history strategies

There are limited data to allow any direct comparisons of historic and current major life history strategies. Current habitat conditions are such that the potential for diverse juvenile life history patterns, such as movement between tributary and mainstem, as well as tributary and mainstem rearing, are possible. The population demonstrates multiple ages of smolt migration and ocean residence time. It does not appear likely that any loss in variability or change in major life history strategies has occurred for this population. Thus, the population rated at **very low risk** for this metric.

B.1.b. Phenotypic variation

We have no direct observations to assess loss or substantial changes in phenotypic traits, therefore we must infer from habitat conditions. However, there does not appear to be the level of habitat changes within the basin that would result in loss of any major traits or substantial shifts in the mean of multiple traits. It is likely that flow and temperature changes in the mainstem Columbia River, as well as temperature changes within the Deschutes River subbasin, have influenced adult migration timing as well as smolt migration timing to a small degree. Thus, we have rated the population at **low risk** for this metric.

B.1.c. Genetic variation

There are only a few samples available from the Deschutes River Westside population, and those that are available are from a small tributary, Nena Creek. These samples show similarity to both the Deschutes River Eastside population samples and to out-of-population hatchery samples. Primarily on the basis of limited information and apparent similarity to the out-of-population hatchery samples, we have rated the population at **moderate risk** for this metric. Additional tissue samples have been collected and will be analyzed in the near future. The genetics variation metric will be reassessed for this population following the completion of analyses of the recent samples.

B.2.a. Spawner composition

(1) *Out-of-DPS spawners*: A significant number of out-of-DPS strays spawn naturally in the Deschutes River Westside population. Estimates of strays are derived from stray hatchery proportions and stray origin data collected at the Warm Springs NFH trap and expanded to unsampled areas in the population. Hatchery fish are removed at the Warm Springs NFH, thus the overall hatchery proportion in the population is less than the proportion observed at Warm Springs NFH. The majority of stray hatchery fish at Warm Springs NFH are out-of-DPS strays. We estimated that hatchery strays have comprised 18% of the natural spawners in the population since 1978. Of the 18%, about 15.2% were estimated as out-of-DPS strays, primarily from the Snake River basin. We were unable to acquire stray origin data for the most recent years, thus we will update the risk rating when the data are received. Given the high proportion and the length of time that out-of-DPS hatchery strays have been present in this population, the rating is **high risk** for this metric.

(2) *Out-of-MPG spawners from within the DPS*: There have been few out-of-MPG within-DPS strays recovered in the Deschutes River. The only source for this type of stray fish is from the Umatilla Hatchery program. This metric rated at **low risk** due to the low proportion of strays.

(3) *Out-of-population spawners from within the MPG*: There have been no observed strays originating from hatchery programs operated outside the Deschutes River subbasin but within the MPG. The rating is **very low risk**.

(4) *Within-population hatchery spawners:* The Round Butte Hatchery program operates as a harvest augmentation program within the Deschutes River subbasin and does not use best management practices as described for supplementation programs. Round Butte Hatchery fish are present in the naturally spawning population at low levels with an average of 2.8% since 1978. We have rated the metric at **moderate risk** because of the low proportion of hatchery fish in the natural spawning population.

The overall spawner composition rating is **high risk** due to the high proportion of out-of-DPS strays that spawn naturally in this population.

B.3.a. Distribution of population across habitat types

The intrinsic potential distribution within historically accessible habitat encompassed seven ecoregions (Figures 9 and 10), of which four accounted for 10% or more of the distribution (Table 3). There has been no substantial shift in ecoregion distribution from the historic intrinsic to the current distribution (Table 3). The population rated as **very low risk** because there are four ecoregions with no substantial change in proportional distribution.

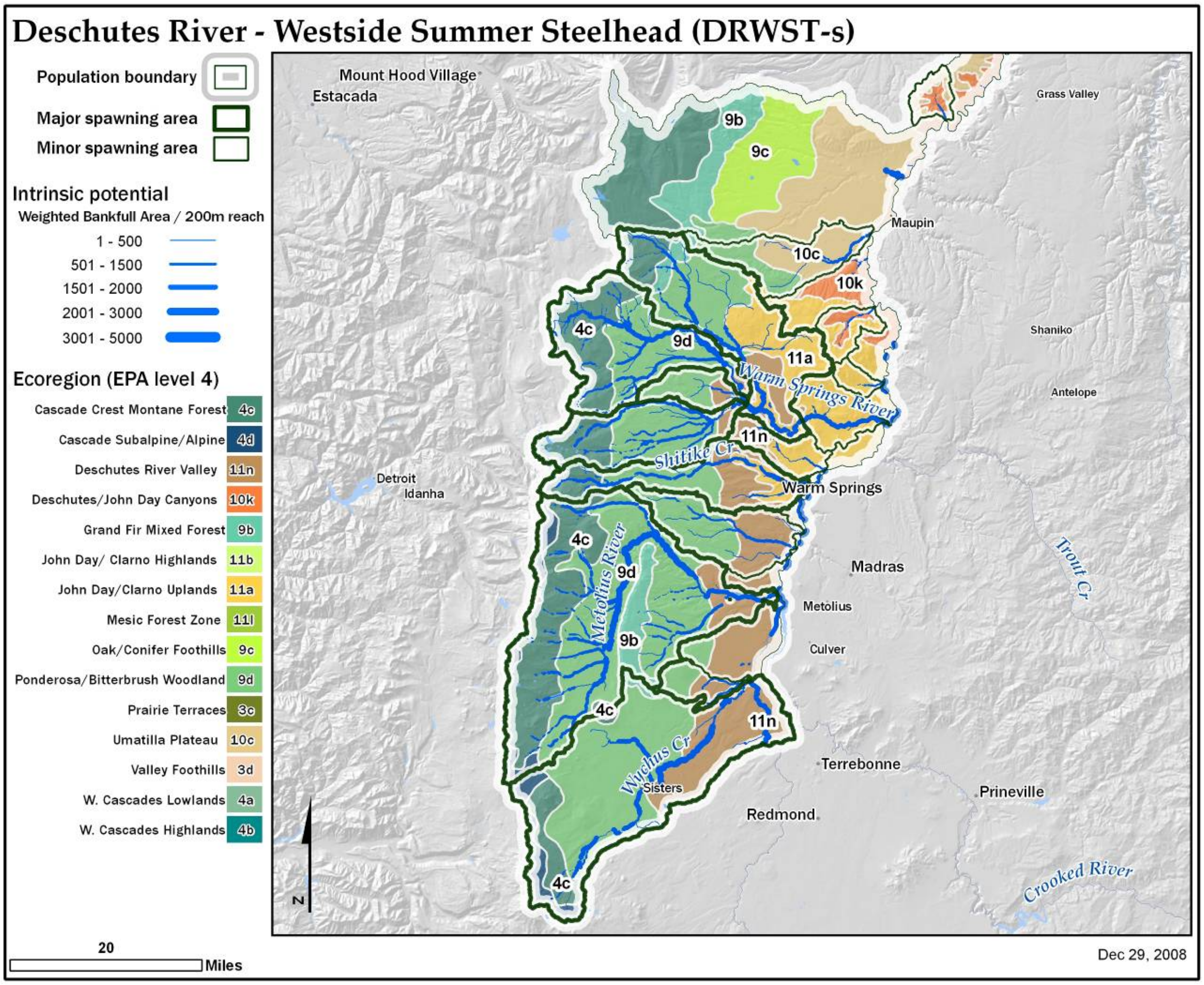

Figure 9. Deschutes River Westside summer steelhead population spawning distribution across EPA level IV ecoregions. This figure is based on currently accessible areas.

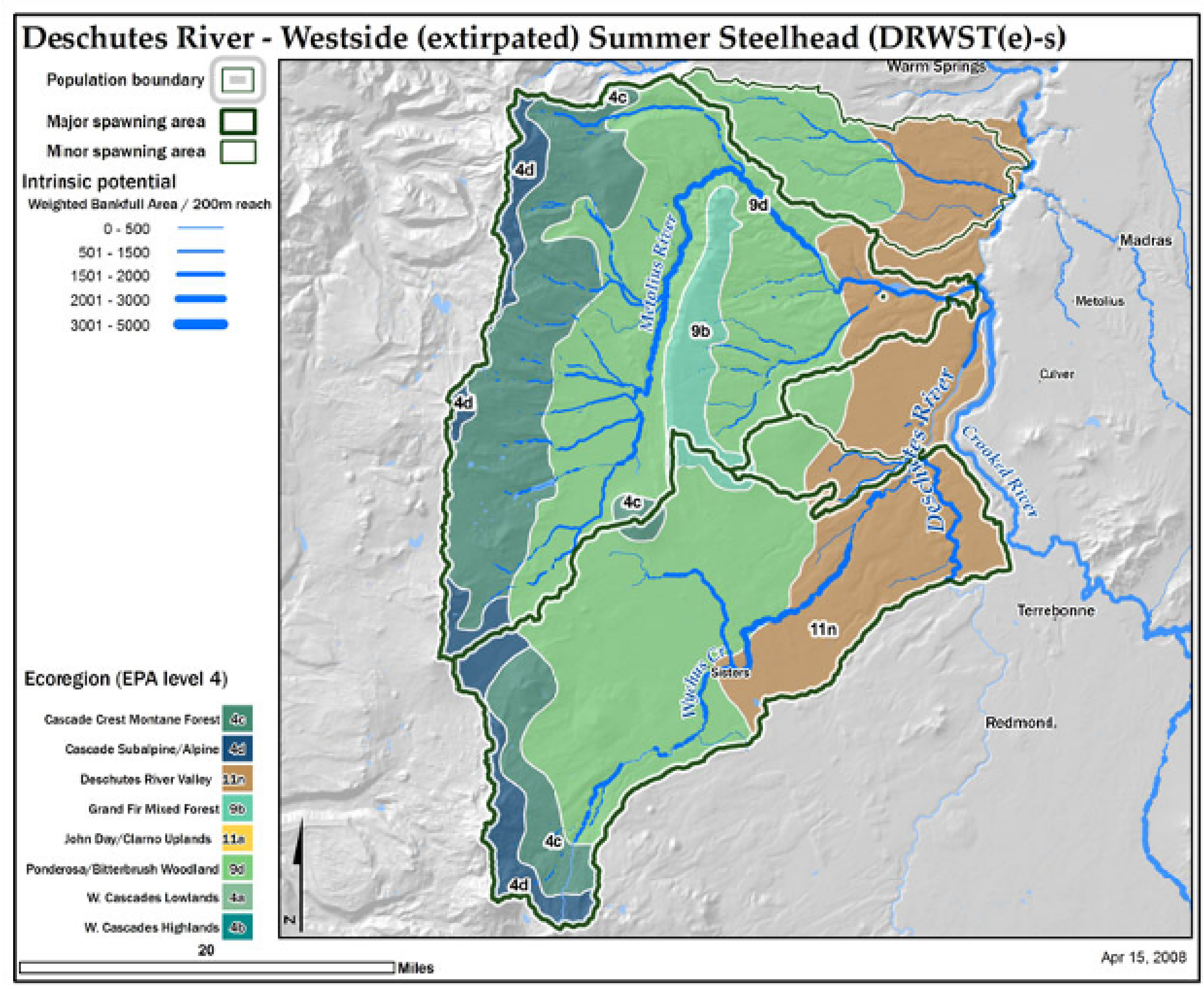

Figure 10. Deschutes River Westside summer steelhead population spawning distribution across EPA level IV ecoregions. This figure is based on historically accessible areas.

Table 3. Deschutes River Westside summer steelhead population proportion of current spawning areas across EPA level IV ecoregions.

Ecoregion	% of *historical* spawning area (non-temp. limited) ALL AREAS	% of *currently* occupied spawning area (non-temp. limited) ALL AREAS	% of *historical* spawning area (non-temp. limited) CURRENTLY OCC. AREAS	% of *currently* occupied spawning area (non-temp. limited) CURRENTLY OCC. AREAS
Umatilla Plateau	1.7	4.0	3.0	4.0
Deschutes/John Day Canyons	10.9	27.4	19.6	27.4
John Day / Clarno Uplands	13.0	19.3	23.4	19.3
Deschutes River Valley	18.3	7.3	7.1	7.3
Cascade Crest Montane Forest	8.2	4.7	10.1	4.7
Grand Fir Mixed Forest	0.3	0.5	0.6	0.5
Ponderosa Pine / Bitterbrush Woodland	47.6	36.8	36.1	36.8

B.4.a. Selective change in natural processes or selective impacts

Hydropower system: This population passes two dams in its seaward and spawning migrations, thus impacts on this population are relatively low. No traits are selectively affected by hydropower activity to the degree that they raise the risk level for this population. The hydropower rating is **low risk** for all traits.

Harvest: Harvest has the potential to affect migration timing, maturation timing and size. However, recent harvest rates for A-run steelhead in the Columbia River mainstem are generally less than 10% annually. Although some harvest may be size-selective for larger fish, the selective mortality would affect slightly more than 2% of the total population. There may be a very slight advantage for earlier returning fish as a result of the timing of the Chinook salmon fishery, and while heritability of adult migration timing is high, the impacts are slight enough to be negligible. There is no selective impact of the recreational fishery. No phenotypic traits appear to be at risk as a result of harvest activity and the rating is **low risk** for all traits.

Hatcheries: There is a hatchery program operated within this population. Hatchery broodstock are collected at Pelton Dam and no natural-origin fish are collected. Broodstock are collected in a manner which results in no selective impact for any adult phenotypic traits. The population is rated at **very low risk** of selective hatchery actions for all traits.

Habitat: Altered flow profiles and increased temperatures in tributary spawning and rearing areas, which have been in place for many generations and are ongoing, likely impose some selection on juvenile and adult migration timing, as well as spawn timing. However, the magnitude of selective mortality is likely negligible; therefore the habitat rating for all traits is **low risk**.

Other: A population of Caspian terns in the estuary has been artificially enhanced by a combination of increased habitat (created by dredge spoils) and artificially increased food availability (large-scale releases of hatchery smolts). These terns appear to exert a size-selective predation pressure that primarily impacts the large steelhead smolts. The rate of predation is highest during tern nesting season in May. This pressure may affect smolt migration timing.

> *Juvenile migration timing:* Steelhead smolts pass through the estuary from April to June. The relatively high predation (10%) on smolts in May could select for earlier and later out-migrants. However, heritability of this trait has not been assessed, so we assume a moderate to low heritability. Because this predation occurs at the peak of migration, the impact of this selection is **low risk**.

No single trait has a moderate risk rating for any selective activity. Therefore, the overall selectivity rating for this population is **low risk.**

Spatial Structure and Diversity Summary

The integrated spatial structure/diversity rating is **Moderate Risk** for the Deschutes River Westside population (Table 4). The population rates at moderate risk for one of the spatial distribution metrics (Goal A: **low risk** overall) because the current distribution is substantially reduced from the historic intrinsic distribution due to blocked passages to areas above the Pelton-Round Butte Complex. Ratings for two diversity metrics resulted in a **moderate risk** rating for Goal B (maintaining natural patterns of variation). Genetic variation rated moderate due to limited data and the lack of differentiation between the Deschutes River samples and outside-basin hatchery samples. Samples collected in 2005-2006 will better inform the risk associated with genetic variation. The proportion of out-of-DPS hatchery strays resulted in a high risk rating for spawner composition. Most of these strays originate from the Snake River basin.

Table 4. Deschutes River Westside summer steelhead population spatial structure and diversity risk rating.

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
A.1.a	VL (2)	VL (2)	Low Risk (Mean = 1)	Low Risk (Mean = 1)	**Moderate Risk**
A.1.b	L (1)	L (1)			
A.1.c	M (0)	M (0)			
B.1.a	VL (2)	VL (2)	Moderate Risk (0)	Moderate Risk (0)	
B.1.b	L (1)	L (1)			
B.1.c	M (0)	M (0)			
B.2.a(1)	H (-1)	High Risk (-1)	High Risk (-1)		
B.2.a(2)	L (1)				
B.2.a(3)	VL (2)				
B.2.a(4)	M (0)				
B.3.a	VL (2)	VL (2)	VL (2)		
B.4.a	L (1)	L (1)	L (1)		

Overall Viability Rating

The Deschutes River Westside steelhead population does not currently meet the ICTRT recommended viability criteria and the overall viability rating is considered **HIGH RISK** (Figure 11). Overall abundance and productivity is rated at **High Risk.** The 10-year geometric mean abundance of natural-origin spawners is 456, which is only 46% of the minimum abundance threshold of 1,000. The 20-year geometric mean productivity (1.05 R/S; Table 6) is below the viability minimum of 1.35 R/S required for an intermediate sized population. A substantial increase in productivity will be required to raise the productivity value to the low risk level. The overall spatial structure and diversity rating is at **Moderate Risk**. The genetics information that is currently being collected will better inform the genetics variation risk level in the future. A reduction in the proportion of naturally spawning out-of-DPS hatchery strays will be needed to reduce the risk rating for the spawner composition metric.

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	**HV**	**HV**	**V**	**M**
	Low (1-5%)	**V**	**V**	**V**	**M**
	Moderate (6 – 25%)	**M**	**M**	**M**	**HR**
	High (>25%)	**HR**	**HR**	**HR Deschutes River Westside**	**HR**

Figure 11. Deschutes River Westside summer steelhead population risk ratings integrated across the four viable salmonid population (VSP) metrics. ***Viability Key: HV – Highly Viable; V – Viable; M – Maintained; HR – high risk; Shaded cells - does not meet viability criteria (darkest cells are at greatest risk).***

Data Summary – Deschutes River Westside Summer Steelhead Population

Data type: Expansions from single pass surveys, Warm Springs weir count. Annual index area counts expanded to total population abundances using ratio of total to index area weighted intrinsic habitat (ICTRT 2007 Appendix C). Assumed 2.1 fish per redd.
SAR: Mid-Columbia steelhead composite series (see *Methods* section).

Table 5. Deschutes River Westside summer steelhead population abundance and productivity data used for curve fits and R/S analysis. Bolded values were used in estimating the current productivity (Table 6).

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	SAR Adj. Factor	Adj. Rtns	Adj. R/S
1980	**436**	**0.94**	**410**	**683**	**1.57**	**0.50**	**345**	**0.79**
1981	**577**	**0.96**	**556**	**804**	**1.39**	**0.68**	**549**	**0.95**
1982	839	0.97	816	789	0.94	0.46	360	0.43
1983	**362**	**0.93**	**337**	**864**	**2.39**	**0.52**	**453**	**1.25**
1984	**701**	**0.88**	**616**	**626**	**0.89**	**0.65**	**405**	**0.58**
1985	929	0.95	882	461	0.50	0.46	212	0.23
1986	**711**	**0.94**	**667**	**373**	**0.52**	**0.94**	**351**	**0.49**
1987	1198	0.86	1026	289	0.24	2.18	629	0.52
1988	898	0.76	683	280	0.31	0.99	277	0.31
1989	**513**	**0.91**	**469**	**163**	**0.32**	**0.96**	**156**	**0.31**
1990	**486**	**0.90**	**435**	**185**	**0.38**	**2.83**	**523**	**1.08**
1991	**299**	**0.80**	**240**	**163**	**0.55**	**2.33**	**381**	**1.27**
1992	**525**	**0.72**	**380**	**189**	**0.36**	**1.88**	**355**	**0.68**
1993	**163**	**0.70**	**114**	**317**	**1.95**	**1.18**	**374**	**2.30**
1994	**284**	**0.73**	**206**	**351**	**1.24**	**1.07**	**375**	**1.32**
1995	**249**	**0.68**	**170**	**378**	**1.52**	**1.23**	**463**	**1.86**
1996	**154**	**0.70**	**108**	**573**	**3.72**	**1.03**	**591**	**3.84**
1997	**417**	**0.75**	**314**	**818**	**1.96**	**0.76**	**624**	**1.50**
1998	**648**	**0.57**	**370**	**1005**	**1.55**	**0.49**	**493**	**0.76**
1999	**452**	**0.64**	**290**	**968**	**2.14**	**0.52**	**501**	**1.11**
2000	653	0.71	464					
2001	914	0.83	760					
2002	1226	0.77	944					
2003	1548	0.83	1283					
2004	611	0.79	482					
2005	594	0.88	520					

Table 6. Deschutes River Westside summer steelhead population geometric mean abundance and productivity estimates (values used for current productivity and abundance are shown in boxes).

	R/S measures						Lambda measures		Abundance
	Not adjusted			SAR adjusted			Not adjusted		Nat. origin
delimited	median	75% lg thresh	75% int thresh	median	75% lg thresh	75% int thresh	1988-1999	1980-1999	geomean
Point Est.	1.46	0.99	1.11	1.48	0.87	1.05	1.04	1.03	456
Std. Err.	0.22	0.18	0.19	0.14	0.17	0.15	0.11	0.12	0.22
count	10	19	16	10	19	16	12	20	10

Table 7. Deschutes River Westside summer steelhead population stock-recruitment curve fit parameter estimates. Biologically unrealistic or highly uncertain values are highlighted in grey.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	0.92	0.16	n/a	n/a	0.34	0.67	52.1	0.84	0.13	n/a	n/a	0.38	0.49	47.3
Const. Rec	435	59	n/a	n/a	n/a	n/a	41.2	399	31	n/a	n/a	n/a	n/a	18.7
Bev-Holt	16.41	54.61	465	122	0.07	0.90	43.9	50.00	78.66	407	34	0.12	0.11	21.8
Hock-Stk	2.87	0.00	152	0	0.07	0.90	44.0	2.92	16.75	137	785	0.12	0.09	21.5
Ricker	2.59	0.78	0.00191	0.00050	0.12	0.81	44.0	2.70	0.55	0.00215	0.00033	0.16	0.02	27.8

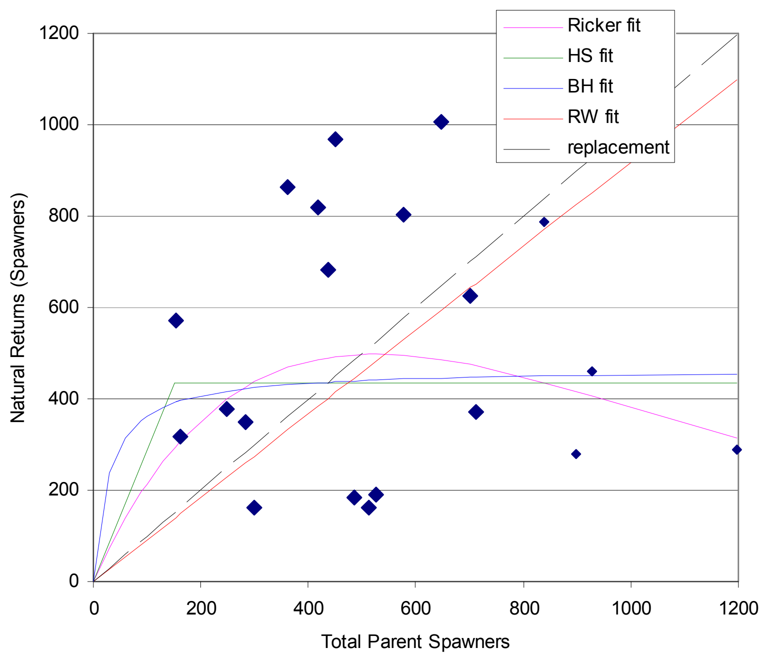

Figure 12. Deschutes River Westside summer steelhead population stock recruitment curves. Bold points were used in estimating the current productivity. Data were not adjusted for marine survival.

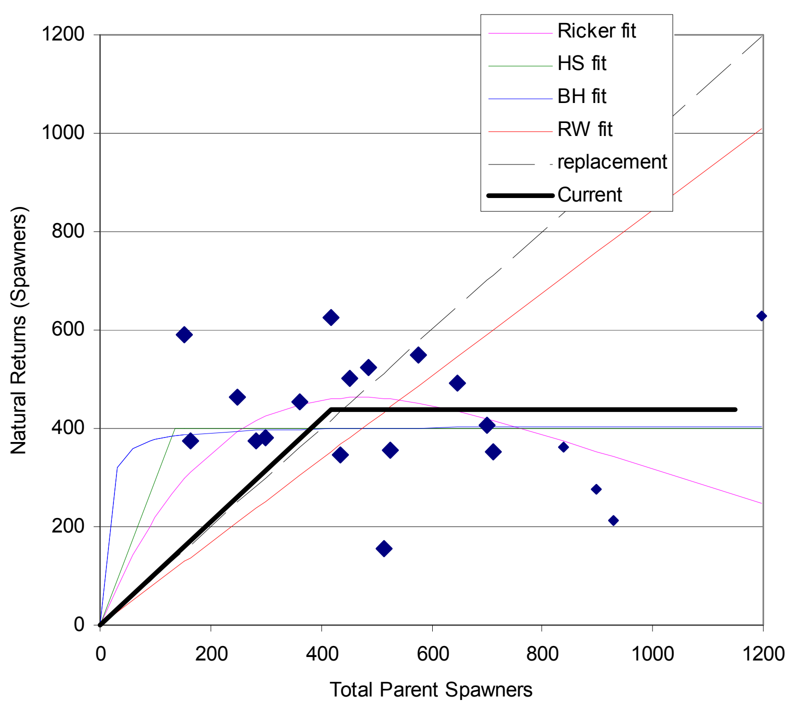

Figure 13. Deschutes River Westside summer steelhead population stock recruitment curves. Bold points were used in estimating the current productivity. Data were adjusted for marine survival. Function labeled "Current" is a Hockey Stick function derived by fixing the slope of the ascending limb at the geometric mean productivity at low to moderate abundance (Table 2) and fitting a capacity estimate to the data series.

Crooked River Summer Steelhead Population

The functionally extirpated Crooked River summer steelhead population (Figure 1), located entirely above the Pelton Reregulation Dam in the Deschutes River subbasin, was historically part of the Cascades Eastern Slope Tributaries MPG within the Mid-Columbia steelhead DPS.

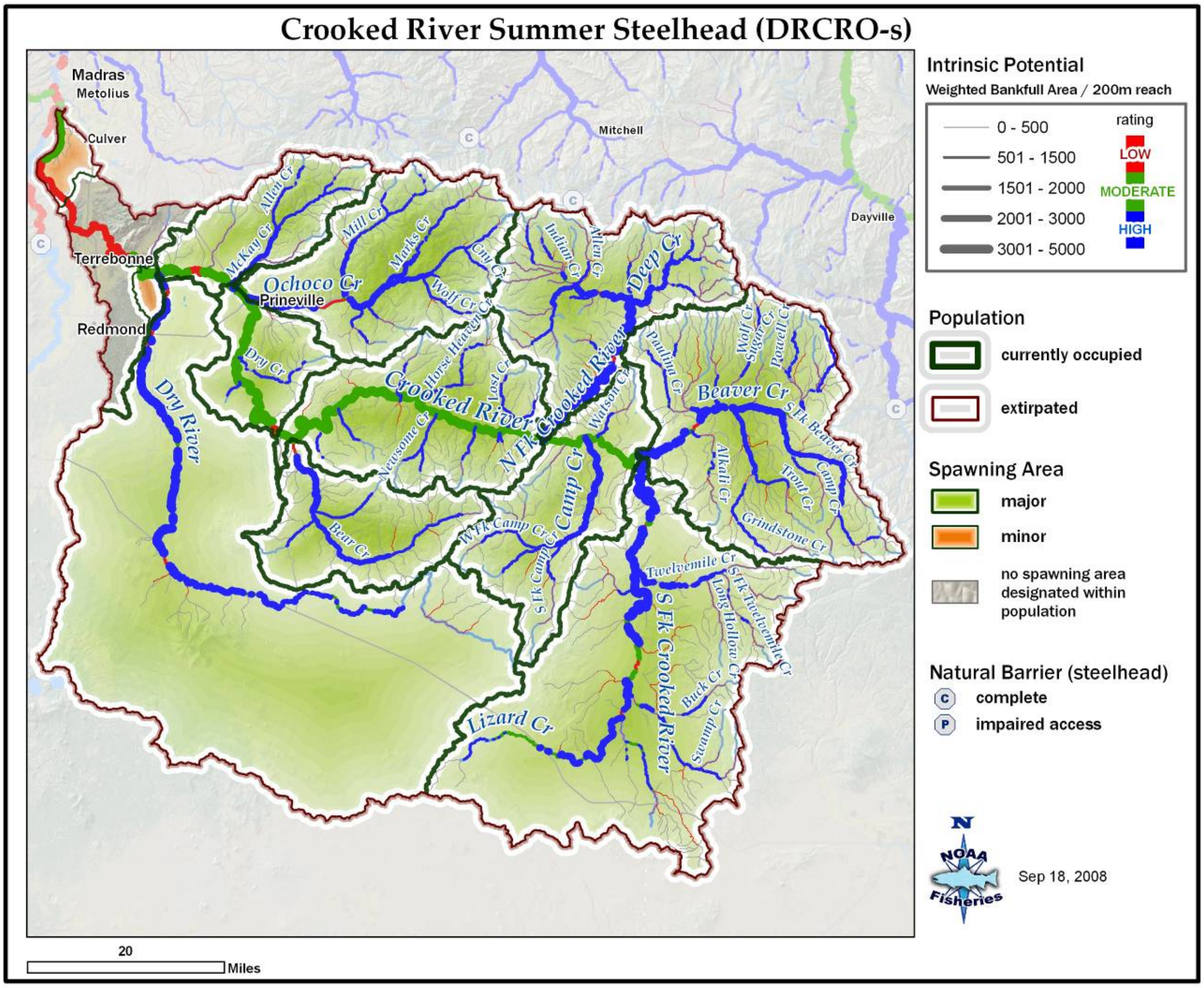

Figure 1. Crooked River summer steelhead population boundary and major (MaSA) and minor (MiSA) spawning areas.

The Interior Columbia Technical Recovery Team (ICTRT) classified the Crooked River population as "very large" in size and complexity (Table 1). A steelhead population classified as very large has a mean minimum abundance threshold of 2,250 natural-origin spawners with sufficient intrinsic productivity (≥ 1.19 recruits per spawner at the abundance threshold level) to achieve a 5% or less risk of extinction over a 100-year timeframe. In order for the Crooked River population to achieve a 1% or less risk ("very low risk") of extinction over 100 years, productivity would need to be at or greater than 14 recruits per spawner at the minimum abundance threshold.

Table 1. Crooked River summer steelhead population basin statistics and intrinsic potential analysis summary.

Drainage area (km^2)	11,832
Stream lengths km (total) [a]	2054
Stream lengths km (below natural barriers) [a]	2046
Branched stream area weighted by intrinsic potential (km^2)	9.855
Branched stream area km^2 (weighted and temp. limited) [b]	9.855
Total stream area weighted by intrinsic potential (km^2)	11.358
Total stream area weighted by intrinsic potential (km^2) temp limited [b]	11.358
Size / Complexity category	Very Large / "B" (dendritic structure)
Number of major spawning areas (MaSA)	10
Number of minor spawning areas (MiSA)	2

a. All stream segments ≥3.8m bankfull width were included.
b. Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was > 22°C.

Current Abundance and Productivity

The Crooked River steelhead population is currently extirpated. Steelhead distribution was restricted in Crooked River by construction of Ochoco Dam at RM 10 in 1921 and further by Bowman Dam (RM 70) constructed in 1961. Access to habitat above RM 100 on the mainstem Deschutes River was blocked entirely by 1968 due to inadequate passage at the Pelton and Round Butte dams, thus terminating access to the Crooked River drainage.

Spatial Structure and Diversity

The ICTRT has identified ten major spawning areas (MaSAs) and two minor spawning areas (MiSAs) within the Crooked River steelhead population (Figure 3.1.7–2). The population boundaries are completely above the Pelton Reregulation Dam and, therefore, all areas are currently inaccessible.

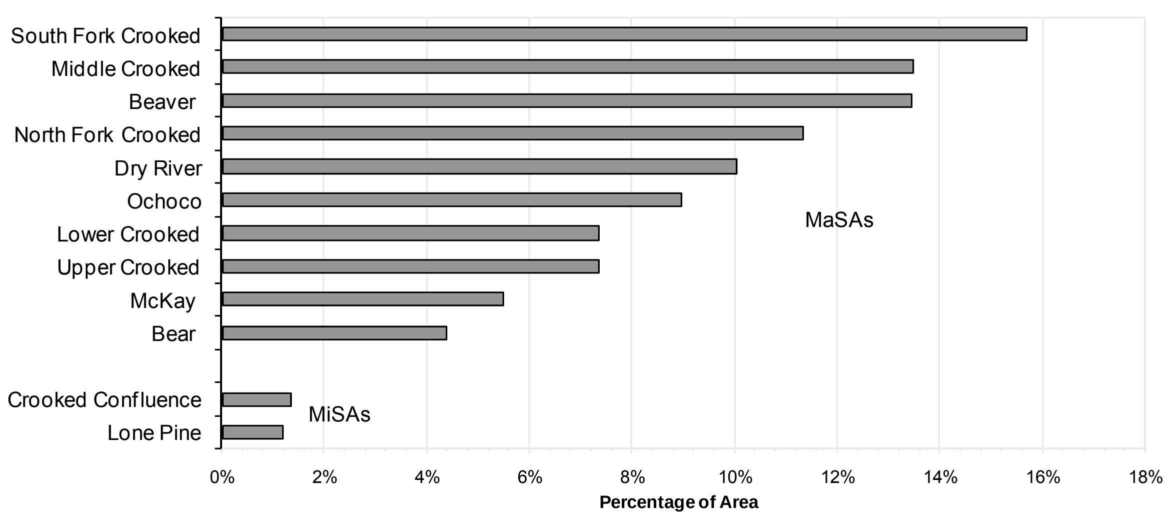

Figure 3.1.7– 2. Crooked River summer steelhead population distribution of intrinsic potential habitat across major (MaSAs) and minor (MiSAs) spawning areas. There are no areas in this population that could potentially have had historical temperature limitations.

Factors and Metrics

A.1.a. Number and spatial arrangement of spawning areas

The Crooked River population has ten MaSAs and two MiSAs distributed in a dendritic pattern. All areas within this population have been extirpated due to the Pelton Reregulation Dam. Reintroduction of steelhead into the Crooked River subbasin is currently being planned.

A.l.b. Spatial extent or range of population

There is no current spawner distribution. All areas above the Pelton Reregulation Dam, including the Crooked River population, have been extirpated (Figure 3).

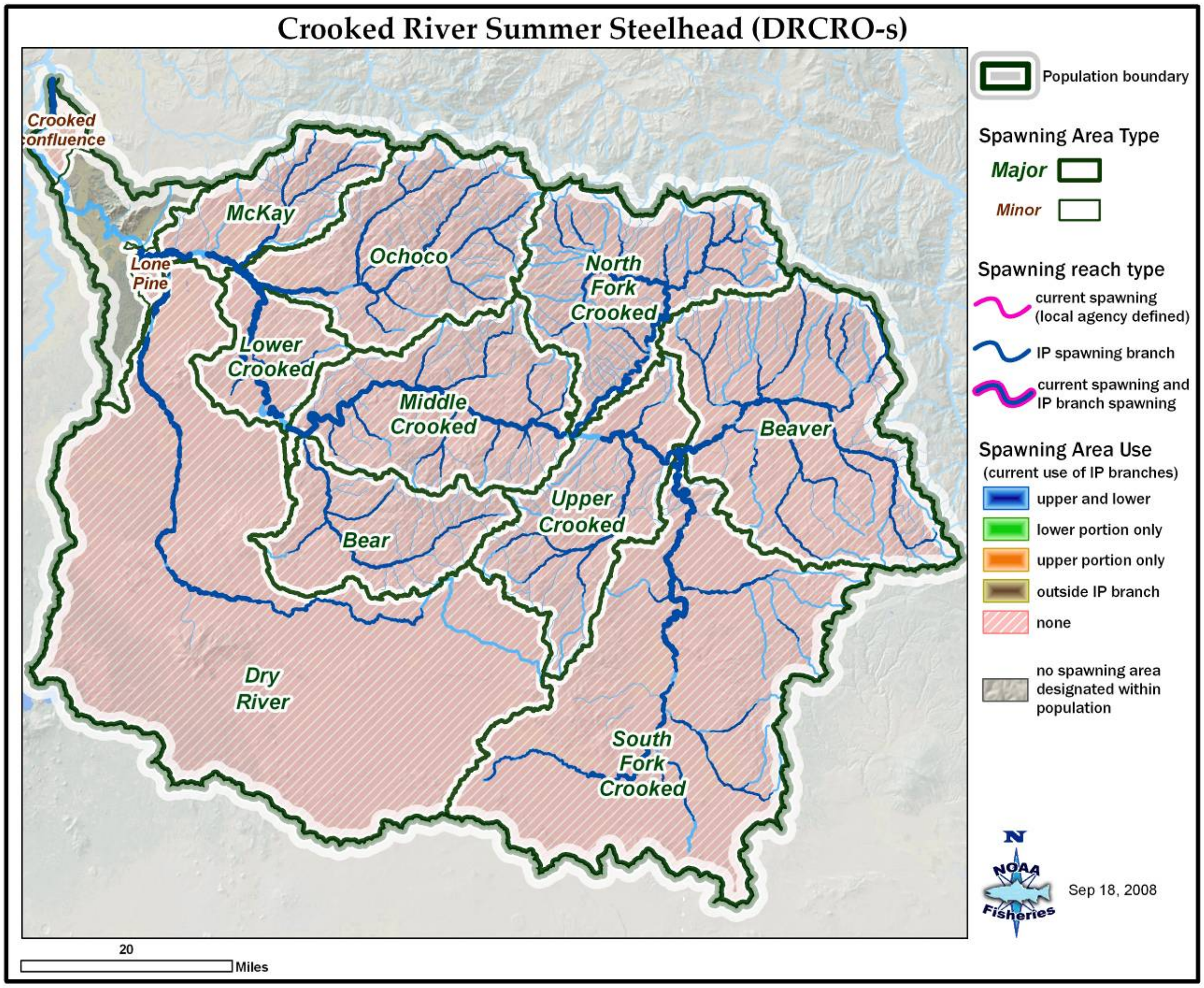

Figure 3. Crooked River summer steelhead population current spawning distribution and spawning area occupancy designations.

A.1.c. Increase or decrease in gaps or continuities between spawning aggregates

This population is functionally extirpated and is therefore not rated.

B.1.a. Major life history strategies

There are no data to allow any direct analyses of historic major life history patterns. This population is functionally extirpated and is therefore not rated.

B.1.b. Phenotypic variation

We have no direct observations to assess historic phenotypic traits. This population is functionally extirpated and is therefore not rated.

B.1.c. Genetic variation

There are no genetics data for the Crooked River population. This population is functionally extirpated and is therefore not rated.

B.2.a. Spawner composition

This population is functionally extirpated and is therefore not rated.

B.3.a. Distribution of population across habitat types

The intrinsic potential distribution encompassed eight ecoregions, of which three accounted for greater than 10% of the distribution (Figure 4). The Crooked River steelhead population is extirpated and therefore no ecoregions are currently occupied.

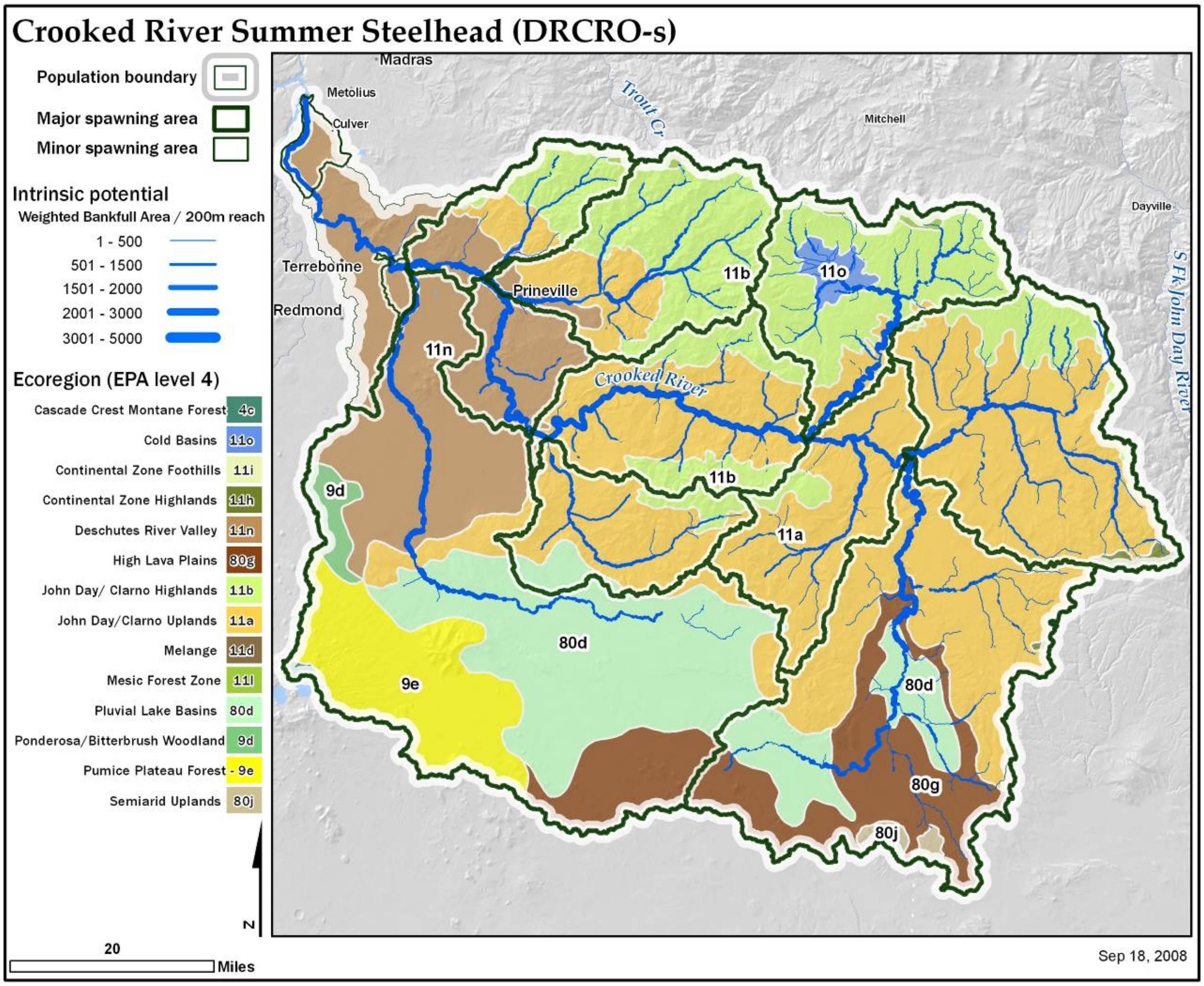

Figure 4. Crooked River summer steelhead population spawning distribution across EPA level IV ecoregions.

Table 2. Crooked River summer steelhead population proportion of current spawning areas across EPA level IV ecoregions.

Ecoregion	% of historical spawning area (non-temp. limited)	% of currently occupied spawning area (non-temp. limited)
John Day Clarno Uplands	46.7	0
John Day Clarno Highlands	13.2	0
Continental Zone Highlands	0.03	0
Mesic Forest Zone	0.04	0
Deschutes River Valley	22.53	0
Cold Basins	2.11	0
Pluvial Lake Basins	7.45	0
High Lava Plains	4.98	0

B.4.a. Selective change in natural processes or selective impacts

This population is functionally extirpated and is therefore not rated.

Spatial Structure and Diversity Summary

The Crooked River summer steelhead population is not rated for spatial structure and diversity since it is considered to be functionally extirpated.

Overall Viability Rating

The Crooked River summer steelhead population does not have an overall viability rating since it is considered to be functionally extirpated.

Lower Mainstem John Day River Summer Steelhead Population

The Lower Mainstem John Day River summer steelhead population (Figure 1) is one of five populations in the John Day River MPG within the Mid-Columbia steelhead DPS. All five populations in the John Day River MPG are summer run.

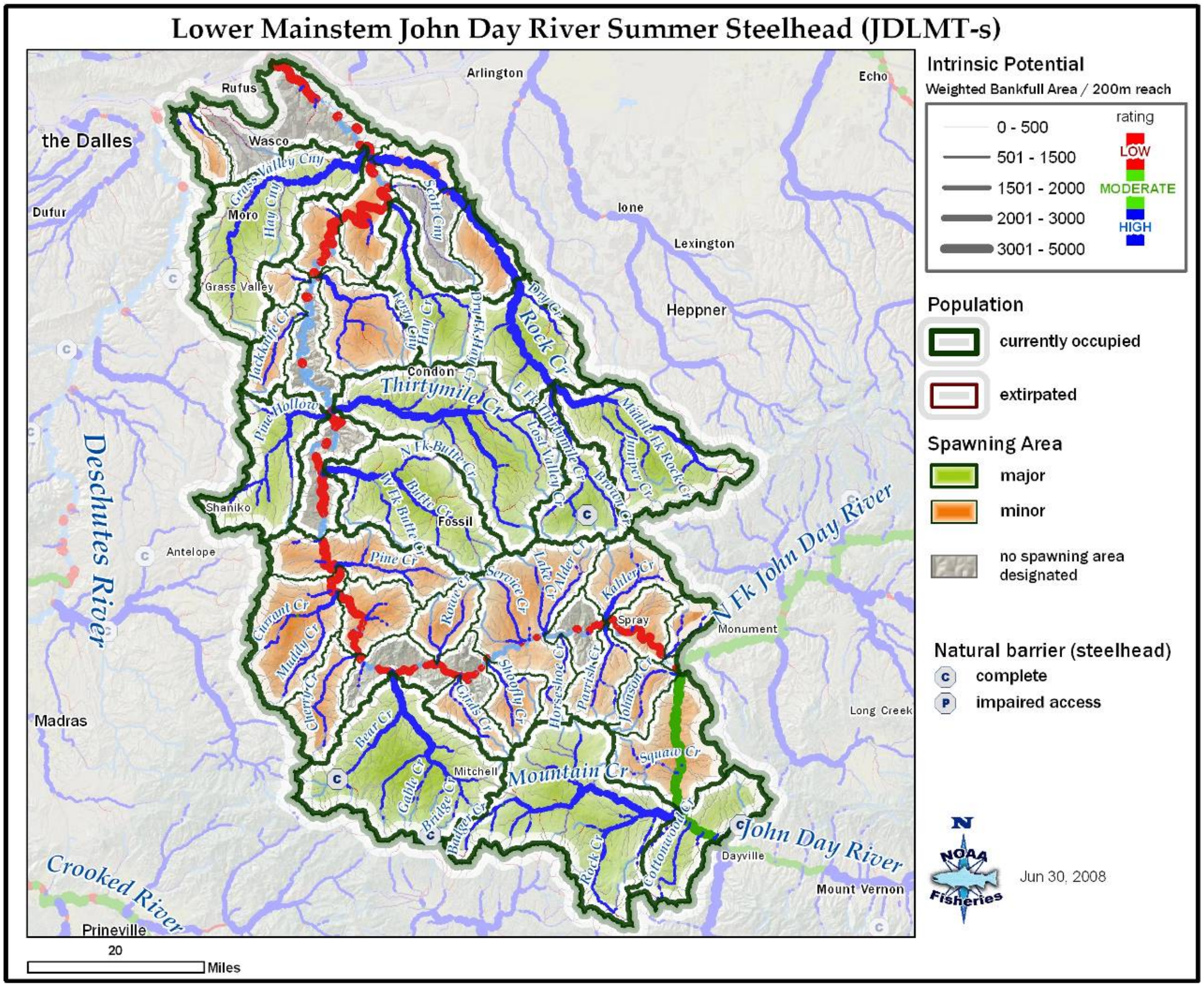

Figure 1. Lower Mainstem John Day River summer steelhead population boundary and major (MaSA) and minor (MiSA) spawning areas.

The Interior Columbia Technical Recovery Team (ICTRT) classified the Lower Mainstem John Day River population as "very large" in size and complexity (Table 1) based on historical habitat potential (ICTRT 2007). A steelhead population classified as very large has a minimum abundance threshold criteria of 2,250 natural-origin spawners with sufficient intrinsic productivity (≥ 1.19 recruits per spawner at the threshold abundance level) to achieve a 5% or less risk ("low risk") of extinction over a 100-year timeframe. In order for the Lower Mainstem population to achieve a 1% or less risk ("very low risk") of extinction over 100 years, productivity would need to be at or greater than 1.41 recruits per spawner at the minimum abundance threshold.

Table 1. Lower Mainstem John Day River summer steelhead population basin statistics and intrinsic potential analysis summary.

Drainage area (km^2)	9,857
Stream lengths km (total) [a]	2,455
Stream lengths km (below natural barriers) [a]	2,411
Branched stream area weighted by intrinsic potential (km^2)	6.778
Branched stream area km^2 (weighted and temp. limited) [b]	5.065
Total stream area weighted by intrinsic potential (km^2)	11.754
Total stream area weighted by intrinsic potential (km^2) temp limited [b]	6.433
Size / Complexity category	Very Large / "B" (dendritic structure)
Number of major spawning areas (MaSAs)	11
Number of minor spawning areas (MiSAs)	19

a. All stream segments ≥ 3.8m bankfull width were included.
b. Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was > 22°C.

Current Abundance and Productivity

Current (1965-2005) total abundance (number of adult spawners in natural production areas) for this population has ranged from 111 in 1979 to 10,557 in 1987 (Figure 2). Abundance estimates are based on expanded redd counts. Index surveys of steelhead redds from the Oregon Department of Fish and Wildlife (ODFW), John Day District, were used for the historical dataset. We used index surveys that showed relatively consistent visitation through all years. Survey data from Bear, Kahler, Parrish, Pine, and Thirtymile creeks were used in the analyses. The current spawning distribution was used for the miles of available habitat within each population's range. The index redd densities were then multiplied by a correction factor to estimate the annual redd densities for the entire spawning distribution, based on the ratio of index redd densities to redd densities in 2004-2005 derived from the Environmental Monitoring and Assessment Program (EMAP); the ratio was consistent for these years (0.36, 0.35). The estimated redd density for the entire spawning area (0.355 x index density) was multiplied by the total miles of spawning habitat currently utilized. Total annual redds were converted to fish by multiplying the total annual number of redds by the number of fish per redd. Fish per redd ratios were developed from survey data on Deer Creek in the Grande Ronde River basin and are an average from four years of data from complete and repeated redd surveys (censuses) above a weir where we have a complete fish count; the calculated average fish per redd estimate was 2.1.

The hatchery-origin/natural-origin composition of spawners was computed separately for the Lower Mainstem John Day River and combined for all other populations in the MPG. Data included observations of positively identified fin-clipped spawners (1992-present) from spawning surveys. Evidence from the Deschutes River indicates that hatchery straying was substantially lower before 1992; because the source of strays in the John Day River basin is the same as the Deschutes River, we assumed a similar trend. No other data are available for earlier years so the hatchery fraction was set at zero. Age composition was derived from scale readings of creel sampled unmarked fish collected during the 1980s above Tumwater Falls.

Recent natural spawners include returns originating from naturally spawning parents and a small fraction of strays from Snake and Columbia River hatchery programs. Spawners originating from naturally spawning parents have comprised an average of 92% of the spawners since hatchery strays began being documented in 1992. Since that time, the percentage of natural spawners has ranged from 82%-99%.

Abundance in recent years has been highly variable. The 10-year (1996-2005) geometric mean abundance of natural-origin spawners was 1,800 (Table 2). During the period 1975-1997, recruits per spawner (R/S, in terms of spawner to spawner) for steelhead in the Lower Mainstem population ranged from 0.14 in 1987 to 17.5 in 1979. The annual R/S estimates were adjusted to reflect the average smolt-to-adult return rate (SAR). The 19-year (1980-1998) geometric mean productivity was 2.99 R/S, adjusted for SAR and delimited at 75% (1,688 spawners) of the abundance threshold.

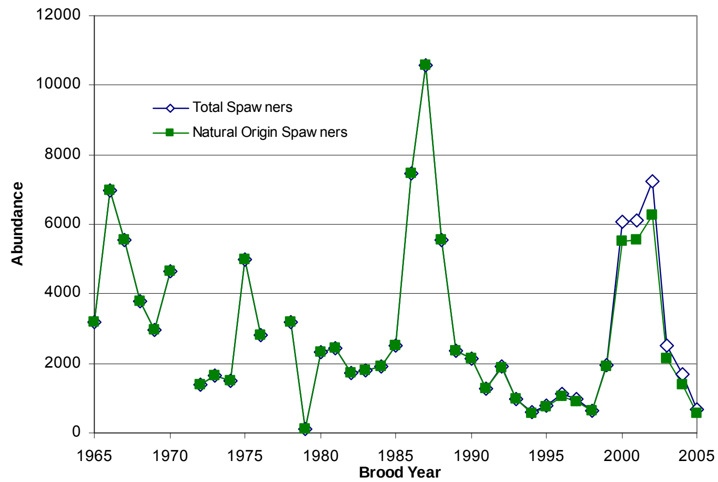

Figure 2. Lower Mainstem John Day River summer steelhead population spawner abundance estimates (1965-2005).

Table 2. Lower Mainstem John Day River summer steelhead population abundance and productivity estimates.

Abundance/Productivity Statistics	Estimate	(Range)	
Abundance: natural-origin spawners (10-year geometric mean, range)	1,800	(563-6,257)	
Proportion: natural-origin spawners (10-year geometric mean, range)	0.90	(0.82-1.00)	
	Estimate	**(90% CI)[b]**	**SE**
Intrinsic productivity (19-year R/S, SAR adjusted & delimited) [a]	2.99	(1.91-4.67)	0.24
Productivity (19-year Beverton-Holt fit, SAR adjusted)	n/a		n/a
Trend Statistics (1980-2005)	**Estimate**	**(95% CI)**	**P>1.0**
ln(natural-origin spawner abundance)	0.98	(0.94-1.14)	
Population growth rate (λ): Hatchery effectiveness = **1.0**	1.00	(0.71-1.41)	0.50
Population growth rate (λ): Hatchery effectiveness = **0.0**	1.01	(0.71-1.43)	0.53

a. Delimited productivity excludes any recruit/spawner pair where the spawner number >75% of the population's minimum abundance threshold. This approach attempts to remove density dependence effects that may influence the productivity estimate.
b. Lower end of the 90% CI on productivity is used in evaluating the impact of parameter uncertainty on risk.

The Lower Mainstem John Day River population is at **Moderate Risk** based on current abundance and productivity. The productivity is at very low risk because the point estimate is above very low risk and the lower end of the adjusted standard error is above the 5% risk level. The abundance is at moderate risk because it resides between the 5% and 25% risk levels (Figure 3).

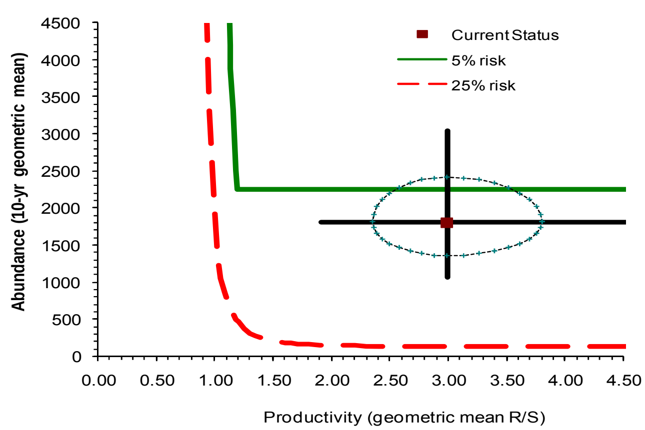

Figure 3. Lower Mainstem John Day River summer steelhead population current abundance/productivity (A/P) compared to the DPS viability curve. Ellipse = 1 SE about the point estimate. Error bars = 90% CI for A/P.

The average trend in natural-origin spawner abundance over the most recent 20 years has been just below 1.0; the population growth rate metric (λ), calculated with relative hatchery effectiveness set to 1.0, was 1.00 for the same period (Table 2). The pattern in returns from 1991 through 2005 is similar to the pattern for several other Mid-Columbia DPS steelhead populations, including the Deschutes River Eastside—an increasing trend beginning in 1996 followed by an abrupt decrease to levels observed in the early 1990s. The estimated proportion of hatchery-origin spawners has averaged approximately 10% for the period. The relative effectiveness of hatchery-origin spawners in contributing to natural production in this population is not known. Setting the value to 0.0, the opposite extreme from 1.0, results in an estimated annual growth rate of 1.01 (0.53 probability of exceeding 1.0).

Spatial Structure and Diversity

The ICTRT has identified 11 major spawning areas (MaSAs) and 19 minor spawning areas (MiSAs) within the Lower Mainstem John Day River population (Figure 4). Spawning is distributed broadly across the landscape in numerous watersheds that flow into the lower mainstem of the John Day River. Moderately large drainages such as Rock, Thirtymile, Bridge, Service, Mountain and Butte creeks comprise a substantial proportion of the production area. In addition, multiple smaller drainages support production. Spawners within the Lower Mainstem population are predominantly natural-origin; however, outside-DPS hatchery fish, primarily from Snake River stocks, are present in significant proportions in some years.

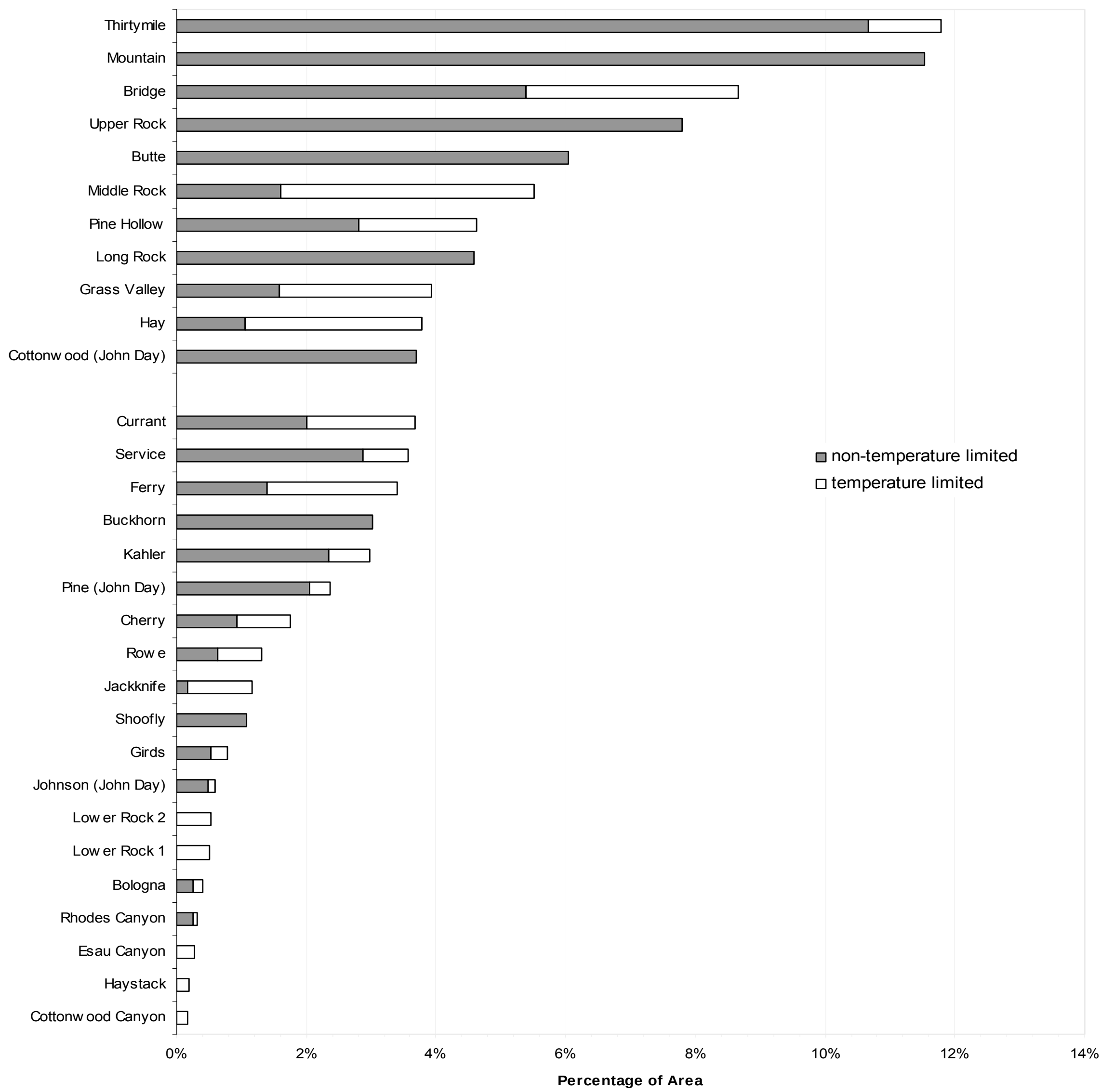

Figure 4. Lower Mainstem John Day River summer steelhead population distribution of intrinsic potential habitat across major and minor spawning areas. White bars represent the area that could potentially have had historical temperature limitations.

Factors and Metrics

A.1.a. Number and spatial arrangement of spawning areas

The Lower Mainstem population has 11 MaSAs and 19 MiSAs distributed in a very complex dendritic pattern. Intrinsic potential is distributed relatively evenly across the 11 MaSAs. Based on the ODFW spawner distribution database all 11 of the MaSAs are currently occupied (except for the upper portion of the Cottonwood MaSA) and 11 of the 19 MiSAs are occupied (Figure 5). A total of 1,197 km of habitat is presently used for spawning. The Lower Mainstem population rates at **very low risk** for this metric.

A.l.b. Spatial extent or range of population

The current spawner distribution closely resembles the intrinsic potential distribution. All of the MaSAs are currently occupied except the upper portion of Cottonwood, and 11 of the 19 MiSAs are also occupied. The unoccupied MiSAs are scattered throughout the population, and, therefore, do not result in a change in extent and range of distribution. The rating is **very low risk**. There are six index spawning survey sites in the Lower Mainstem population.

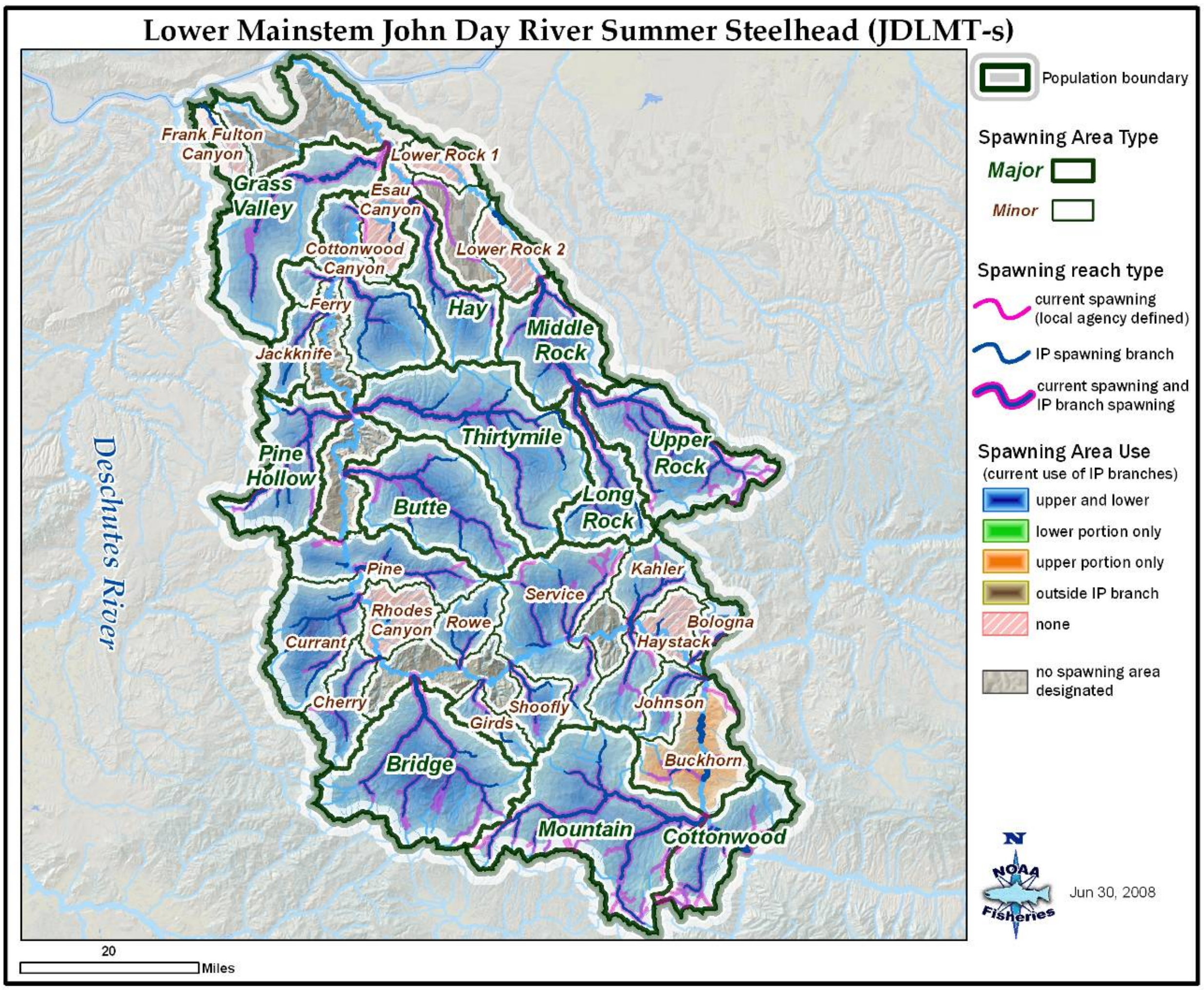

Figure 5. Current spawning distribution and spawning area occupancy designations of the Lower Mainstem John Day River summer steelhead population.

A.1.c. Increase or decrease in gaps or continuities between spawning aggregates

There has not been any significant increase in gaps relative to historic intrinsic distribution. Although 8 of the 19 MiSAs are not currently occupied, the remaining occupied spawning areas (11 MaSAs and 11 MiSAs) provide good continuity between spawning areas throughout the population as well as relatively unchanged gaps. The Lower Mainstem population rating is **very low risk** for this metric.

B.1.a. Major life history strategies

The Lower Mainstem population is an A-run population that migrates to the ocean at multiple ages and returns after spending one or two years in the ocean (based on ages of natural-origin angler caught fish). These life history patterns are consistent with other A-run steelhead. There are limited data available to evaluate changes in life history patterns for this population; thus, they must be inferred based on habitat changes. This population is very large and inhabits a broad geographic area with habitat quality ranging from good to poor. Although current habitat conditions provide opportunity for expression of diverse life history strategies, habitat changes (particularly temperature) have likely reduced movement patterns and summer rearing distribution. This population rates at **moderate risk** for this metric because of the loss of tributary habitat rearing due to flow and temperature.

B.1.b. Phenotypic variation

There are no data to directly assess if any phenotypic traits have been substantially changed or lost, thus, they must inferred from habitat data. We hypothesize that there has been some reduction in variability of traits, such as adult entry and migration timing through the Columbia and John Day rivers, as well as juvenile migration timing. Although the distribution of these types of traits has likely been altered, the magnitude has likely not been substantial. Habitat conditions and absence of significant major phenotypic selective pressures indicate this population is at **low risk**.

B.1.c. Genetic variation

There are limited genetic data for John Day River populations, and no samples have been analyzed for the Lower Mainstem population. The major concern regarding genetic variation within the Lower Mainstem population relates to the spawner composition and potential genetic effects of out-of-DPS hatchery strays. There are no past population bottlenecks or intentional hatchery practices that would influence genetic variation. Due to the high proportion of hatchery strays and the lack of genetic data for this population, we have rated this metric as **moderate risk.** Samples were collected in 2005 and 2006 to provide an assessment of the genetic characteristics of the Lower Mainstem population. These data will allow for a more informed assessment of the genetic variation in the future.

B.2.a. Spawner composition

(1) *Out-of-DPS spawners:* Based on coded wire tags (CWTs) recovered primarily from recreational fisheries, the proportion of out-of-DPS hatchery spawners in the Lower Mainstem John Day River population has ranged from 0.1 in the early 1990s to 0.18 in 2004, with a mean

of 0.07. The trend from the early 1990s to 2005 has shown a consistent increase in hatchery proportion through time. The hatchery fish originate primarily from the Snake River Basin. Due to the combined effects of the high hatchery fraction, the increasing trend through time, and the origin of the strays, this population rates at **high risk** for this metric.

(2) *Out-of-MPG spawners from within the DPS*: There have been a total of four CWTs recovered from fish in the John Day River from out-of-MPG within-DPS origin. Three originated from the Umatilla Hatchery program and one from the Deschutes Hatchery program. It appears very few within-DPS hatchery fish stray into the John Day River, thus the rating is **low risk** for this metric.

(3) *Out-of-population spawners from within the MPG:* There are no steelhead hatchery programs operated within the John Day River basin; therefore, this metric is rated as **very low risk**.

(4) *Within-population hatchery spawners:* There are no steelhead hatchery programs operated within the John Day River basin; therefore, this metric is rated as **very low risk.**

The overall spawner composition rating is **high risk** due to the high proportion of out-of-DPS strays that potentially spawn in this population**.**

B.3.a. Distribution of population across habitat types

The intrinsic potential distribution of the Lower Mainstem John Day River population encompassed seven ecoregions (Figure 6), although only two had values greater than 10%. There has been little change in distribution among ecoregions and no substantial reductions. All ecoregions that had significant use historically remain in use currently (Table 3). The rating is **low risk** for this metric.

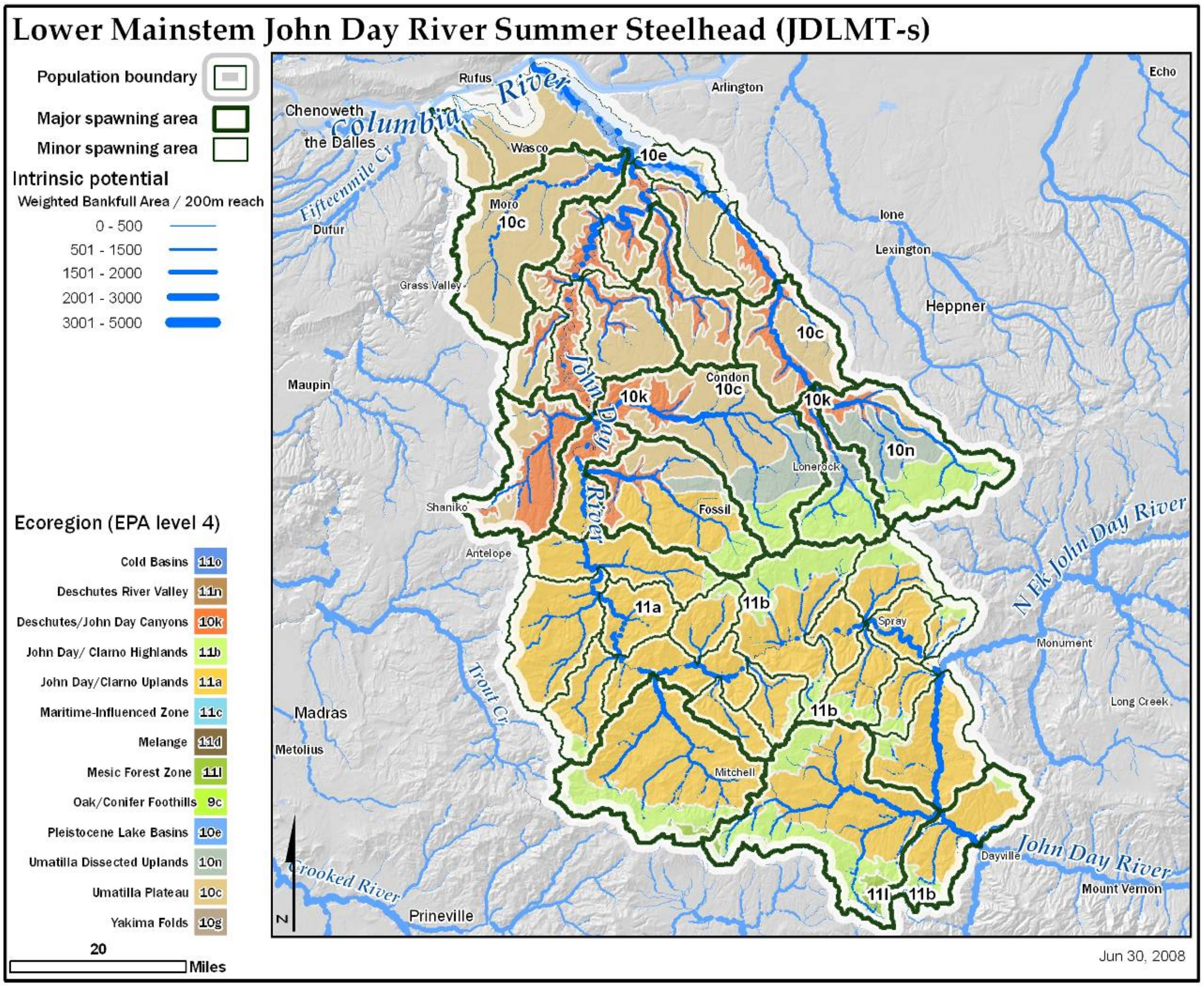

Figure 6. Lower Mainstem John Day River summer steelhead population spawning distribution across EPA level IV ecoregions.

Table 3. Proportion of current spawning areas across EPA level IV ecoregions of the Lower Mainstem John Day River summer steelhead population.

Ecoregion	% of historical spawning area (non-temp. limited)	% of currently occupied spawning area (non-temp. limited)
Deschutes/John Day Canyons	32.0	35.4
John Day Clarno Highlands	5.2	7.9
John Day Clarno Uplands	46.6	42.7
Mesic Forest Zone	0.2	0.4
Pleistocene Lake Basins	6.1	0.1
Umatilla Dissected Uplands	2.7	4.7
Umatilla Plateau	7.2	8.9

B.4.a. Selective change in natural processes or selective impacts

Hydropower system: This population passes three dams on the lower mainstem Columbia River in its seaward and spawning migrations. The hydropower system and associated reservoirs appear to impose some selection on smolt and adult migration timing. All hydropower effects have persisted for multiple generations and are ongoing.

> *Adult migration timing:* The dams create a thermal barrier in the reservoirs that delays and potentially induces some mortality of migrating adults. This barrier is diminished later in the migration season. Because the timing of the barrier varies from year to year and does not develop in some years, and the degree of differential survival is likely low although not well-understood, we rate the selection intensity as low. Heritability of this trait is high; thus, the hydropower rating for this trait is **moderate risk**.

Harvest: Harvest has the potential to affect migration timing, maturation timing, and size. However, recent harvest rates for A-run steelhead in the Columbia River mainstem are generally less than 10% annually. Although some harvest may be size-selective for larger fish, the selective mortality would affect slightly more than 2% of the total population. There may be a very slight advantage for earlier returning fish as a result of the timing of the Chinook salmon fishery, and while heritability of adult migration timing is high, the impacts would be negligible. There is very limited tribal harvest of natural-origin fish within the John Day River subbasin. Impacts from the recreational fishery are incidental to the harvest of hatchery-origin fish and are not selective. No phenotypic traits appear to be at risk as a result of this activity. The harvest rating is **low risk** for all traits.

Hatcheries: There are no steelhead hatchery programs operated within the population; therefore, the hatchery rating is **very low risk** for all traits.

Habitat: Altered flow and increased temperatures in spawning, rearing, and the mainstem migration corridor, which have been in place for many generations and are ongoing, likely impose some selection on juvenile and adult migration timing.

> *Adult migration timing:* Low flows in the late summer and early fall in the John Day River likely expose adults that enter the river early to above normal mortality rates. Adult migration timing is highly heritable, but a negligible proportion of the population is likely subject to these effects. Thus, the impact of habitat changes on this trait is **low risk.**
>
> *Juvenile migration timing:* Late spring and early summer temperatures are elevated relative to historical conditions. There has likely been some affect on juvenile migration timing as late spring and early summer river temperatures can reach stressful levels in some years in the John Day River mainstem. Selection intensity is considered negligible and the heritability of this trait is moderate to low. The impact of habitat changes on this trait is **low risk**.

Other: A population of Caspian terns in the estuary has been artificially enhanced by a combination of increased habitat (created by dredge spoils) and artificially increased food availability (large-scale releases of hatchery smolts). These terns appear to exert a size-selective

predation pressure that primarily impacts the large steelhead smolts. The rate of predation is highest during tern nesting season in May. This pressure may affect smolt migration timing.

> *Juvenile migration timing:* Steelhead smolts pass through the estuary from April to June. The relatively high predation (10%) on smolts in May could select for earlier and later out-migrants. However, heritability of this trait has not been assessed, so we assume a moderate to low heritability. Because this predation occurs at the peak of migration, the impact of this selective factor is **low risk**.

There is only one trait that has a moderate rating for one selective activity. Therefore, the overall selectivity rating for this population is **low risk.**

Spatial Structure and Diversity Summary

The integrated spatial structure/diversity rating is **Moderate Risk** for the Lower Mainstem John Day River population (Table 4). The rating for Goal A (allowing natural rates and level of spatially mediated processes) was **very low risk**. The current spawner distribution is similar to historic with all MaSAs occupied. The MiSAs that are currently unoccupied have little influence on gaps and continuity, and spawners are spread over a very broad geographic area.

The rating for Goal B (maintaining natural levels of variation) was **moderate risk**. This rating was a result of moderate risk for life history and genetic variation and high risk for spawner composition out-of-DPS hatchery strays. The magnitude and trend in out-of-DPS hatchery strays are of significant concern. Analysis of genetic information will yield considerable insight into the genetic characteristics of this population. The extent of hatchery introgression will be useful information for future spatial structure/diversity risk assessments.

Table 4. Spatial structure and diversity risk rating of the Lower Mainstem John Day River summer steelhead population.

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
A.1.a	VL (2)	VL (2)	Very Low Risk (Mean = 2)	Very Low Risk (Mean = 2)	**Moderate Risk**
A.1.b	VL (2)	VL (2)			
A.1.c	VL (2)	VL (2)			
B.1.a	M (0)	M (0)	Moderate (0)	Moderate Risk (0)	
B.1.b	L (1)	L (1)			
B.1.c	M (0)	M (0)			
B.2.a(1)	H (-1)	High Risk (-1)	High Risk (-1)		
B.2.a(2)	L (1)				
B.2.a(3)	VL (2)				
B.2.a(4)	VL (2)				
B.3.a	L (1)	L (1)	L (1)		
B.4.a	L (1)	L (1)	L (1)		

Overall Viability Rating

The Lower Mainstem John Day River summer steelhead population does not meet viability criteria. However, the population does meet criteria to be rated as **MAINTAINED** (Figure 7). Overall abundance and productivity is rated at **Moderate Risk.** The 10-year geometric mean abundance of natural-origin spawners is 1,800, which is 80% of the minimum abundance threshold of 2,250. The 19-year geometric mean productivity (2.99 R/S; Table 6) exceeds the minimum required productivity of 1.19 R/S at the abundance threshold. Overall spatial structure and diversity is also rated at **Moderate Risk.** To achieve a viable rating, this population must improve in both abundance/productivity and spatial structure/diversity. Out-of-DPS spawners are the most influential factor on diversity risk. Additional data are needed to better quantify spawner composition to reduce the uncertainty associated with this risk metric.

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	**HV**	**HV**	**V**	**M**
	Low (1-5%)	**V**	**V**	**V**	**M**
	Moderate (6 – 25%)	**M**	**M**	**M** **Lower Mainstem John Day River**	**HR**
	High (>25%)	**HR**	**HR**	**HR**	**HR**

Figure 7. Lower Mainstem John Day River summer steelhead population risk ratings integrated across the four viable salmonid population (VSP) metrics. ***Viability Key: HV – Highly Viable; V – Viable; M – Maintained; HR – High Risk; Shaded cells – does not meet viability criteria (darkest cells are at greatest risk).***

Data Summary – Lower Mainstem John Day River

Data type: Redd count expansion - Index area redd counts expanded to total population estimate by applying ratio of average redd densities (samples across all areas to samples from index reaches) from EMAP surveys. Assumed 2.1 fish per redd.
Smolt-to-Adult Return rate (SAR): Mid-Columbia composite series (see *Methods*).

Table 5. Abundance and productivity data used for curve fits and R/S analysis of the Lower Mainstem John Day River summer steelhead population. Bold values used in estimating the current productivity (Table 6).

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	SAR Adj. Factor	Adj. Rtns	Adj. R/S
1980	2329	1.00	2329	2749	1.18	0.50	1388	0.60
1981	2420	1.00	2420	5525	2.28	0.68	3773	1.56
1982	1714	1.00	1714	8654	5.05	0.46	3955	2.31
1983	1815	1.00	1815	7493	4.13	0.52	3924	2.16
1984	1916	1.00	1916	3776	1.97	0.65	2442	1.27
1985	2521	1.00	2521	2154	0.85	0.46	989	0.39
1986	7468	1.00	7468	1716	0.23	0.94	1618	0.22
1987	10557	1.00	10557	1515	0.14	2.18	3297	0.31
1988	5546	1.00	5546	1348	0.24	0.99	1335	0.24
1989	2366	1.00	2366	774	0.33	0.96	744	0.31
1990	2133	1.00	2133	703	0.33	2.83	1990	0.93
1991	**1264**	**1.00**	**1264**	**898**	**0.71**	**2.33**	**2096**	**1.66**
1992	1917	0.99	1889	945	0.49	1.88	1777	0.93
1993	**986**	**0.99**	**972**	**892**	**0.90**	**1.18**	**1054**	**1.07**
1994	**593**	**0.97**	**577**	**1682**	**2.84**	**1.07**	**1801**	**3.04**
1995	**806**	**0.94**	**755**	**3890**	**4.83**	**1.23**	**4765**	**5.92**
1996	**1115**	**0.93**	**1041**	**5597**	**5.02**	**1.03**	**5776**	**5.18**
1997	**960**	**0.95**	**911**	**5527**	**5.75**	**0.76**	**4218**	**4.39**
1998	**652**	**0.96**	**625**	**3929**	**6.02**	**0.49**	**1926**	**2.95**
1999	1933	0.98	1894					
2000	6058	0.91	5524					
2001	6096	0.91	5553					
2002	7231	0.87	6257					
2003	2512	0.85	2134					
2004	1688	0.82	1380					
2005	671	0.84	563					

Table 6. Lower Mainstem John Day River summer steelhead population geometric mean abundance and productivity estimates (values used for current productivity and abundance are shown in boxes).

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
delimited	median	75% threshold	median	75% threshold	1987-1998	1980-1998	geomean
Point Est.	3.02	2.85	2.59	2.99	0.97	1.02	1800
Std. Err.	0.25	0.34	0.18	0.24	0.35	0.35	0.29
count	9	7	9	7	12	19	10

Table 7. Stock-recruitment curve fit parameter estimates for the Lower Mainstem John Day River summer steelhead population. Biologically unrealistic or highly uncertain values are highlighted in grey.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	1.24	0.35	n/a	n/a	0.37	0.87	66.3	1.18	0.28	n/a	n/a	0.34	0.82	59.6
Const. Rec	2325	426	n/a	n/a	n/a	n/a	50.1	2202	287	n/a	n/a	n/a	n/a	37.2
Bev-Holt	50	110	2392	476	0.16	0.86	53.2	50	91	2264	326	0.27	0.42	40.3
Hock-Stk	3.58	0.66	652	1	0.16	0.86	52.9	2.99	1.20	750	317	0.26	0.42	39.8
Ricker	3.08	0.86	0.00035	0.00008	0.29	0.77	55.4	2.52	0.59	0.00030	0.00007	0.42	0.40	48.6

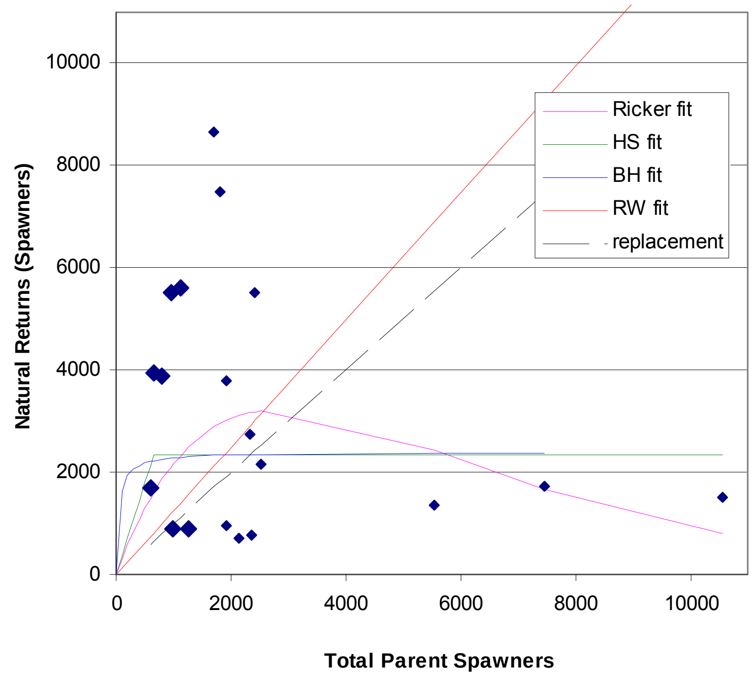

Figure 8. Lower Mainstem John Day River summer steelhead population stock recruitment curves. Bold points were used in estimating the current productivity. Data were not adjusted for marine survival.

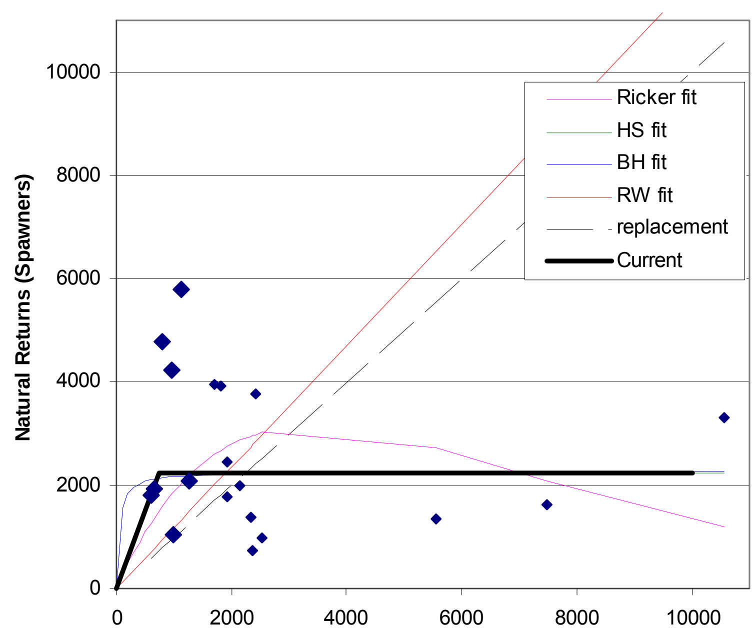

Figure 9. Lower Mainstem John Day River summer steelhead population stock recruitment curves. Bold points were used in estimating the current productivity. Data were adjusted for marine survival. Function labeled "Current" is a Hockey Stick function derived by fixing the slope of the ascending limb at the geometric mean productivity at low to moderate abundance (Table 2) and fitting a capacity estimate to the data series.

North Fork John Day River Summer Steelhead Population

The North Fork John Day River summer steelhead population (Figure 1) is one of five populations in the John Day River MPG within the Mid-Columbia steelhead DPS. All five populations in this MPG are summer run.

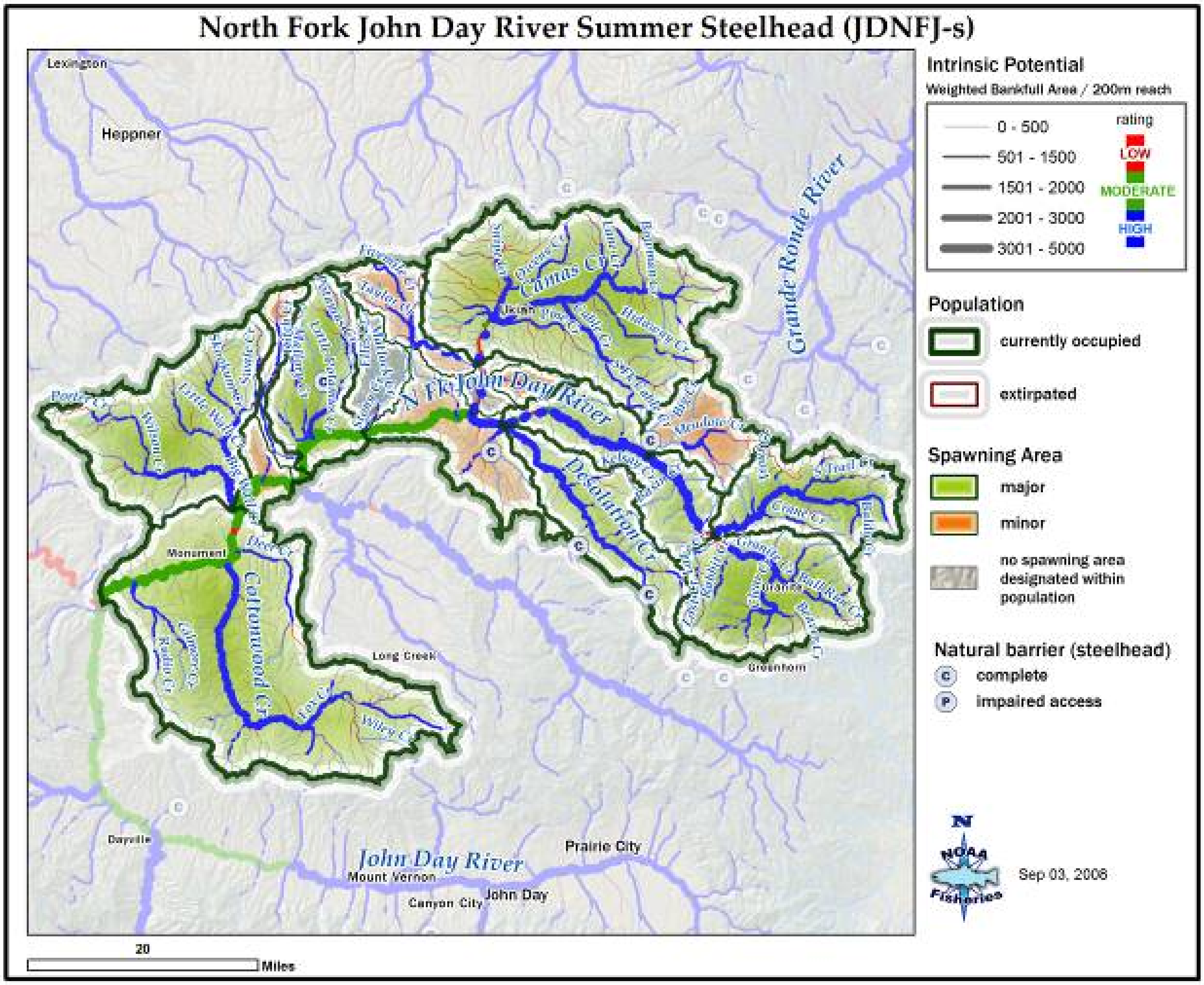

Figure 1. North Fork John Day River summer steelhead population boundary and major (MaSA) and minor (MiSA) spawning areas.

The Interior Columbia Technical Recovery Team (ICTRT) classified the North Fork population as “large” in size and complexity (Table 1) based on historical habitat potential (ICTRT 2007). A steelhead population classified as large has a mean minimum abundance threshold criteria of 1,500 natural-origin spawners with sufficient intrinsic productivity (≥ 1.26 recruits per spawner at the abundance threshold level) to achieve a 5% or less risk (“low risk”) of extinction over a 100-year timeframe. In order for the North Fork John Day River population to achieve a 1% or less risk (“very low risk”) of extinction over 100 years, productivity would need to be at or greater than 1.53 recruits per spawner at the minimum abundance threshold.

Table 1. North Fork John Day River summer steelhead population basin statistics and intrinsic potential analysis summary.

Drainage area (km^2)	4,788
Stream lengths km (total) [a]	1,823
Stream lengths km (below natural barriers) [a]	1,678
Branched stream area weighted by intrinsic potential (km^2)	5.221
Branched stream area km^2 (weighted and temp. limited) [b]	4.917
Total stream area weighted by intrinsic potential (km^2)	6.867
Total stream area weighted by intrinsic potential (km^2) temp limited [b]	6.474
Size / Complexity category	Large / "B" (dendritic)
Number of major spawning areas (MaSAs)	8
Number of minor spawning areas (MiSAs)	7

a. All stream segments ≥ 3.8m bankfull width were included.
b. Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was > 22°C.

Current Abundance and Productivity

Current (1965-2005) total spawner abundance (number of adult spawners in natural production areas) has ranged from 369 in 1990 to 10,235 in 1965 (Figure 2). Abundance estimates are based on expanded redd counts. Index surveys of steelhead redds from the Oregon Department of Fish and Wildlife (ODFW), John Day District, were used for the historical dataset. We used index surveys that showed relatively consistent visitation through years. Survey data from Beaver, Fox, North Fork Trail, Middle Fork Trail, Wall and Wilson creeks were used in the analyses. The current spawning distribution was used for the miles of available habitat within the population's range. The index redd densities were then multiplied by a correction factor based on the ratio of index densities to EMAP (Environmental Monitoring and Assessment Program) densities for 2004-2005; this ratio was consistent for these years (0.36, 0.35). The estimated redd density for the entire spawning area (0.355 x index density) was multiplied by the total miles of currently utilized spawning habitat. Total annual redds were converted to fish by multiplying the total annual number of redds by the number of fish per redd. Fish/redd ratios were developed from survey data on Deer Creek in the Grande Ronde River basin. The ratio is an average from four years of data of complete and repeated surveys (censuses) of redds above a weir where we have a complete count; the calculated average fish per redd estimate was 2.1.

The hatchery-origin/natural-origin composition of spawners were computed separately for the Lower Mainstem John Day River population and combined for all other populations in the MPG. Data used to represent the North Fork population included observations of positively identified fin-clipped spawners (1992-present) from spawning survey observations in the four populations above the Lower Mainstem, and observations from rotary screw trap and seine collections of adults (2000-present). There is evidence from the Deschutes River that hatchery straying was substantially lower before 1992, and since the source of strays in the John Day River basin is the same as the Deschutes River, we are assuming a similar trend. No other data are available for earlier years so the hatchery fraction was set at zero. Age composition was derived from scale readings of creel sampled unmarked fish collected during the 1980s above Tumwater Falls.

Recent year natural spawners include returns originating from naturally spawning parents, and a small fraction of strays from the Snake and Columbia River hatchery programs. Since documentation of hatchery strays began in 1992, spawners originating from naturally spawning parents have comprised an average of 93% of the spawners, ranging from 87-99%.

Abundance in recent years has been moderately variable. The 10-year (1996-2005) geometric mean abundance of natural-origin spawners was 1,740 (1,898 total spawners; Table 2). During the period 1979-1998, recruits per spawner (R/S, in terms of spawner to spawner) for steelhead in the North Fork John Day River ranged from 0.10 in 1985 to 3.07 in 1991. The annual R/S estimates were adjusted to reflect the average smolt-to-adult return rate (SAR). The 20-year (1979-1998) geometric mean productivity was 2.41 R/S, adjusted for SAR and delimited at 75% (1,125 spawners) of the abundance threshold (Table 2).

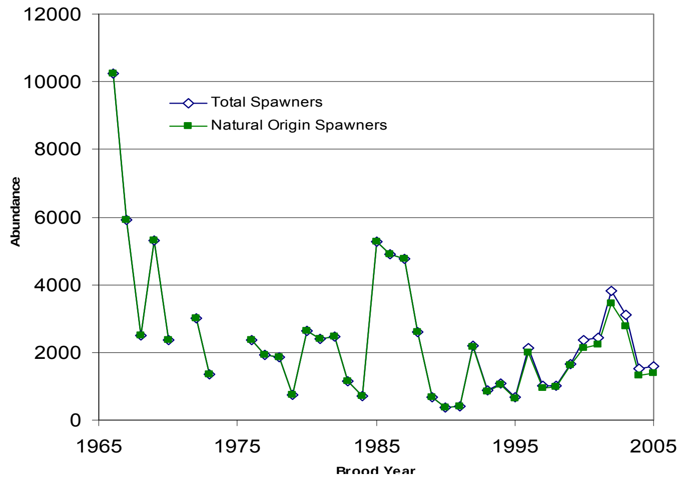

Figure 2. North Fork John Day River summer steelhead population spawner abundance estimates (1966-2005).

Table 2. North Fork John Day River summer steelhead population abundance and productivity estimates.

Abundance/Productivity Statistics	Estimate	(Range)	
Abundance: natural-origin spawners (10-year geometric mean, range)	1740	(369-10,235)	
Proportion: natural-origin spawners (10-year geometric mean, range)	0.93	(0.87-1.00)	
	Estimate	**(90% CI)[b]**	**SE**
Intrinsic productivity (20-year R/S, SAR adjusted & delimited) [a]	2.41	(1.31-4.42)	0.22
Productivity (20-year Beverton-Holt fit, SAR adjusted)	n/a		n/a
Trend Statistics (1980-2005)	**Estimate**	**(95% CI)**	**P>1.0**
ln(natural-origin spawner abundance)	0.99	(0.95-1.16)	
Population growth rate (λ): Hatchery effectiveness = **1.0**	1.00	(0.79-1.25)	0.48
Population growth rate (λ): Hatchery effectiveness = **0.0**	1.00	(0.80-1.26)	0.51

a. Delimited productivity excludes any recruit/spawner pair where spawner number >75% of population's minimum abundance threshold. This approach attempts to remove density dependence effects that may influence the productivity estimate.
b. Lower end of the 90% CI on productivity is used in evaluating the impact of parameter uncertainty on risk.

The North Fork John Day River population is at **Very Low Risk** based on current abundance and productivity. The point estimate for abundance and productivity is above the 1% risk curve (Figure 3) and the lower end of the 98% confidence interval (CI) for productivity is above the 25% risk curve.

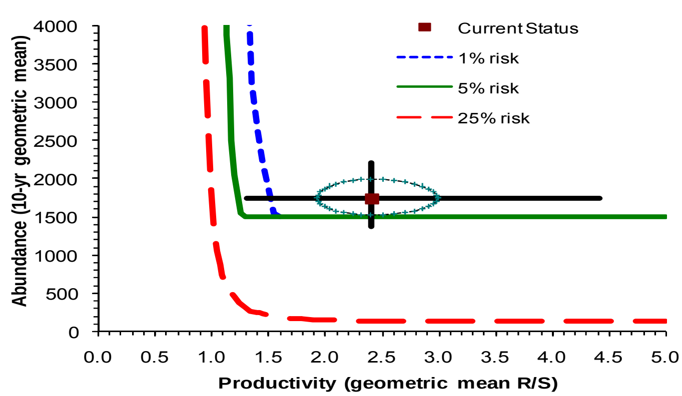

Figure 3. North Fork John Day River summer steelhead population current abundance and productivity (A/P) compared to DPS viability curve. Ellipse = 1 SE about the point estimate. Error bars = 90% CI for A, 98% CI for P (if point estimate >1% risk curve, the uncertainty test is <1% probability the combined A/P is at high risk).

The abundance of natural-origin spawners in the North Fork population has fluctuated substantially over the recent 20-year period. The average trend in natural-origin spawner abundance has been 0.99; the population growth rate metric (calculated with relative hatchery effectiveness set to 1.0) was 1.00 for the same period (Table 2). The pattern in returns from 1991 through 2005 is similar to the pattern for several other Mid-Columbia DPS steelhead populations, including the Deschutes River Eastside—an increasing trend beginning in 1996 followed by an abrupt decrease to levels observed in the early 1990s. The estimated proportion of spawners of hatchery-origin has averaged approximately 7% for the period. The relative effectiveness of hatchery-origin spawners in contributing to natural production in this population is not known. Setting the value to 0.0 did not change the point estimate of the average population growth rate for the period, although the probability of exceeding 1.0 increased slightly from 0.48 to 0.51.

Spatial Structure and Diversity

The ICTRT has identified eight major spawning areas (MaSAs) and seven minor spawning areas (MiSAs) within the North Fork John Day River steelhead population (Figure 4). Spawning is distributed broadly throughout the population boundaries including many tributaries and mainstem areas of Cottonwood, Camas, Desolation, and Granite creeks and the upper North Fork John Day River. Spawners in the North Fork John Day River are primarily natural-origin fish; however, outside-DPS hatchery fish, primarily from Snake River stocks, are present in the North Fork population.

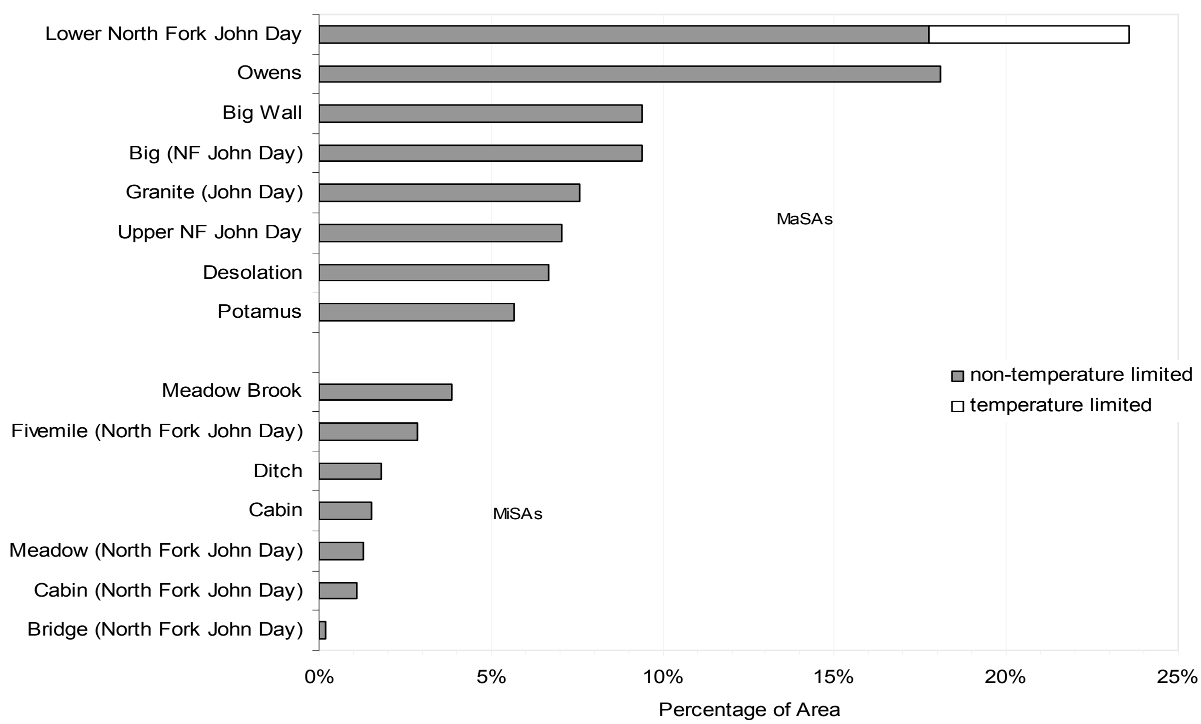

Figure 4. North Fork John Day River summer steelhead population distribution of intrinsic potential habitat across major (MaSAs) and minor spawning areas (MiSAs). White bars represent areas that could potentially have had historical temperature limitations.

Factors and Metrics

A.1.a. Number and spatial arrangement of spawning areas

The North Fork John Day River population has eight MaSAs and seven MiSAs which are distributed in a complex dendritic pattern. Based on the ODFW spawner distribution database all eight MaSAs and seven MiSAs are currently occupied and a total of 1,194 km are presently used for spawning (Figure 5). The North Fork population rates at **very low risk** for this metric because it has more than four MaSAs occupied in a dendritic configuration.

A.l.b. Spatial extent or range of population

The current spawner distribution mirrors the historical distribution represented by the intrinsic potential analyses. All MaSAs and MiSAs are currently occupied (Figure 5). The current spatial extent and range criteria rating for the North Fork population is **very low risk**. Index area spawning surveys are conducted in six spawning tributaries in the North Fork population.

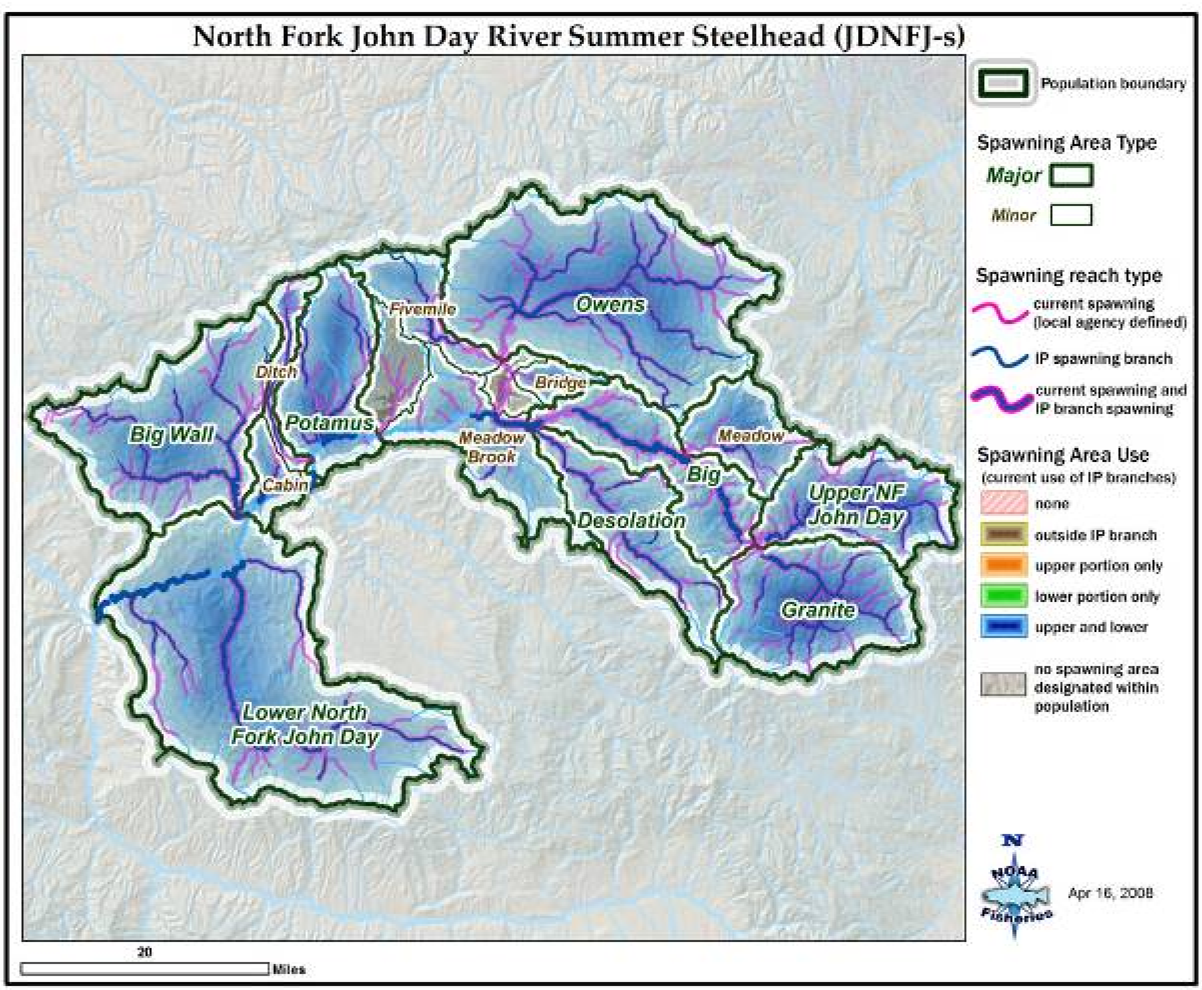

Figure 5. North Fork John Day River summer steelhead population current spawning distribution and spawning area occupancy designations.

A.1.c. Increase or decrease in gaps or continuities between spawning aggregates

There have been no significant increases in gaps between spawning areas. Connectivity between historic spawning areas has remained relatively unchanged. The North Fork population rates at **very low risk** for gaps.

B.1.a. Major life history strategies

There are limited data for evaluating specific life history patterns of North Fork John Day River steelhead, and therefore we use habitat information to infer changes in life history strategies. A significant proportion of the North Fork population resides in wilderness area with habitat conditions that are relatively unaltered. Habitat conditions throughout the population do theoretically provide the opportunity for expression of all historic life history strategies. The North Fork John Day River population is an A-run population with ocean migration occurring predominantly at age 2 and age 3, and adults returning after one or two years in the ocean. These life history patterns are consistent with what we observe for most A-run populations. We have no evidence of loss of major life history strategies, thus the rating is **very low risk** for this metric.

B.1.b. Phenotypic variation

Data were not available to evaluate if any phenotypic traits have been lost. We used habitat information to infer potential changes in phenotypic traits. Relatively unaltered habitat conditions across a significant proportion of the population results in the absence of significant phenotypic selective pressures, thus the population is at **very low risk** for loss of phenotypic traits.

B.1.c. Genetic variation

There are limited genetic data for John Day River steelhead populations, with only one sample from the North Fork population. The populations within the John Day MPG are not well differentiated from one another. There is no biological basis to explain why the samples did not show normal differentiation. There are no past events, such as severe population bottlenecks or hatchery outplanting that would explain these results. There are out-of-DPS strays in the John Day River basin but the degree of introgression is unknown, and the past genetic samples, which were collected in the 1980s, were taken at a time when stray proportions were likely lower than in recent years. We have assigned a rating of **low risk** for this metric. This rating is driven by the balance between apparent similarity within and between populations and the relative degree of differentiation. Samples were collected in 2005 that will better inform the risk assessment for genetic variation in the future.

B.2.a. Spawner composition

(1) *Out-of-DPS spawners:* Available data were inadequate to estimate the out-of-DPS hatchery fraction specifically for the North Fork population. The estimates derived were based on data from a composite of the four populations (South Fork, Middle Fork, Upper John Day, and North Fork) in the John Day River MPG that are above the Lower Mainstem population. These estimates were calculated from observations from spawning surveys and kelt collections seined from the mainstem. Since 1992, the estimated hatchery fraction ranged from 0.01-0.13. The mean hatchery fraction was 0.067. Based on coded wire tags (CWTs) recovered primarily from recreational fisheries, the majority of stray hatchery fish originate from Snake River hatcheries. Given that the hatchery fraction of out-of-DPS strays is estimated to be greater than 0.05 for two or more generations, the rating is **high risk** for this metric.

(2) *Out-of-MPG spawners from within the DPS:* There have been four fish with CWTs recovered in the John Day River from out-of-MPG within-DPS origin. Three originated from

the Umatilla Hatchery program and one from the Deschutes. It appears very few within-DPS hatchery fish stray into the John Day River, thus the rating is **low risk** for this metric.

(3) *Out-of-population spawners from within the MPG:* There are no steelhead hatchery programs operated within the John Day River basin, therefore this metric is rated **very low risk**.

(4) *Within-population hatchery spawners:* There are no steelhead hatchery programs operated within the John Day River basin, therefore this metric is rated as **very low risk**.

The overall rating for the spawner composition metric is **high risk** due to the high proportion of out-of-DPS strays that spawn naturally in this population**.**

B.3.a. Distribution of population across habitat types

The intrinsic potential distribution of the North Fork John Day River summer steelhead population encompassed six ecoregions, with the John Day Clarno Highlands and Mesic Forest zone comprising slightly over 60% of the distribution (Table 3). There are four ecoregions that comprise greater than 10% of the historic distribution. There has been little change in ecoregion distribution between intrinsic and current distribution with all six ecoregions currently occupied at nearly identical proportions as the intrinsic distribution (Figure 6). There have been no substantial reductions in any of the ecoregions. The rating for this metric is **very low risk**.

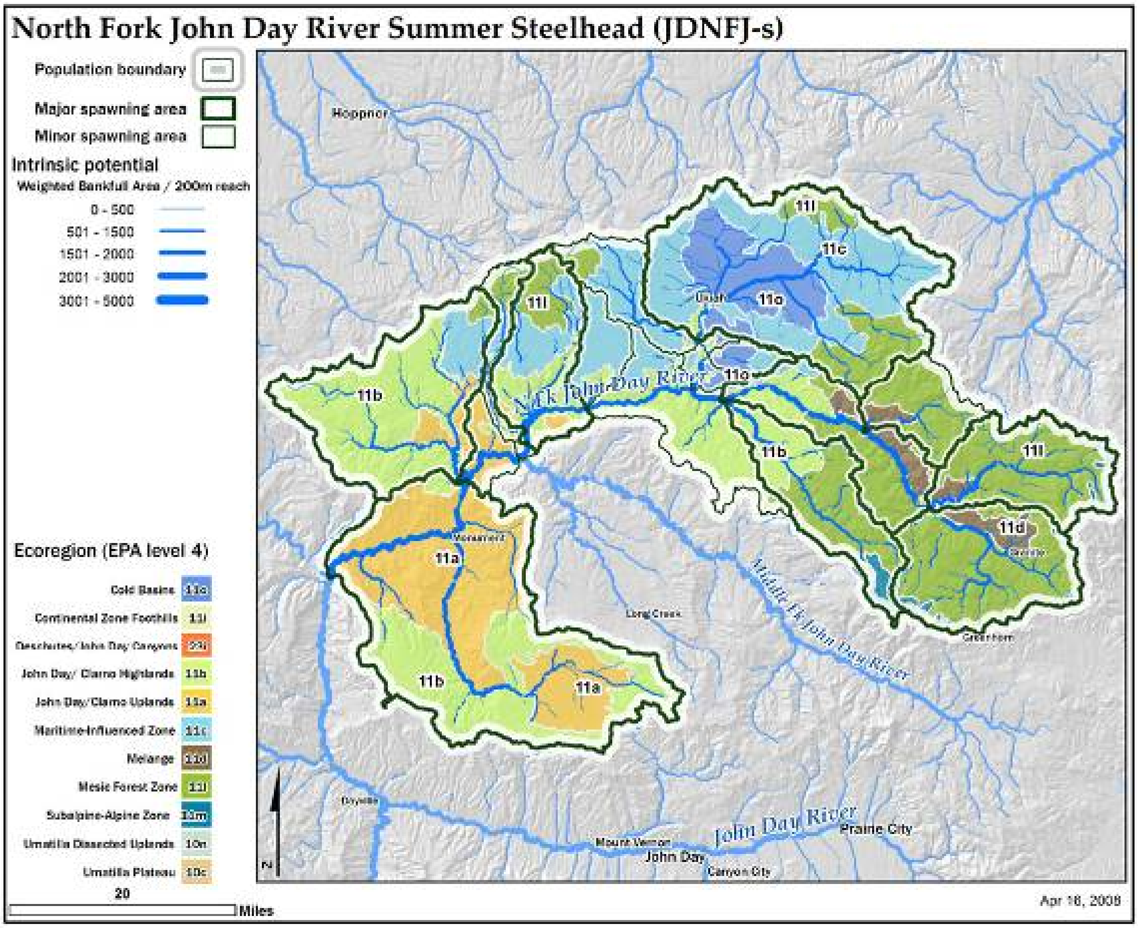

Figure 6. North Fork John Day River summer steelhead population spawning distribution across EPA level IV ecoregions.

Table 3. North Fork John Day River summer steelhead population proportion of current spawning areas across EPA level IV ecoregions.

Ecoregion	% of historical spawning area (non-temp. limited)	% of currently occupied spawning area (non-temp. limited)
Cold Basins	8.3	10.4
John Day Clarno Highlands	27.0	26.4
John Day Clarno Uplands	26.6	16.9
Maritime-Influenced Zone	10.4	11.9
Melange	2.4	3.3
Mesic Forest Zone	25.3	31.2

B.4.a. Selective change in natural processes or selective impacts

Hydropower system: This population crosses three dams on the lower mainstem Columbia River in its seaward and spawning migrations. The hydropower system and associated reservoirs appear to impose some selection on smolt and adult migration timing. All hydropower effects have persisted for multiple generations and are ongoing.

> *Adult migration timing:* These dams establish a thermal barrier in the reservoirs that delays and potentially induces some mortality of migrating adults. This barrier is diminished later in the migration season. Because the timing of the barrier varies from year to year and does not develop in some years, and the degree of differential survival is likely low and not well-understood, we rate the selection intensity as low. Heritability of this trait is high, thus the hydropower rating for this trait is **moderate risk**.

Harvest: Harvest has the potential to affect migration timing, maturation timing and size. However, recent harvest rates for A-run steelhead in the Columbia River mainstem are generally less than 10% annually. Although some harvest may be size-selective for larger fish, the selective mortality would affect slightly more than 2% of the total population. There may be a very slight advantage for earlier returning fish as a result of the timing of the Chinook salmon fishery, and while heritability of adult migration timing is high, the impacts are slight enough to be negligible. There is very limited tribal harvest of natural-origin fish within the John Day River subbasin; impacts from the recreational fishery are incidental to hatchery-origin fish harvest and are not selective. No phenotypic traits appear to be at risk as a result of this activity. The harvest rating is **low risk** for all traits.

Hatcheries: There are no steelhead hatchery programs operated within the population; therefore, the hatchery rating is **very low risk** for all traits.

Habitat: Little change in flow profile and temperature has occurred within the population boundaries. However, some change has occurred in the mainstem John Day River which would affect the North Fork population.

> *Adult migration timing:* Low flows in the late summer and early fall in the John Day River likely expose adults that enter the river early to above normal mortality rates. Adult migration timing is highly heritable, but a negligible proportion of the population is likely subject to these effects. Thus, the impact of habitat changes on this trait is **low.**
>
> *Juvenile migration timing:* Late spring and early summer temperatures are elevated relative to historical conditions. There has likely been some effect on juvenile migration timing as temperatures can reach stressful levels in the John Day River mainstem in late spring and early summer in some years. Selection intensity is considered negligible and the heritability of this trait is moderate to low. The rating for this trait is **low risk**.

Other: A population of Caspian terns in the estuary has been artificially enhanced by a combination of increased habitat (created by dredge spoils) and artificially increased food availability (large-scale releases of hatchery smolts). These terns appear to exert a size-selective predation pressure that primarily impacts the large steelhead smolts. The rate of predation is highest during tern nesting season in May. This pressure may affect smolt migration timing.

Juvenile migration timing: Steelhead smolts pass through the estuary from April to June. The relatively high predation (10%) on smolts in May could select for earlier and later out-migrants. However, heritability of this trait has not been assessed, so we assume a moderate to low heritability. Because this predation occurs at the peak of migration, the impact of this selective factor is **low risk**.

There is only one trait that has a moderate rating for one selective activity. Therefore, the overall selectivity rating for this population is **low risk.**

Spatial Structure and Diversity Summary

The combined integrated spatial structure/diversity rating is **Low Risk** for the North Fork John Day River population (Table 4). The rating for Goal A (allowing natural rates and level of spatially mediated processes) was **very low risk**. The current spawner distribution mimics the intrinsic distribution. The population is distributed broadly across the landscape in numerous MaSAs and MiSAs. Good continuity exists between spawning areas and current gaps between spawning areas are similar to historic gaps.

The rating for Goal B (maintaining natural levels of variation) was **low risk**. However, there remains considerable uncertainty about the ratings for genetic variation and out-of-DPS hatchery strays in the natural spawners. Additional genetic analyses and interpretation is needed to determine the degree of genetic variation and differentiation, as well as to examine evidence for degree of stray hatchery fish introgression. We rated the metric for out-of-DPS hatchery strays as very high. The data used for this rating are a composite from four John Day River populations. Additional population-specific spawner composition data are needed to improve the certainty of the out-of-DPS stray hatchery risk rating. If there is significant hatchery introgression that is affecting the genetic variation through time then the risk rating for "genetic variation" will increase and the overall risk rating for Goal B and spatial structure/diversity will also increase.

Table 4. North Fork John Day River summer steelhead population spatial structure and diversity risk rating.

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
A.1.a	VL (2)	VL (2)	Very Low Risk (Mean = 2)	Very Low Risk (Mean = 2)	**Low Risk**
A.1.b	VL (2)	VL (2)			
A.1.c	VL (2)	VL (2)			
B.1.a	VL (2)	VL (2)	Low Risk (1)	Low Risk (Mean = 0.75)	
B.1.b	VL (2)	VL (2)			
B.1.c	L (1)	L (1)			
B.2.a(1)	H (-1)	High Risk (-1)	High Risk (-1)		
B.2.a(2)	L (1)				
B.2.a(3)	VL (2)				
B.2.a(4)	VL (2)				
B.3.a	VL (2)	VL (2)	VL (2)		
B.4.a	L (1)	L (1)	L (1)		

Overall Viability Rating

The North Fork John Day River summer steelhead population currently meets ICTRT viability criteria and is rated **HIGHLY VIABLE** (Figure 7). Overall abundance and productivity is rated at **Very Low Risk.** The 10-year geometric mean abundance of natural-origin spawners is 1,740, which exceeds the minimum abundance threshold of 1,500. The 20-year geometric mean productivity (2.41 R/S; Table 6) is well above the 1.26 R/S required at the minimum abundance threshold. Overall spatial structure and diversity is rated at **Low Risk.** The ratings for genetic variation and out-of-DPS hatchery-origin spawner composition were the most influential on the overall spatial structure/diversity assessment. There is considerable uncertainty regarding the genetic effect of out-of-DPS strays, as well as the actual proportion of natural spawners that are hatchery strays. There are limited population-specific data to estimate the spawner composition in the North Fork population. Enhanced monitoring efforts should be undertaken to develop better estimates of the composition of North Fork John Day River spawners.

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	**HV**	**HV** **North Fork John Day River**	**V**	**M**
	Low (1-5%)	**V**	**V**	**V**	**M**
	Moderate (6 – 25%)	**M**	**M**	**M**	**HR**
	High (>25%)	**HR**	**HR**	**HR**	**HR**

Figure 7. North Fork John Day River summer steelhead population risk ratings integrated across the four viable salmonid population (VSP) metrics. ***Viability Key: HV – Highly Viable; V – Viable; M – Maintained; HR – High Risk; Shaded cells - does not meet viability criteria (darkest cells are at greatest risk).***

Data Summary – North Fork John Day River

Data type: Redd count expansion - Index area redd counts expanded to total population estimate by applying ratio of average redd densities (samples across all areas to samples from index reaches) from EMAP surveys. Assumed 2.1 fish per redd.
Smolt-to-Adult Return rate (SAR): Mid-Columbia composite series (see *Methods*).

Table 5. North Fork John Day River summer steelhead population abundance and productivity data used for curve fits and R/S analysis. Bold values were used in estimating the current productivity (Table 6).

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	SAR Adj. Factor	Adj. Rtns	Adj. R/S
1979	**757**	**1.00**	**757**	**1358**	**1.79**	**1.94**	**2633**	**3.48**
1980	2633	1.00	2633	3167	1.20	0.50	1599	0.61
1981	2390	1.00	2390	5041	2.11	0.68	3442	1.44
1982	2473	1.00	2473	4598	1.86	0.46	2101	0.85
1983	1153	1.00	1153	3383	2.94	0.52	1772	1.54
1984	**704**	**1.00**	**704**	**1521**	**2.16**	**0.65**	**984**	**1.40**
1985	5264	1.00	5264	522	0.10	0.46	240	0.05
1986	4895	1.00	4895	563	0.11	0.94	531	0.11
1987	4754	1.00	4754	1240	0.26	2.18	2699	0.57
1988	2603	1.00	2603	1460	0.56	0.99	1446	0.56
1989	**687**	**1.00**	**687**	**925**	**1.35**	**0.96**	**889**	**1.29**
1990	**369**	**1.00**	**369**	**955**	**2.59**	**2.83**	**2703**	**7.33**
1991	**415**	**1.00**	**415**	**1274**	**3.07**	**2.33**	**2973**	**7.16**
1992	2185	0.99	2154	1425	0.65	1.88	2679	1.23
1993	**867**	**0.99**	**855**	**1036**	**1.19**	**1.18**	**1224**	**1.41**
1994	**1078**	**0.97**	**1050**	**1385**	**1.29**	**1.07**	**1483**	**1.38**
1995	**683**	**0.94**	**640**	**1922**	**2.82**	**1.23**	**2355**	**3.45**
1996	2122	0.93	1981	2309	1.09	1.03	2383	1.12
1997	**1013**	**0.95**	**961**	**2823**	**2.79**	**0.76**	**2155**	**2.13**
1998	**1021**	**0.96**	**978**	**2930**	**2.87**	**0.49**	**1437**	**1.41**
1999	1660	0.98	1626					
2000	2350	0.91	2143					
2001	2448	0.91	2230					
2002	3828	0.90	3444					
2003	3093	0.89	2758					
2004	1527	0.87	1328					
2005	1602	0.87	1393					

Table 6. North Fork John Day River summer steelhead population geometric mean abundance and productivity estimates (values used for current productivity and abundance are shown in boxes).

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
delimited	median	75% threshold	median	75% threshold	1987-1998	1979-1998	geomean
Point Est.	2.07	2.07	2.41	2.41	1.01	1.09	1740
Std. Err.	0.12	0.12	0.22	0.22	0.02	0.15	0.13
count	10	10	10	10	12	20	10

Table 7. North Fork John Day River summer steelhead population stock-recruitment curve fit parameter estimates. Biologically unrealistic or highly uncertain values are highlighted in grey.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	1.17	0.27	n/a	n/a	0.71	0.55	62.0	1.15	0.30	n/a	n/a	1.09	0.46	67.8
Const. Rec	1653	228	n/a	n/a	n/a	n/a	42.1	1622	230	n/a	n/a	n/a	n/a	43.2
Bev-Holt	12.92	19.48	1871	441	0.18	0.72	44.4	50.00	68.78	1665	252	0.35	0.39	46.4
Hock-Stk	2.03	0.46	951	266	0.21	0.64	43.5	4.68	0.10	347	1	0.34	0.39	46.0
Ricker	3.76	0.60	0.00061	0.00007	0.13	0.59	31.5	4.32	0.86	0.00070	0.00008	0.29	0.11	40.1

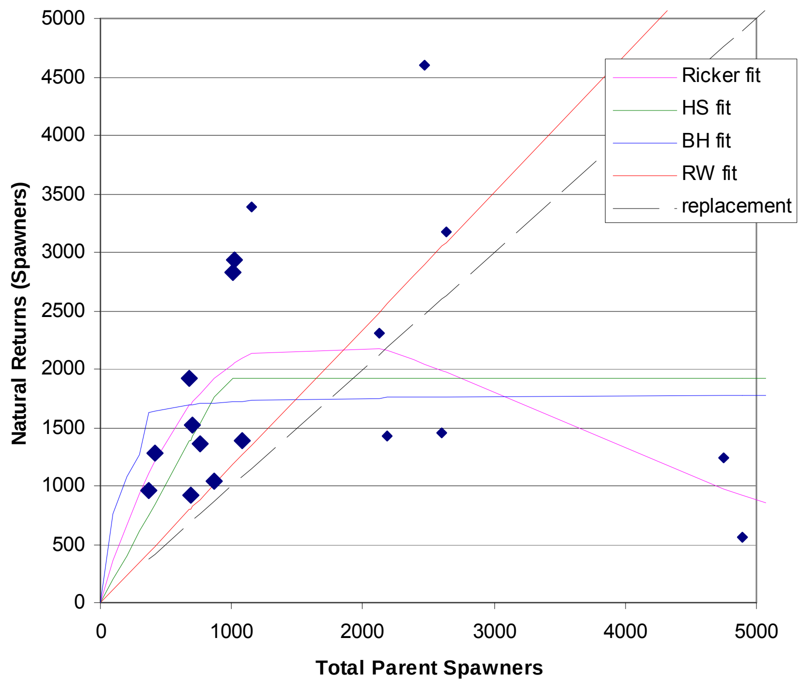

Figure 8. North Fork John Day River summer steelhead population stock recruitment curves. Bold points were used in estimating the current productivity. Data were not adjusted for marine survival.

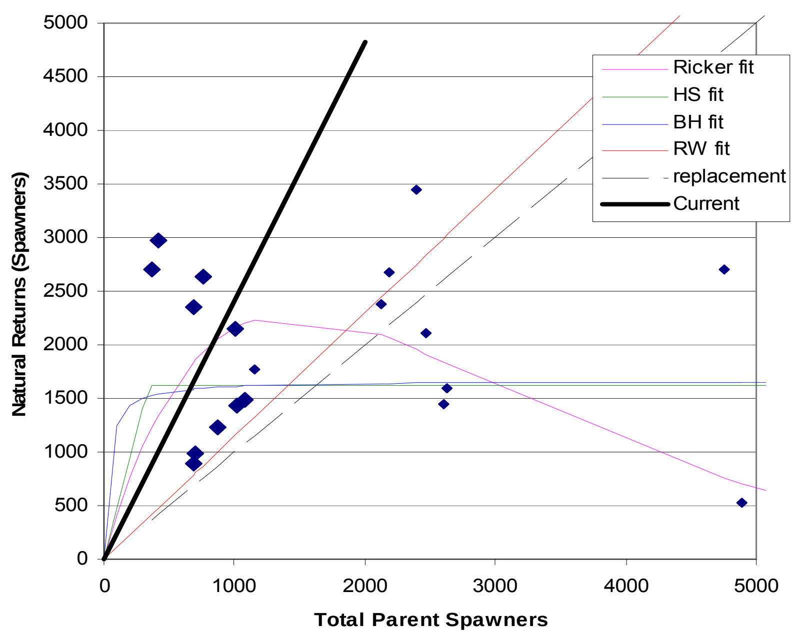

Figure 9. North Fork John Day River summer steelhead population stock recruitment curves. Bold points were used in estimating the current productivity. Data were adjusted for marine survival. Function labeled "Current" is a Hockey Stick function derived by fixing the slope of the ascending limb at the geometric mean productivity at low to moderate abundance (Table 2) and fitting a capacity estimate to the data series.

Middle Fork John Day River Summer Steelhead Population

The Middle Fork John Day River summer steelhead population (Figure 1) is one of five populations in the John Day River MPG within the Mid-Columbia steelhead DPS. All five populations in this MPG are summer run.

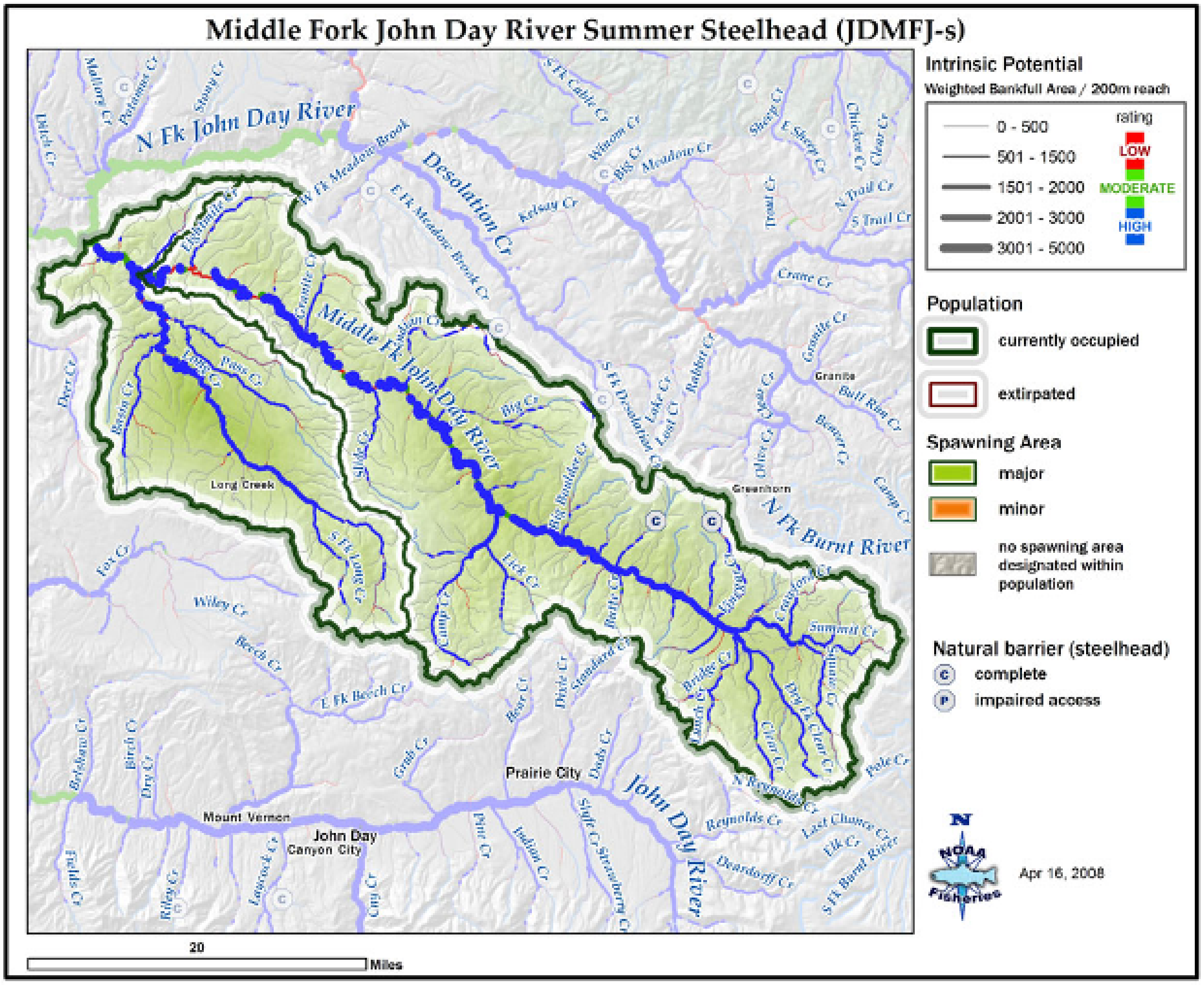

Figure 1. Middle Fork John Day River summer steelhead population boundary and major (MaSA) and minor (MiSA) spawning areas.

The Interior Columbia Technical Recovery Team (ICTRT) classified the Middle Fork population as "intermediate" in size and complexity (Table 1) based on historical habitat potential (ICTRT 2007). A steelhead population classified as intermediate has a mean minimum abundance threshold of 1,000 natural-origin spawners with a sufficient intrinsic productivity (≥ 1.35 recruits per spawner at the minimum abundance threshold) to achieve a 5% or less risk ("low risk") of extinction over a 100-year timeframe. In order for the Middle Fork population to achieve a 1% or less risk ("very low risk") of extinction over 100 years, productivity would need to be at or greater than 1.64 recruits per spawner at the minimum abundance threshold.

Table 1. Middle Fork John Day River summer steelhead population basin statistics and intrinsic potential analysis summary.

Drainage area (km^2)	2,052
Stream lengths km (total) [a]	704
Stream lengths km (below natural barriers) [a]	690
Branched stream area weighted by intrinsic potential (km^2)	2.592
Branched stream area km^2 (weighted and temp. limited) [b]	2.592
Total stream area weighted by intrinsic potential (km^2)	2.963
Total stream area weighted by intrinsic potential (km^2) temp limited [b]	2.963
Size / Complexity category	Intermediate / "B" (dendritic structure)
Number of major spawning areas (MaSAs)	2
Number of minor spawning areas (MiSAs)	0

a. All stream segments ≥ 3.8m bankfull width were included.
b. Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was > 22°C.

Current Abundance and Productivity

Current (1966-2005) total spawner abundance (number of adult spawners in natural production areas) has ranged from 337 in 2005 to 3,538 in 1979 (Figure 2). Abundance estimates are based on expanded redd counts. Index surveys of steelhead redds from the Oregon Department of Fish and Wildlife (ODFW), John Day District, were used for the historical dataset. We used index surveys that showed relatively consistent visitation through years (Beaver, Camp, Deep, and Lick creeks). The current spawning distribution was used for the miles of available habitat within each population's range. The index redd densities were then multiplied by a correction factor based on the ratio of index densities to EMAP (Environmental Monitoring and Assessment Program) densities for 2004-2005; the ratio was consistent for these years (0.36, 0.35). The estimated redd density for the entire spawning area (0.355 x index density) was multiplied by the total miles of currently utilized spawning habitat. Total annual redds were converted to fish by multiplying the total annual number of redds by the number of fish per redd. Fish/redd ratios were developed from four years of data of complete and repeated surveys (censuses) on Deer Creek in the Grande Ronde River basin of redds above a weir where we have a complete count. The average fish per redd estimate from Deer Creek was 2.1.

The hatchery-origin/natural-origin composition of spawners were computed separately for the Lower Mainstem John Day River population, and combined for all other populations in the MPG. Data used to represent the Middle Fork population included observations of positively identified adipose fin-clipped spawners (1992-present) from spawning survey observations in the four populations above the Lower Mainstem population, and observations from rotary screw trap and seine collections of adults (2000-present). There is evidence from the Deschutes River that hatchery straying was substantially lower before 1992, and because the source of strays in the John Day River subbasin is the same as the Deschutes River, we are assuming a similar trend. No other data are available for earlier years so the hatchery fraction was set at zero. Age composition was derived from scale readings of creel sampled unmarked fish collected during the 1980s from locations above Tumwater Falls.

Recent year natural spawners include returns originating from naturally spawning parents, and a small fraction of strays from the Snake and Columbia River hatchery programs. Since documentation of hatchery strays began in 1992, spawners originating from naturally spawning parents have comprised an average of 93%, ranging from 87%-99%.

Abundance in recent years has been moderately variable. The 10-year (1996-2005) geometric mean abundance of natural-origin spawners was 756 (Table 2). During the period 1969-1998, recruits per spawner (R/S, in terms of spawner to spawner) for steelhead in the Middle Fork John Day River ranged from 0.17 in 1992 to 3.84 in 1997. The annual R/S estimates were adjusted to reflect the average smolt-to-adult return rate (SAR). The 20-year (1979-1998) geometric mean productivity was 2.45 R/S, adjusted for SAR and delimited at 75% (563 spawners) of the abundance threshold (Table 2).

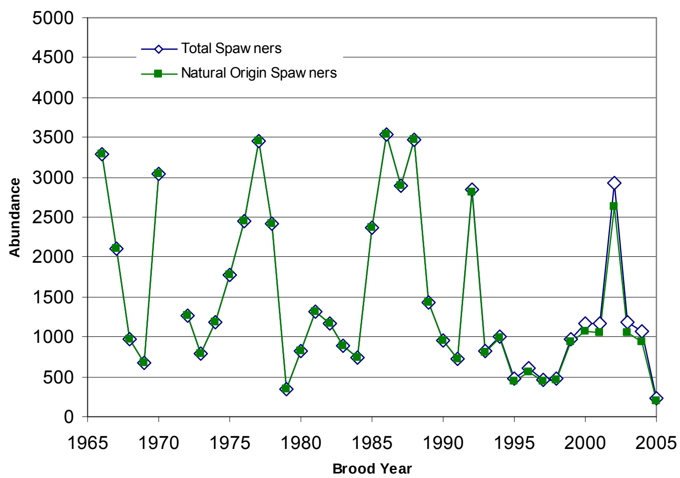

Figure 2. Middle Fork John Day River summer steelhead spawner abundance estimates (1966-2005).

Table 2. Middle Fork John Day River summer steelhead population abundance and productivity.

Abundance/Productivity Statistics	Estimate	(Range)	
Abundance: natural-origin spawners (10-year geometric mean, range)	756	(195-3538)	
Proportion: natural-origin spawners (10-year geometric mean, range)	0.93	(0.87-1.00)	
	Estimate	**(90% CI)[b]**	**SE**
Intrinsic productivity (20-year R/S, SAR adjusted & delimited) [a]	2.45	(1.81-3.32)	0.16
Productivity (20-year Beverton-Holt fit, SAR adjusted)	n/a		n/a
Trend Statistics (1980-2005)	**Estimate**	**(95% CI)**	**P>1.0**
ln(natural-origin spawner abundance)	0.97	(0.93-1.06)	
Population growth rate (λ): Hatchery effectiveness = **1.0**	1.00	(0.79-1.26)	0.50
Population growth rate (λ): Hatchery effectiveness = **0.0**	1.01	(0.80-1.27)	0.53

a. Delimited productivity excludes any recruit/spawner pair where the spawner number >75% of the population's minimum abundance threshold. This approach attempts to remove density dependence effects that may influence the productivity estimate.
b. Lower end of the 90% CI on productivity is used in evaluating the impact of parameter uncertainty on risk.

The Middle Fork John Day River population is at **Moderate Risk** based on current abundance and productivity. The point estimate is between the 5% and 25% risk curves (Figure 3).

The abundance of natural-origin spawners in the Middle Fork population has fluctuated substantially over the recent 20-year period. The average trend in natural-origin spawner abundance has been 0.97; the population growth rate metric (calculated with relative hatchery effectiveness set to 1.0) was 1.00 for the same period (Table 2). The pattern in returns from 1991 through 2005 is similar

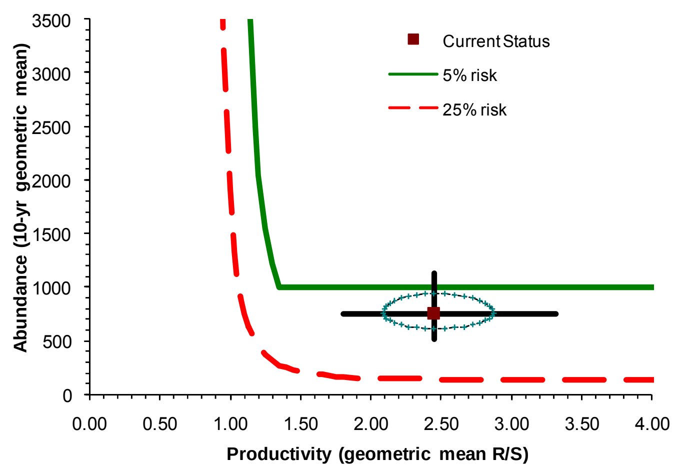

Figure 3. Middle Fork John Day River summer steelhead population current abundance/productivity (A/P) compared to the DPS viability curve. Ellipse = 1 SE about the point estimate. Error bars = 90% CI for A/P.

to the pattern for several other Mid-Columbia DPS steelhead populations, including the Deschutes River Eastside—an increasing trend beginning in 1996 followed by an abrupt decrease to levels observed in the early 1990s. The estimated proportion of spawners of hatchery-origin has averaged approximately 7% for the period. The relative effectiveness of hatchery-origin spawners in contributing to natural production in this population is not known. Setting the value to 0.0, the opposite extreme from 1.0, results in an estimated annual growth rate of 1.01 (0.53 probability of exceeding 1.0).

Spatial Structure and Diversity

The ICTRT has identified two major spawning areas (MaSAs) and no minor spawning areas (MiSAs) within the Middle Fork John Day River summer steelhead population (Figure 4). Spawning is distributed broadly throughout the population boundaries including mainstem areas in the lower and upper Middle Fork John Day River and Long Creek. There are numerous tributary spawning streams distributed from the lower end of the population boundary to the uppermost reaches. Spawners within the Middle Fork John Day River are primarily natural-origin fish; however, outside-DPS hatchery fish, primarily from Snake River stocks, are present in the Middle Fork population.

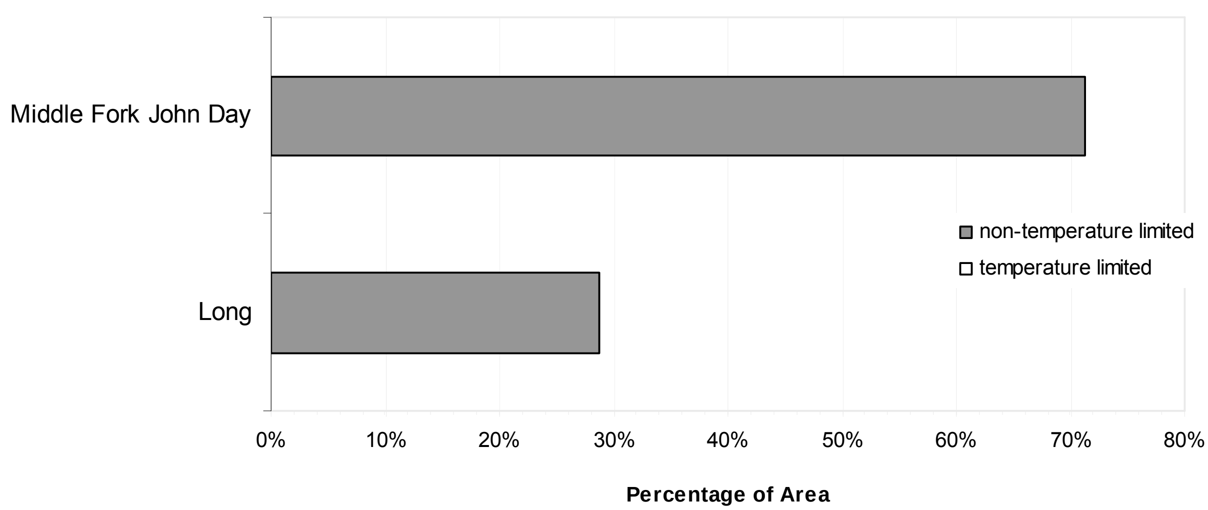

Figure 4. Middle Fork John Day River summer steelhead population distribution of intrinsic potential habitat across major (MaSAs) and minor spawning areas (MiSAs).

Factors and Metrics

A.1.a. Number and spatial arrangement of spawning areas

The Middle Fork population has two MaSAs (no MiSAs) which are distributed in a dendritic pattern. Based on the ODFW spawner distribution database all of the major and minor spawning areas are occupied and a total of 546 km are currently used for spawning (Figure 5). The Middle Fork population rates at **low risk** because it has two MaSAs occupied in a non-linear configuration.

A.l.b. Spatial extent or range of population

The current spawner distribution mirrors the historical distribution as represented by the intrinsic potential analyses. All MaSAs are currently occupied (Figure 5). The current spatial extent and range criteria are rated as **very low risk** for the Middle Fork population. There are four index spawning survey reaches in the Middle Fork population. Recent spawning ground surveys results will be analyzed for future viability assessments.

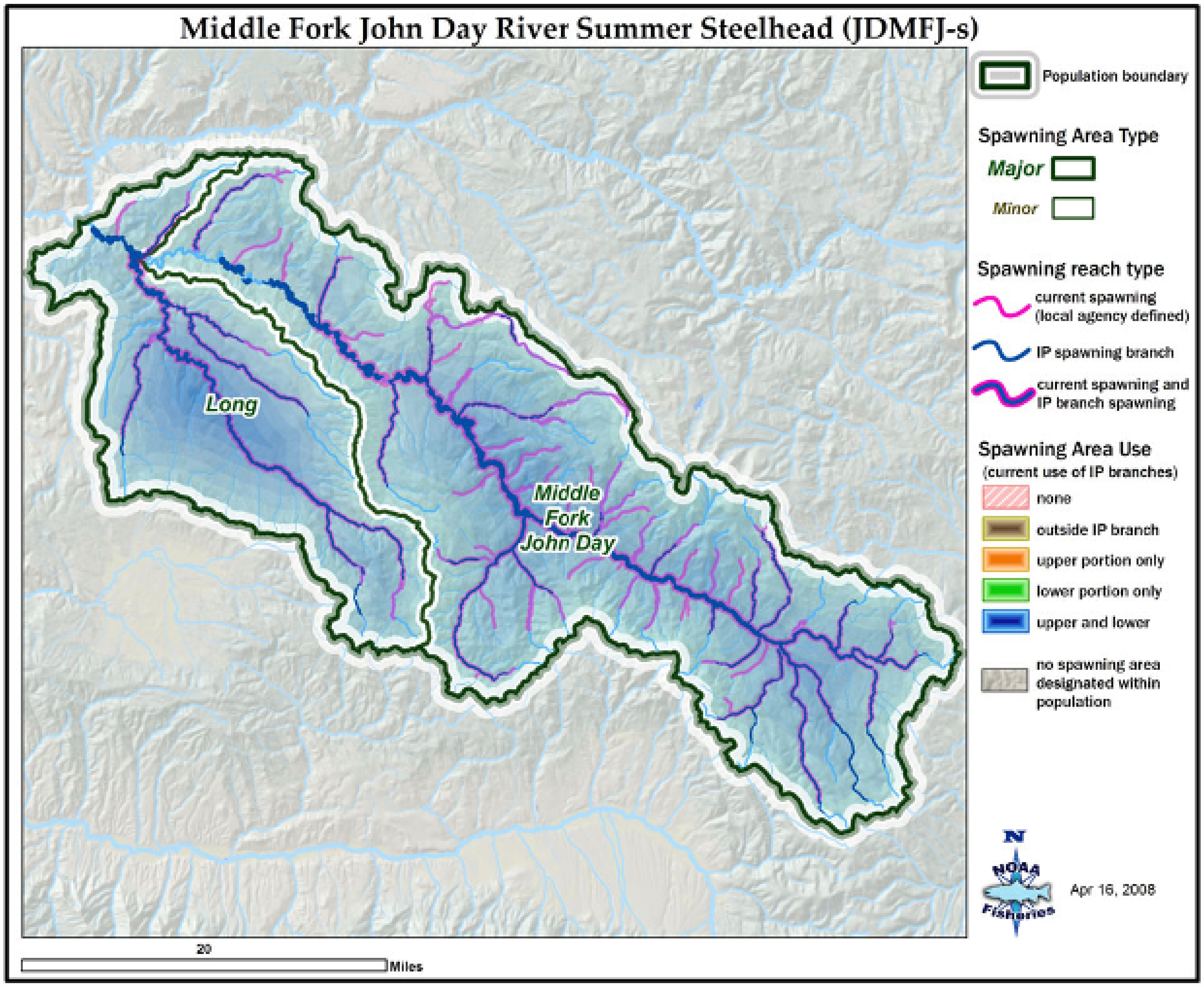

Figure 5. Middle Fork John Day River summer steelhead population current spawning distribution and spawning area occupancy designations.

A.1.c. Increase or decrease in gaps or continuities between spawning aggregates

There has been little or no increase in gaps or loss in continuity between spawning areas within the Middle Fork population. Thus, the Middle Fork population rates as **low risk** for gaps and continuity.

B.1.a. Major life history strategies

There are no direct observations to assess loss in major life history strategies for the Middle Fork John Day River steelhead population; therefore we infer loss of life history diversity based on habitat changes. Although habitat conditions, particularly temperature, have been altered through time, there remains the theoretical opportunity to express diverse life history strategies similar to intrinsic potential. Juvenile steelhead exhibit diverse patterns of movement throughout their life cycle and rear in a variety of habitat types. Middle Fork John Day River steelhead are A-Run steelhead and appear to exhibit typical A-Run age at out-migration and ocean residence duration. The rating for loss of life history strategies is **low risk** for this metric.

B.1.b. Phenotypic variation

Current habitat conditions are not such that selective pressures would have significantly changed or eliminated any phenotypic traits. Mainstem Columbia River migrating corridor temperature changes and temperature changes in the John Day River have likely altered juvenile migration timing, thus reducing trait variability. We hypothesize that conditions have not altered the mean or variability of traits to the point that the risk level rises to moderate. Current habitat conditions and absence of other significant phenotypic selective pressure indicate that the Middle Fork population is at **low risk** for this metric.

B.1.c. Genetic variation

There are limited genetics data for John Day River steelhead populations and only one sample from the Middle Fork population. The samples from populations within the John Day River MPG are not well differentiated from one another. However, these samples were taken from a relatively small geographic area over a short time frame. There is no biological basis for the low level of differentiation. Samples were collected in the mid-1980s before any significant potential effects of hatchery strays. There have been no bottlenecks or other demographic factors that would have resulted in genetic variation impairment. There are out-of-DPS strays in the Middle Fork population; however the degree of introgression is unknown. We have assigned a rating of **low risk** for this metric. This rating is driven by balance between apparent similarity within and between populations and the relative degree of differentiation within and between the John Day River populations. Samples from multiple locations were collected in 2005 and will be analyzed to better inform the risk rating for this metric in the future.

B.2.a. Spawner composition

(1) *Out-of-DPS spawners*: Inadequate data exist to estimate the out-of-DPS hatchery fraction specifically for the Middle Fork population. Estimates we used in this assessment were based on data from a composite of the four populations (South Fork, Middle Fork, Upper John Day, and North Fork) in the John Day River MPG that are above the Lower Mainstem population. These estimates are based on observations from spawning surveys and kelt collections seined from the mainstem. Since 1992, the estimated hatchery fraction ranged from 0.01-0.13. The mean hatchery fraction was 0.067. Based on recovery of hatchery fish with coded wire tags (CWTs), primarily from angler caught fish, the majority of stray hatchery fish originate from Snake River

hatcheries. Given that the hatchery fraction of out-of-DPS strays is estimated to be greater than 0.05 for two or more generations, the rating is **high risk** for this metric.

(2) *Out-of-MPG spawners from within the DPS*: There have been four steelhead with CWTs recovered in the John Day River MPG from out-of-MPG within-DPS origin. Three originated from the Umatilla Hatchery program and one from the Deschutes. It appears very few within-DPS hatchery fish stray into the John Day River, thus the rating is **low risk** for this metric.

(3) *Out-of-population spawners from within the MPG:* There are no steelhead hatchery programs operated within the John Day River basin, therefore this metric is rated as **very low risk**.

(4) *Within-population hatchery spawners:* There are no steelhead hatchery programs operated within the John Day River basin, therefore this metric is rated as **very low risk**.

The overall rating for the spawner composition metric is **high risk**, due to the high proportion of out-of-DPS strays that spawn naturally in this population**.**

B.3.a. Distribution of population across habitat types

The intrinsic potential distribution of the Middle Fork population encompassed four ecoregions, with the John Day Clarno Highlands, John Day Clarno Uplands, and Melange being the dominant ecoregions (Figure 6). There has been little change in ecoregion distribution between intrinsic and current. All MaSAs in the intrinsic distribution are currently occupied in a similar distribution pattern (Table 3). The rating is **low risk** for this metric.

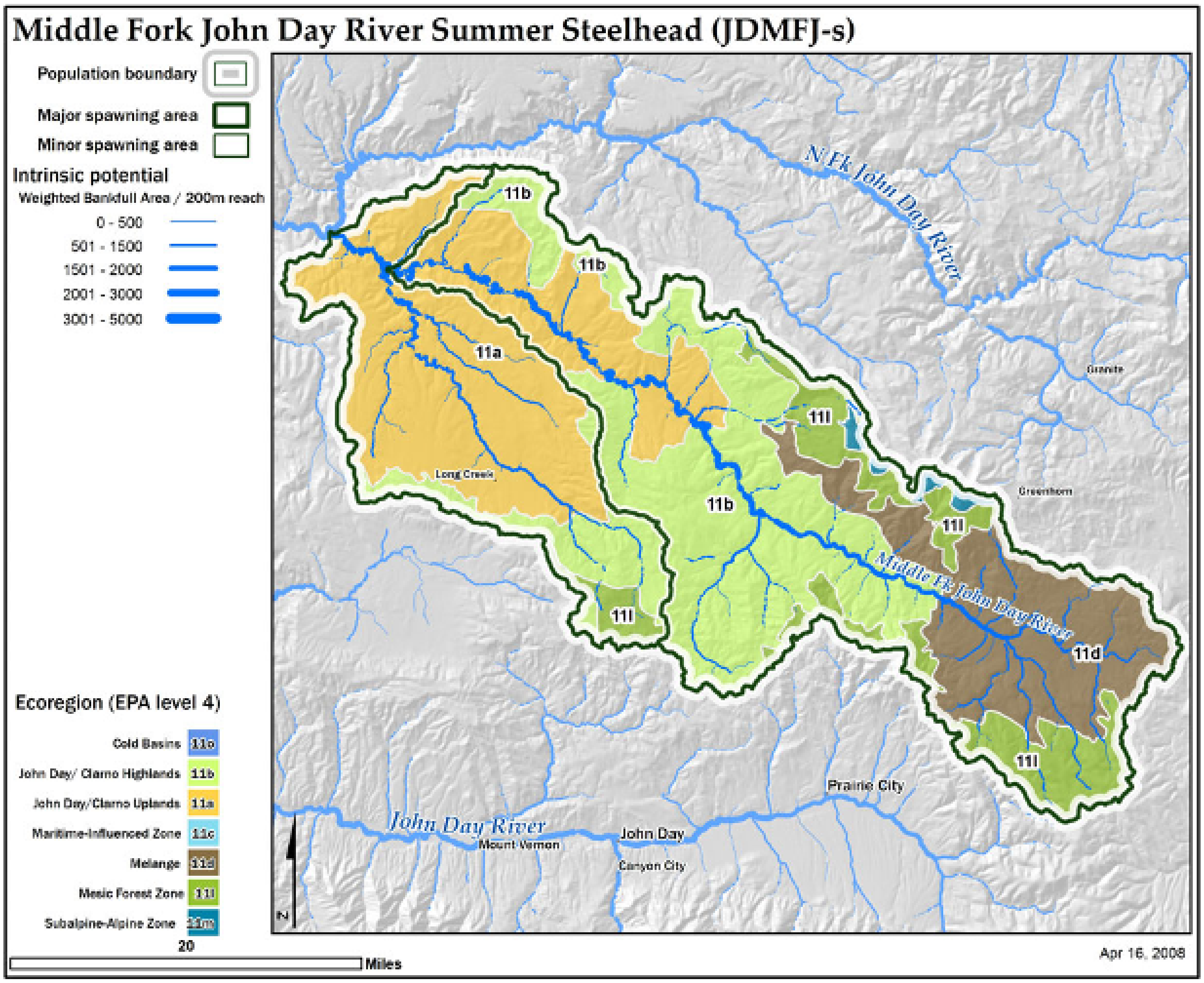

Figure 6. Middle Fork John Day River summer steelhead population spawning distribution across EPA level IV ecoregions.

Table 3. Middle Fork John Day River summer steelhead population proportion of current spawning areas across EPA level IV ecoregions.

Ecoregion	% of historical spawning area (non-temp. limited)	% of currently occupied spawning area (non-temp. limited)
John Day Clarno Highlands	30.9	37.7
John Day Clarno Uplands	46.2	38.2
Melange	19.6	22.2
Mesic Forest Zone	3.3	2.0

B.4.a. Selective change in natural processes or selective impacts

Hydropower system: This population crosses three dams on the lower mainstem Columbia River in its seaward and spawning migrations. The hydropower system and associated reservoirs appear to impose some selection on smolt and adult migration timing. All hydropower effects have persisted for multiple generations and are ongoing.

> *Adult migration timing:* These dams establish a thermal barrier in the reservoirs that delays and potentially induces some mortality of migrating adults. This barrier is diminished later in the migration season. Because the timing of the barrier varies from year to year and does not develop in some years, and the degree of differential survival is likely low and not well-understood, we rate the selection intensity as low. Heritability of this trait is high, thus the hydropower rating for this trait is **moderate risk**.

Harvest: Harvest has the potential to affect migration timing, maturation timing and size. However, recent harvest rates for A-run steelhead in the Columbia River mainstem are generally less than 10% annually. Although some harvest may be size-selective for larger fish, the selective mortality would affect slightly more than 2% of the total population. There may be a very slight advantage for earlier returning fish as a result of the timing of the Chinook salmon fishery, and while heritability of adult migration timing is high, the impacts are slight enough to be negligible. There is very limited tribal harvest of natural-origin fish within the John Day River subbasin; impacts from the recreational fishery are incidental to hatchery-origin fish harvest and are not selective. No phenotypic traits appear to be at risk as a result of this activity. The harvest rating is **low risk** for all traits.

Hatcheries: There are no steelhead hatchery programs operated within the population; therefore, the hatchery rating is **very low risk** for all traits.

Habitat: Altered flow profiles and increased temperatures have been in place for many generations and are ongoing; there is likely some selection on juvenile and adult migration timing.

> *Adult migration timing:* Low flows in the late summer and early fall in the John Day River likely expose adults that enter the river early to above normal mortality rates. Adult migration timing is highly heritable, but a negligible proportion of the population is likely subject to these effects. Thus, the impact of habitat changes on this trait is **low risk.**

> *Juvenile migration timing:* Late spring and early summer temperatures are elevated relative to historical conditions. There has likely been some effect on juvenile migration timing as temperatures can reach stressful levels in the John Day River mainstem in late spring and early summer in some years. Selection intensity is considered negligible and the heritability of this trait is moderate to low. The rating for this trait is **low risk**.

Other: A population of Caspian terns in the estuary has been artificially enhanced by a combination of increased habitat (created by dredge spoils) and artificially increased food availability (large-scale releases of hatchery smolts). These terns appear to exert a size-selective

predation pressure that primarily impacts the large steelhead smolts. The rate of predation is highest during tern nesting season in May. This pressure may affect smolt migration timing.

> *Juvenile migration timing:* Steelhead smolts pass through the estuary from April to June. The relatively high predation (10%) on smolts in May could select for earlier and later out-migrants. However, heritability of this trait has not been assessed, so we assume a moderate to low heritability. Because this predation occurs at the peak of migration, the impact of this selective factor is **low risk**.

There is only one trait that has a moderate rating for one selective activity. Therefore, the overall selectivity rating for this population is **low risk.**

Spatial Structure and Diversity Summary

The integrated spatial structure/diversity rating is **Moderate Risk** for the Middle Fork John Day River summer steelhead population (Table 4). The rating for Goal A (allowing natural rates and levels of spatially mediated processes) was **low risk**. The current spawner distribution of the Middle Fork population mimics the intrinsic distribution. The population is distributed broadly across the landscape, in both MaSAs with adequate gaps and good continuity between spawning areas.

The rating for Goal B (maintaining natural levels of variation) was **moderate risk**. Additional genetics analyses are needed to better assess genetic variation and hatchery introgression. This population was rated high risk for proportion of out-of-DPS hatchery strays based on a limited time series of composite John Day River population data. Better population-specific spawner composition data are needed to better understand the out-of-DPS hatchery stray influence. If there is significant hatchery introgression that affects genetic variation through time, then the risk rating may increase.

Table 4. Middle Fork John Day River summer steelhead population spatial structure and diversity risk rating.

<table>
<tr><th rowspan="2">Metric</th><th colspan="5">Risk Assessment Scores</th></tr>
<tr><th>Metric</th><th>Factor</th><th>Mechanism</th><th>Goal</th><th>Population</th></tr>
<tr><td>A.1.a</td><td>L (1)</td><td>L (1)</td><td rowspan="3">Low Risk
(Mean = 1.3)</td><td rowspan="3">Low Risk
(Mean = 1.3)</td><td rowspan="12">Moderate Risk</td></tr>
<tr><td>A.1.b</td><td>VL (2)</td><td>VL (2)</td></tr>
<tr><td>A.1.c</td><td>L (1)</td><td>L (1)</td></tr>
<tr><td>B.1.a</td><td>L (1)</td><td>L (1)</td><td rowspan="3">Low Risk (1)</td><td rowspan="9">Moderate Risk
(Mean = 0.5)</td></tr>
<tr><td>B.1.b</td><td>L (1)</td><td>L (1)</td></tr>
<tr><td>B.1.c</td><td>L (1)</td><td>L (1)</td></tr>
<tr><td>B.2.a(1)</td><td>H (-1)</td><td rowspan="4">High Risk
(-1)</td><td rowspan="4">High Risk (-1)</td></tr>
<tr><td>B.2.a(2)</td><td>L (1)</td></tr>
<tr><td>B.2.a(3)</td><td>VL (2)</td></tr>
<tr><td>B.2.a(4)</td><td>VL (2)</td></tr>
<tr><td>B.3.a</td><td>L (1)</td><td>L (1)</td><td>L (1)</td></tr>
<tr><td>B.4.a</td><td>L (1)</td><td>L (1)</td><td>L (1)</td></tr>
</table>

Overall Viability Rating

The Middle Fork John Day River summer steelhead population does not currently meet the ICTRT criteria for viable status. However, the population does meet the criteria to be rated as **MAINTAINED** (Figure 7). Overall abundance and productivity is rated at **Moderate Risk.** The 10-year geometric mean abundance of natural-origin spawners is 756, which is 76% of the minimum abundance threshold of 1,000. The 20-year geometric mean productivity (2.45 R/S; Table 6) exceeds the minimum required productivity of 1.35 R/S at the abundance threshold. Overall spatial structure and diversity is rated at **Low Risk** and the lower end of the adjusted standard error met the low risk criteria. Increased annual abundance would allow this population to achieve an abundance/productivity risk rating of low and raise the overall viability rating to viable.

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	**HV**	**HV**	**V**	**M**
	Low (1-5%)	**V**	**V**	**V**	**M**
	Moderate (6 – 25%)	**M**	**M**	**M** **Middle Fork John Day River**	**HR**
	High (>25%)	**HR**	**HR**	**HR**	**HR**

Figure 7. Middle Fork John Day River summer steelhead population risk ratings integrated across the four viable salmonid population (VSP) metrics. ***Viability Key: HV – Highly Viable; V – Viable; M – Maintained; HR – High Risk; Shaded cells - does not meet viability criteria (darkest cells are at greatest risk).***

Data Summary – Middle Fork John Day River

Data type: Redd count expansion - Index area redd counts expanded to total population estimate by applying ratio of average redd densities (samples across all areas to samples from index reaches) from EMAP surveys. Assumed 2.1 fish per redd.
Smolt-to-Adult Return rate (SAR): Mid-Columbia composite series (see *Methods*).

Table 5. Middle Fork John Day River summer steelhead population abundance and productivity data used for curve fits and R/S analysis. Bold values were used in estimating the current productivity (Table 6).

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	SAR Adj. Factor	Adj. Rtns	Adj. R/S
1979	**337**	**1.00**	**337**	**971**	**2.88**	**1.94**	**1882**	**5.58**
1980	815	1.00	815	1749	2.15	0.50	883	1.08
1981	1318	1.00	1318	2950	2.24	0.68	2015	1.53
1982	1160	1.00	1160	3238	2.79	0.46	1480	1.28
1983	884	1.00	884	3008	3.40	0.52	1576	1.78
1984	**739**	**1.00**	**739**	**2310**	**3.13**	**0.65**	**1494**	**2.02**
1985	2373	1.00	2373	1192	0.50	0.46	547	0.23
1986	3538	1.00	3538	1028	0.29	0.94	969	0.27
1987	2899	1.00	2899	1665	0.57	2.18	3625	1.25
1988	3471	1.00	3471	1726	0.50	0.99	1710	0.49
1989	1433	1.00	1433	849	0.59	0.96	816	0.57
1990	961	1.00	961	701	0.73	2.83	1984	2.07
1991	**716**	**1.00**	**716**	**500**	**0.70**	**2.33**	**1166**	**1.63**
1992	2851	0.99	2810	497	0.17	1.88	935	0.33
1993	816	0.99	805	497	0.61	1.18	587	0.72
1994	1008	0.97	981	737	0.73	1.07	789	0.78
1995	**480**	**0.94**	**450**	**1016**	**2.12**	**1.23**	**1245**	**2.59**
1996	**604**	**0.93**	**564**	**1215**	**2.01**	**1.03**	**1254**	**2.08**
1997	**460**	**0.95**	**436**	**1769**	**3.84**	**0.76**	**1350**	**2.93**
1998	**477**	**0.96**	**457**	**1762**	**3.69**	**0.49**	**864**	**1.81**
1999	965	0.98	945					
2000	1169	0.91	1066					
2001	1164	0.91	1061					
2002	2933	0.90	2639					
2003	1187	0.89	1058					
2004	1075	0.87	934					
2005	224	0.87	195					

Table 6. Middle Fork John Day River summer steelhead population geometric mean abundance and productivity estimates (values used for current productivity and abundance are shown in boxes).

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
delimited	median	75% threshold	median	75% threshold	1987-1998	1979-1998	geomean
Point Est.	2.10	2.34	1.93	2.45	0.97	1.02	756
Std. Err.	0.21	0.22	0.18	0.16	0.16	0.16	0.22
count	10	7	10	7	12	20	10

Table 7. Middle Fork John Day River summer steelhead population stock-recruitment curve fit parameter estimates. Biologically unrealistic or highly uncertain values are highlighted in grey.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	1.17	0.24	n/a	n/a	0.43	0.70	58.2	1.15	0.21	n/a	n/a	0.62	0.27	53.5
Const. Rec	1247	162	n/a	n/a	n/a	n/a	39.8	1224	123	n/a	n/a	n/a	n/a	29.3
Bev-Holt	50	302	1284	286	0.11	0.82	42.6	50	119	1259	154	0.20	0.03	32.2
Hock-Stk	2.88	1.66	439	259	0.10	0.83	42.4	3.98	22.87	307	1763	0.20	0.05	32.1
Ricker	2.99	0.67	0.00069	0.00013	0.15	0.76	43.8	2.71	0.52	0.000626	0.000113	0.27	-0.01	37.8

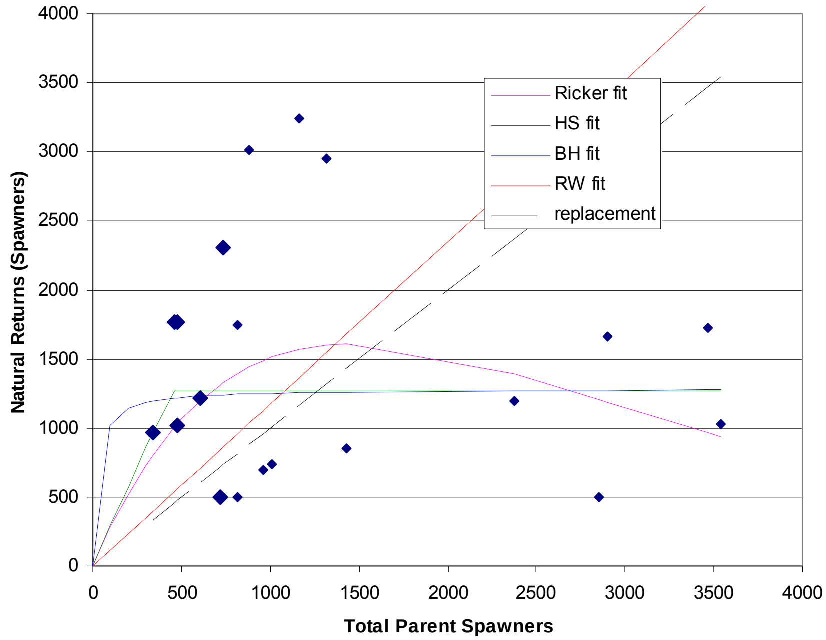

Figure 8. Middle Fork John Day River summer steelhead population stock recruitment curves. Bold points were used in estimating the current productivity. Data were not adjusted for marine survival.

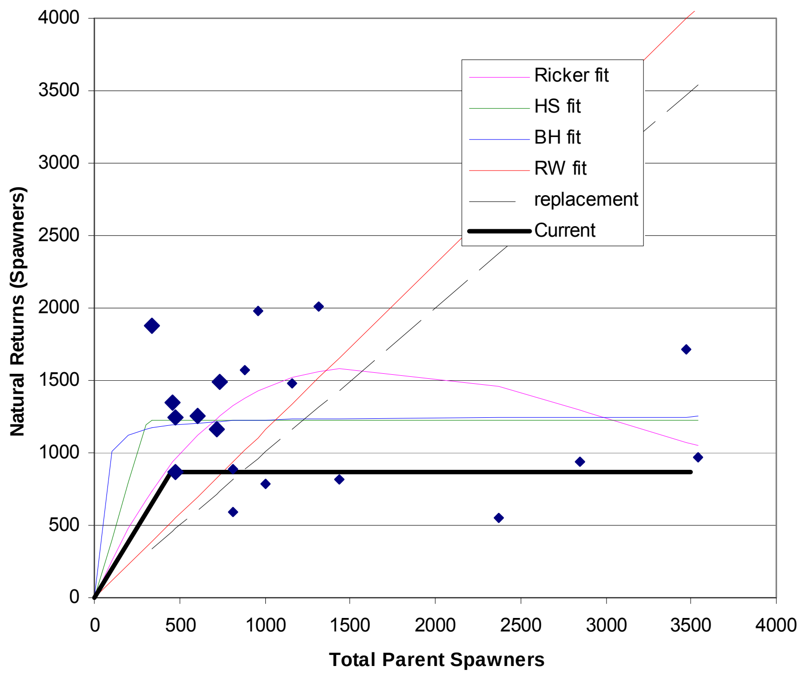

Figure 9. Middle Fork John Day River summer steelhead population stock recruitment curves. Bold points were used in estimating the current productivity. Data were adjusted for marine survival. Function labeled "Current" is a Hockey Stick function derived by fixing the slope of the ascending limb at the geometric mean productivity at low to moderate abundance (Table 2) and fitting a capacity estimate to the data series.

South Fork John Day River Summer Steelhead Population

The South Fork John Day River summer steelhead population (Figure 1) is one of five populations in the John Day River MPG within the Mid-Columbia River DPS. All five populations in this MPG are summer run.

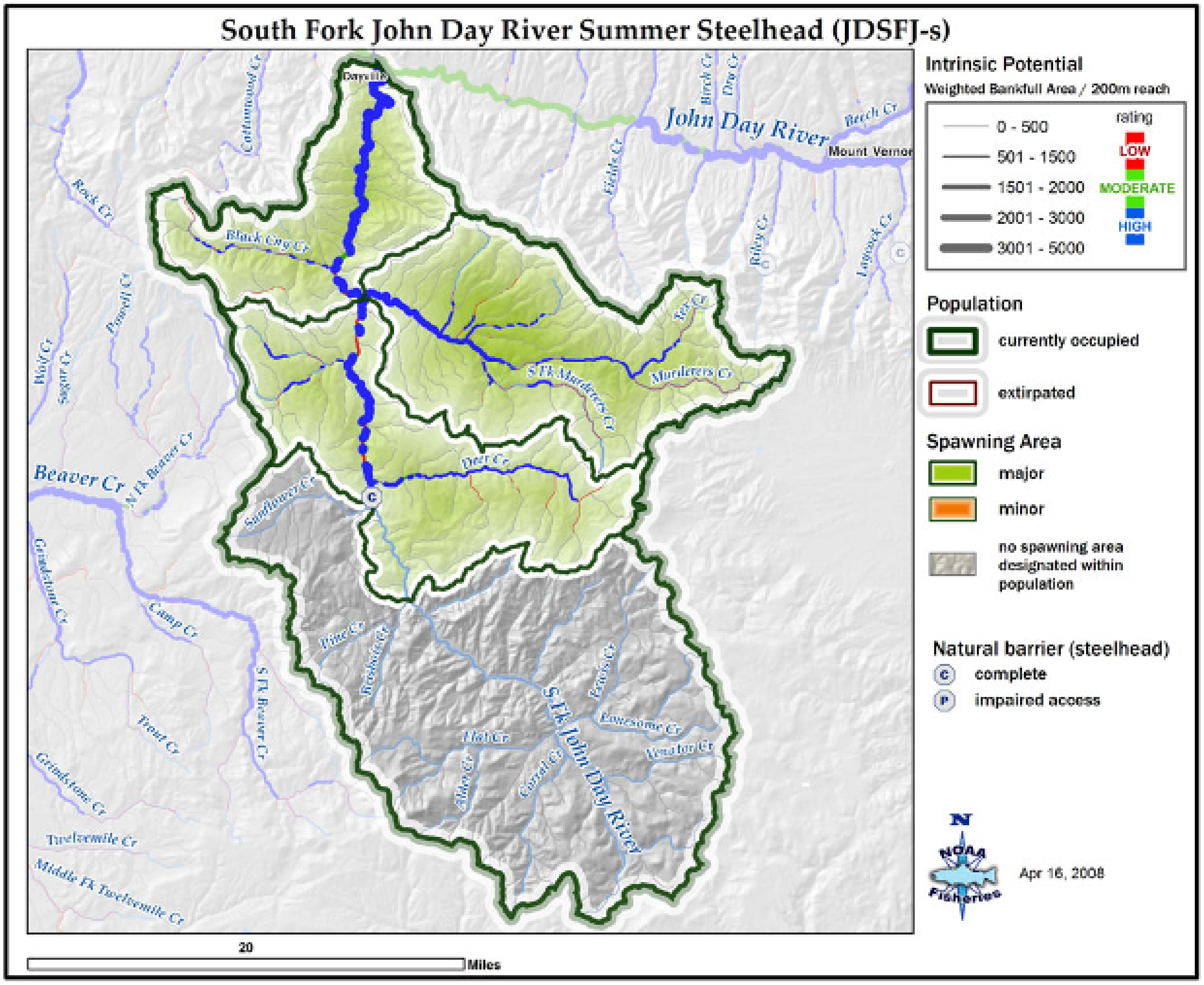

Figure 1. South Fork John Day River summer steelhead population boundary and major (MaSA) and minor (MiSA) spawning areas.

The Interior Columbia Technical Recovery Team (ICTRT) classified the South Fork population as “basic” in size and complexity (Table 1) based on historical habitat potential (ICTRT 2007), which is the smallest population classification. A steelhead population classified as basic has a minimum abundance threshold criteria of 500 natural-origin spawners with sufficient intrinsic productivity (≥ 1.56 recruits per spawner at the minimum abundance threshold) to achieve a 5% or less risk (“low risk”) of extinction over a 100-year timeframe. In order for the South Fork population to achieve a 1% or less risk (“very low risk”) of extinction over 100 years, productivity would need to be at or greater than 2.00 recruits per spawner at the minimum abundance threshold.

Table 1. South Fork John Day River summer steelhead basin statistics and intrinsic potential analysis.

Drainage area (km^2)	1,570
Stream lengths km (total) [a]	451
Stream lengths km (below natural barriers) [a]	226
Branched stream area weighted by intrinsic potential (km^2)	0.881
Branched stream area km^2 (weighted and temp. limited) [b]	0.881
Total stream area weighted by intrinsic potential (km^2)	1.030
Total stream area weighted by intrinsic potential (km^2) temp limited [b]	1.030
Size / Complexity category	Basic / "B" (dendritic structure)
Number of major spawning areas (MaSAs)	3
Number of minor spawning areas (MiSAs)	0

a. All stream segments ≥ 3.8m bankfull width were included.
b. Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was > 22^{o}C.

Current Abundance and Productivity

Current (1960-2005) total spawner abundance (number of adult spawners in natural production areas) has ranged from 105 in 1999 to 2,454 in 1962 (Figure 2). Abundance estimates are based on expanded redd counts. Index surveys of steelhead redds from the Oregon Department of Fish and Wildlife (ODFW), John Day District, were used for the historical dataset. We used index surveys that showed relatively consistent visitation through the years. Survey data from Black Canyon, Deer, upper Murderer's, lower Murderer's, Tex, and Wind creeks were used in the analyses. The current spawning distribution was used for the miles of available habitat within each population's range. The index redd densities were then multiplied by a correction factor based on the ratio of index densities to EMAP (Environmental Monitoring and Assessment Program) densities for 2004-2005. The ratio was consistent for these years (0.36, 0.35). The estimated redd density for the entire spawning area (0.355 x index density) was multiplied by the total miles of currently utilized spawning habitat. Total annual redds were converted to fish by multiplying the total annual number of redds by the number of fish per redd. An average ratio of 2.1 fish per redd was developed from Deer Creek survey data in the Grande Ronde River basin. The ratio is an average from four years of data of complete and repeated surveys (censuses) of redds above a weir where we have a complete count.

The hatchery-origin/natural-origin composition of spawners were computed separately for the Lower Mainstem John Day River population, and combined for all other populations in the John Day River MPG. Data used to represent the South Fork population included observations of positively identified adipose fin-clipped spawners (1992-present) from spawning survey observations in the four populations above the Lower Mainstem, and observations from rotary screw trap and seine collections of adults (2000-present). There is evidence from the Deschutes River that hatchery straying was substantially lower before 1992, and since the source of strays in the John Day River subbasin is the same as in the Deschutes River, we assumed a similar trend. No other data are available for earlier years so the hatchery fraction was set at zero. Age composition was derived from scale readings of creel sampled unmarked fish collected during the 1980s from locations above Tumwater Falls.

Recent year natural spawners include recruits originating from naturally spawning parents and a small fraction of strays from the Snake and Columbia River hatchery programs. Since documentation of hatchery strays began in 1992, spawners originating from naturally spawning parents have comprised an average of 93%, ranging from 87% to 99%.

Abundance in recent years has been moderately variable. The 10-year (1996-2005) geometric mean abundance of natural-origin spawners was 259 (Table 2). During the period 1961-1998, recruits per spawner (R/S, in terms of spawner to spawner) for steelhead in the South Fork John Day River ranged from 0.20 in 1987 to 13.54 in 1968. The annual R/S estimates were adjusted to reflect the average smolt-to-adult return rate (SAR). The 20-year (1979-1998) geometric mean productivity was 2.06 R/S, adjusted for SAR and delimited at 75% (375 spawners) of the abundance threshold.

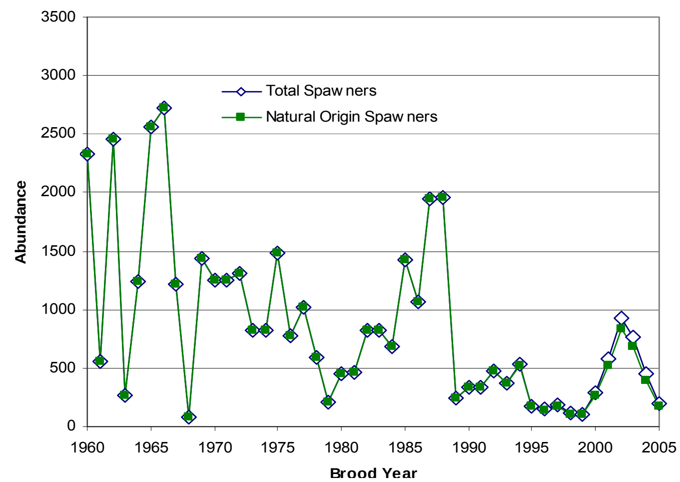

Figure 2. South Fork John Day River summer steelhead population spawner abundance (1960-2005).

Table 2. South Fork John Day River summer steelhead population abundance and productivity.

Abundance/Productivity Statistics	Estimate	(Range)	
Abundance: natural-origin spawners (10-year geometric mean, range)	259	(76-2729)	
Proportion: natural-origin spawners (10-year geometric mean, range)	0.93	(0.87-1.00)	
	Estimate	**(90% CI)[b]**	**SE**
Intrinsic productivity (20-year R/S, SAR adjusted & delimited) [a]	2.06	(1.26-3.38)	0.27
Productivity (20-year Beverton-Holt fit, SAR adjusted)	n/a		n/a
Trend Statistics (1980-2005)	**Estimate**	**(95% CI)**	**P>1.0**
ln(natural-origin spawner abundance)	0.95	(0.91-1.09)	
Population growth rate (λ): Hatchery effectiveness = **1.0**	0.98	(0.74-1.32)	0.44
Population growth rate (λ): Hatchery effectiveness = **0.0**	0.99	(0.74-1.33)	0.47

a. Delimited productivity excludes any recruit/spawner pair where the spawner number >75% of the population's minimum abundance threshold. This approach attempts to remove density dependence effects that may influence the productivity estimate.
b. Lower end of the 90% CI on productivity is used in evaluating the impact of parameter uncertainty on risk.

The South Fork John Day River population is at **Moderate Risk** based on current abundance and productivity. The point estimate resides between the 5% and 25% viability curves (Figure 3). The lower bound of the adjusted standard error for both the productivity and abundance extend below the 25% risk level.

The average trend in abundance over the most recent 20 years has been below 1.0 based on both the trend in natural-origin spawner abundance and the population growth rate metrics (Table 2). The pattern in returns from 1980 through 2005 is similar to the pattern for several other Mid-

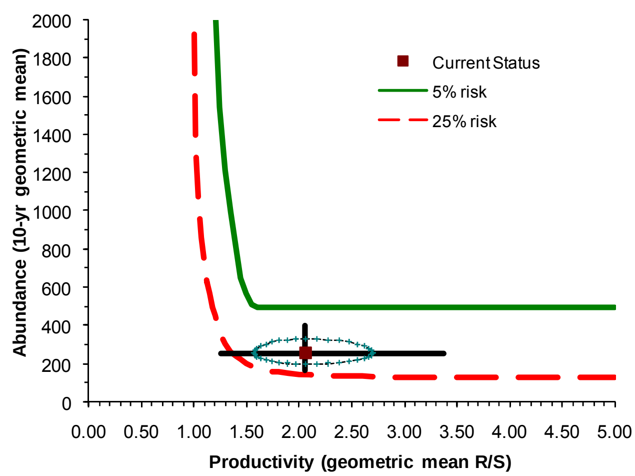

Figure 3. South Fork John Day River summer steelhead population current abundance/productivity (A/P) compared to the DPS viability curve. Ellipse = 1 SE about the point estimate. Error bars = 90% CI for A/P.

Columbia DPS steelhead populations—generally high returns in the mid-1980s, increasing trend beginning in 2000, followed by an abrupt decline in the most recent years. The estimated proportion of hatchery-origin spawners for this population has been relatively low. Therefore the alternative estimate of population growth rate (assuming that hatchery spawners are not contributing as parents to natural production) is slightly higher than, but similar to, the standard estimate. The data series for South Fork John Day steelhead abundance extends back to 1960. Spawning levels in the 1970s were generally higher than levels observed from 1980 through 2005.

Spatial Structure and Diversity

The ICTRT has identified three major spawning areas (MaSAs) and no minor spawning areas (MiSAs) within the South Fork John Day River steelhead population (Figure 4). A natural barrier at Izee Falls limits distribution in the mainstem South Fork John Day River. Spawning is distributed broadly throughout the population boundaries including mainstem areas in the South Fork John Day River, Murderers Creek, and Canyon Creek, as well as many tributaries. Spawners within the South Fork population are primarily natural-origin fish; however, out-of-DPS hatchery fish, primarily from Snake River stocks, are present in the South Fork population.

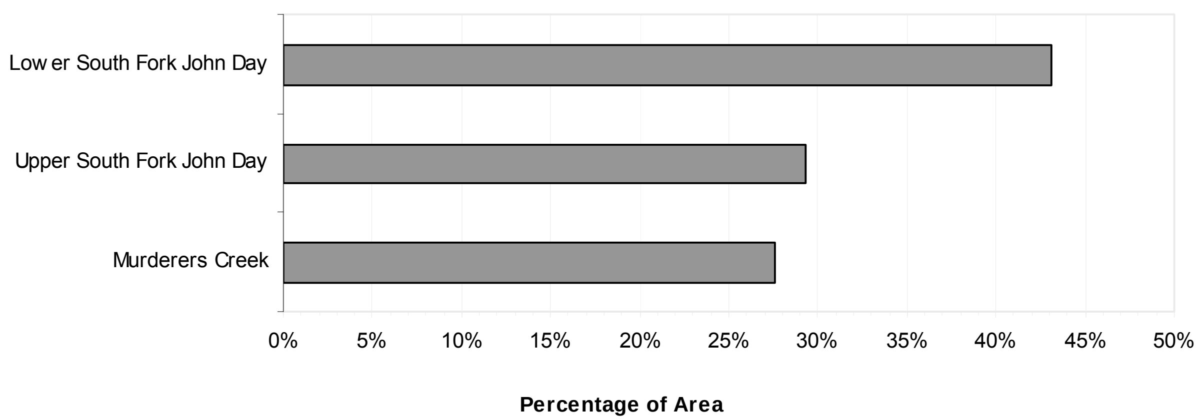

Figure 4. South Fork John Day River summer steelhead population distribution of intrinsic potential habitat across major spawning areas (MaSAs). No minor spawning areas present.

Factors and Metrics

A.1.a. Number and spatial arrangement of spawning areas

The South Fork John Day River has three MaSAs which are distributed in a dendritic pattern. Intrinsic potential is distributed relatively equally between the three MaSAs in the lower mainstem South Fork, Murderer's Creek, and the upper South Fork. Based on the ODFW spawner distribution database, all of the spawning reaches identified within the intrinsic potential distribution are currently occupied, and 247 km of habitat are presently used for spawning (Figure 5). The South Fork population rates at **low risk** for this metric because all three MaSAs are occupied.

A.l.b. Spatial extent or range of population

The current spawning distribution based on the ODFW distribution database mirrors the historical distribution represented by the intrinsic potential analyses. All MaSAs are currently occupied (Figure 5). The South Fork population is rated **very low risk** for spatial extent and range criteria. Index area spawning surveys are conducted in five creeks, including at least one reach in each MaSA. Recent spawning ground surveys results will be analyzed for future viability assessments.

A.1.c. Increase or decrease in gaps or continuities between spawning aggregates

There has been no increase or decrease in gaps between spawning areas. Spawning habitat connectivity appears to be unchanged within the South Fork population. The South Fork population rates at **very low risk** for gaps and connectivity.

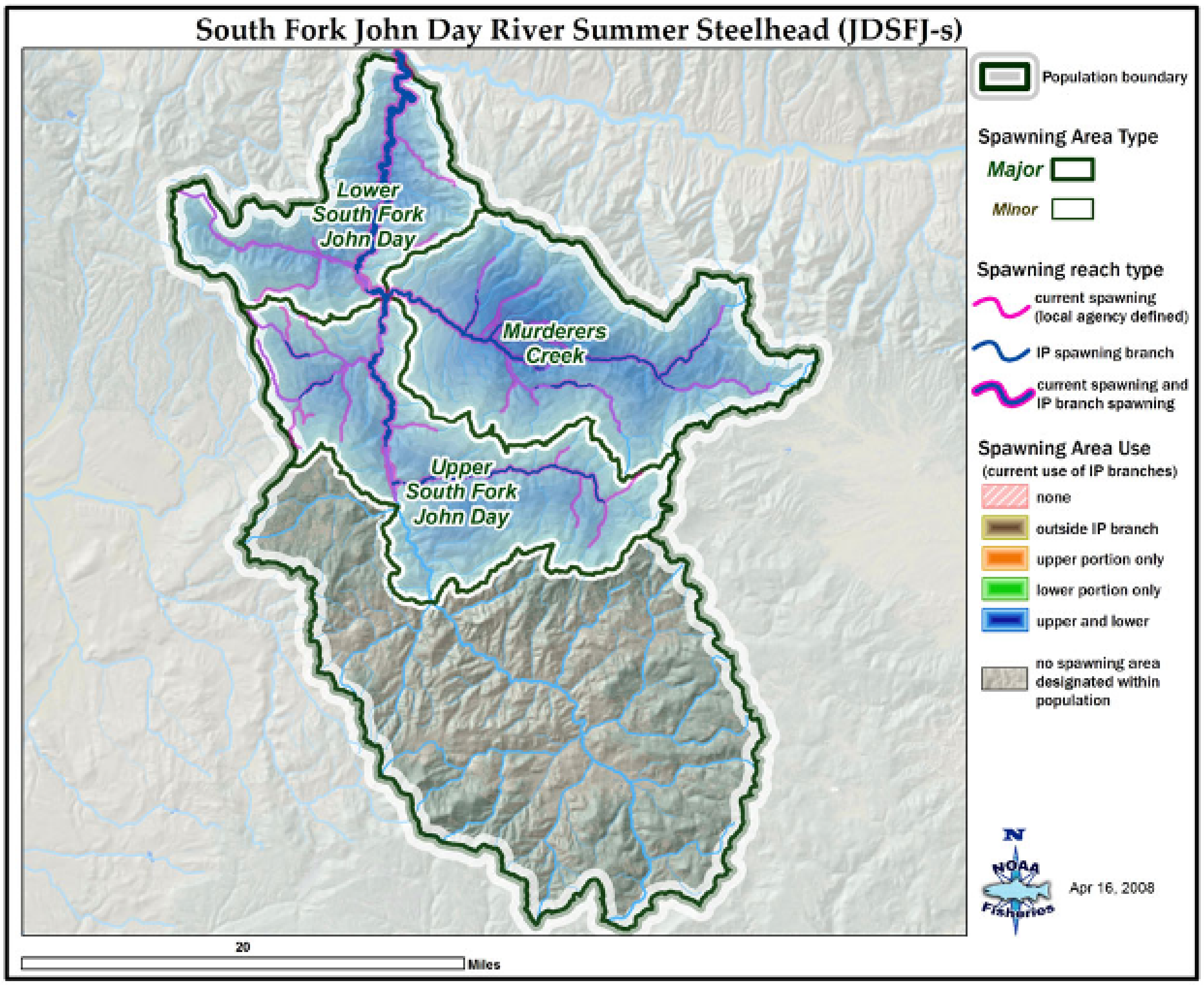

Figure 5. South Fork John Day River summer steelhead population current spawning distribution and spawning area occupancy designations.

There are no direct observations to evaluate current life history strategies relative to historic; therefore we infer loss of life history diversity based on habitat changes. Increased water temperatures have likely reduced connectivity and quantity of habitats available during summer, but have not likely resulted in loss of any major life history strategies. Juvenile steelhead currently exhibit diverse patterns of movement to and from tributaries and mainstem reaches throughout the life cycle. These diverse movement patterns result in rearing in a diversity of habitat types. South Fork John Day River steelhead are A-run with predominant smolt age-at-migration of age 2 and age 3 and return primarily after one or two years in the ocean. These characteristics are typical for summer run steelhead in the Columbia River basin. Evidence does not indicate loss of any major life history strategies, thus the population rates at **low risk** for this metric**.**

B.1.b. Phenotypic variation

We have no data to assess if any phenotypic traits have been significantly changed or lost. Although habitat conditions are altered from historic conditions the types of alterations would not result in loss of significant phenotypic traits. Due to water temperature changes in the mainstem Columbia River and John Day River, there have likely been reductions in the variation of adult migration timing and some reduction in distribution of summer rearing. There are no other major selective pressures which would cause significant changes or loss of traits. The South Fork population rates at **low risk** for phenotypic variation.

B.1.c. Genetic variation

There are limited genetics data for John Day River steelhead populations and only one sample from the South Fork population. The South Fork population shows greater between-population divergence than the other John Day River samples. Overall, the John Day River samples were not well differentiated. Samples were taken from a relatively small geographic area over a short timeframe. There is no biological basis for the low level of differentiation. Past genetic samples were likely taken prior to potential significant hatchery influence. For the genetic variation metric, we have assigned a level of **low risk** to the South Fork population. This rating reflects a balance between apparent similarity between populations in the John Day River MPG and some degree of differentiation. Samples were collected from multiple locations in 2005 and will be analyzed in the near future to better inform the genetic variation risk assessment.

B.2.a. Spawner composition

(1) *Out-of-DPS spawners:* There are inadequate data to estimate the out-of-DPS hatchery fraction specifically for the South Fork population. Estimates we used in this assessment were based on data from a composite of four John Day River populations (South Fork, Middle Fork, North Fork and Upper Mainstem). These estimates are based on observations from spawning surveys and kelt collections. Since 1992 the estimate hatchery fraction has ranged from 0.01-0.13 with a mean of 0.067. Based on coded wire tags (CWTs) recovered primarily from recreational fisheries, most of the strays are from Snake River hatcheries. Given the level and duration of strays, the population rated at **high risk** for this metric.

(2) *Out-of-MPG spawners from within the DPS:* There have been a total of four fish with CWTs recovered in the John Day River from out-of-MPG within-DPS origin. Three originated from

the Umatilla Hatchery program and one from the Deschutes. It appears very few within-DPS hatchery fish stray into the John Day River MPG, thus the rating is **low risk**.

(3) *Out-of-population spawners from within the MPG:* There are no steelhead hatchery programs operated within the John Day River basin, and this metric is rated as **very low risk**.

(4) *Within-population hatchery spawners*. There are no steelhead hatchery programs operated within the John Day River basin, therefore this metric is rated as **very low risk**.

The overall rating for spawner composition is **high risk** due to the high proportion of out-of-DPS strays that spawn naturally in this population**.**

B.3.a. Distribution of population across habitat types

The intrinsic potential distribution of the South Fork population encompassed five ecoregions, with the John Day Clarno Uplands being predominant. The current distribution is nearly identical to the intrinsic distribution (Figure 6 and Table 3), thus we have rated this population at **low risk** because only two of the ecoregions contain greater than 10% of the historic distribution.

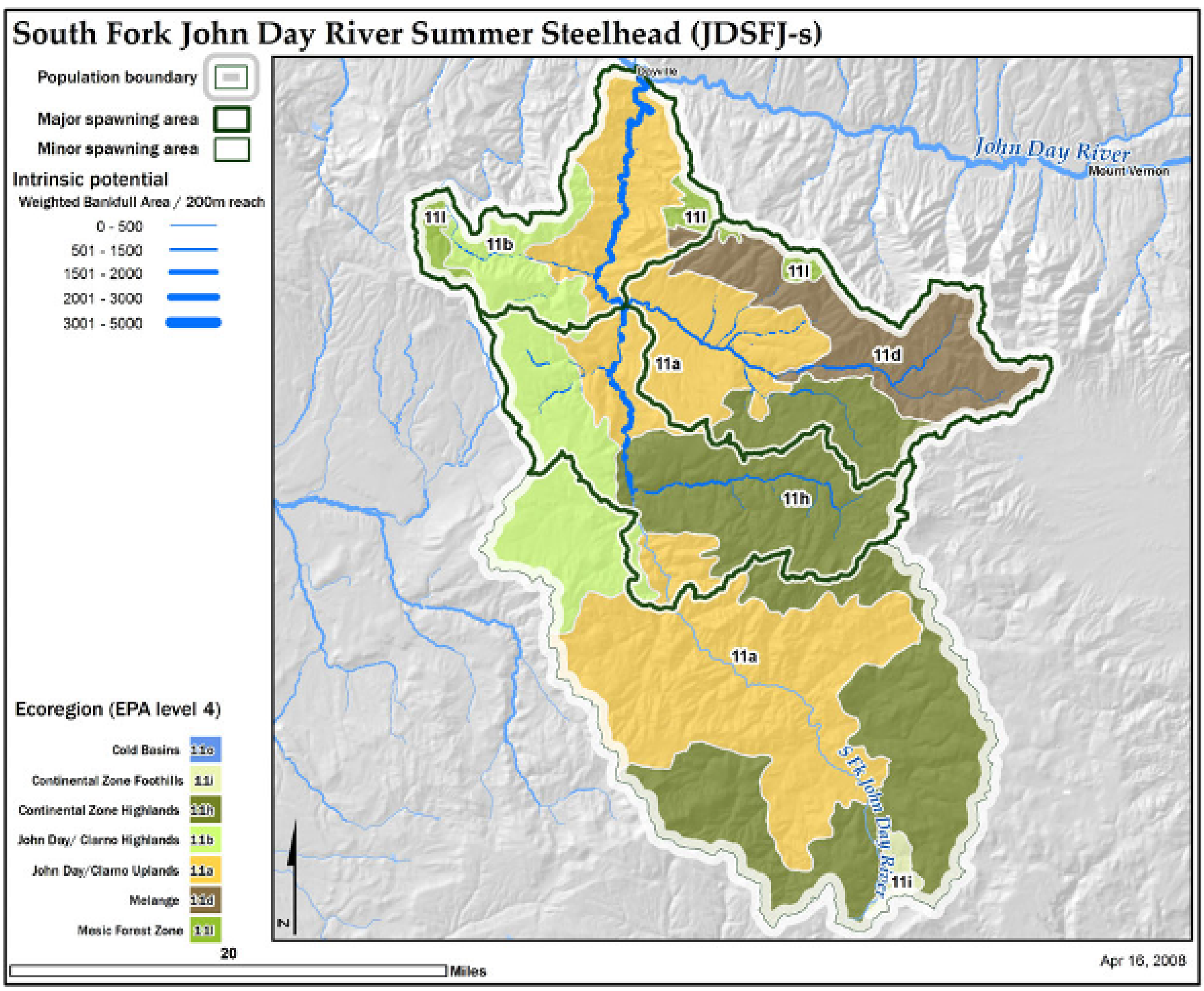

Figure 6. South Fork John Day River summer steelhead population spawning distribution across EPA level IV ecoregions.

Table 3. South Fork John Day River summer steelhead population proportion of current spawning areas across EPA level IV ecoregions.

Ecoregion	% of historical spawning area (non-temp. limited)	% of currently occupied spawning area (non-temp. limited)
Continental Zone Highlands	16.7	16.4
John Day Clarno Highlands	3.4	3.4
John Day Clarno Uplands	69.9	70.2
Melange	9.9	9.9
Mesic Forest Zone	0.1	0.1

B.4.a. Selective change in natural processes or selective impacts

Hydropower system: This population passes three dams on the lower mainstem Columbia River in its seaward and spawning migrations. The hydropower system and associated reservoirs appear to impose some selection on smolt and adult migration timing. All hydropower effects have persisted for multiple generations and are ongoing.

> *Adult migration timing*: These dams establish a thermal barrier in the reservoirs that delays and potentially induces some mortality of migrating adults. This barrier is diminished later in the migration season. Because the timing of the barrier varies from year to year and does not develop in some years, and the degree of differential survival is likely low and not well-understood, we rate the selection intensity as low. Heritability of this trait is high, thus the hydropower rating for this trait is **moderate risk**.

Harvest: Harvest has the potential to affect migration timing, maturation timing and size. However, recent harvest rates for A-run steelhead in the Columbia River mainstem are generally less than 10% annually. Although some harvest may be size-selective for larger fish, the selective mortality would affect slightly more than 2% of the total population. There may be a very slight advantage for earlier returning fish as a result of the timing of the Chinook salmon fishery, and while heritability of adult migration timing is high, the impacts are slight enough to be negligible. There is very limited tribal harvest of natural-origin fish within the John Day River subbasin; impacts from the recreational fishery are incidental to hatchery-origin fish harvest and are not selective. No phenotypic traits appear to be at risk as a result of this activity. The harvest rating is **low risk** for all traits.

Hatcheries: There are no steelhead hatchery programs operated within the population; therefore, the hatchery rating is **very low risk** for all traits.

Habitat: Altered flow profiles and increased temperatures have been in place for many generations and are ongoing; there is likely some selection on juvenile and adult migration timing.

> *Adult migration timing:* Low flows in the late summer and early fall in the John Day River likely expose adults that enter the river early to above normal mortality rates. Adult migration timing is highly heritable, but a negligible proportion of the population is likely subject to these effects. Thus, the impact of habitat changes on this trait is **low risk.**

> *Juvenile migration timing:* Late spring and early summer temperatures are elevated relative to historical conditions. There has likely been some effect on juvenile migration timing as temperatures can reach stressful levels in the John Day River mainstem in late spring and early summer in some years. Selection intensity is considered negligible and the heritability of this trait is moderate to low. The rating for this trait is **low risk**.

Other: A population of Caspian terns in the estuary has been artificially enhanced by a combination of increased habitat (created by dredge spoils) and artificially increased food availability (large-scale releases of hatchery smolts). These terns appear to exert a size-selective

predation pressure that primarily impacts the large steelhead smolts. The rate of predation is highest during tern nesting season in May. This pressure may affect smolt migration timing.

> *Juvenile migration timing:* Steelhead smolts pass through the estuary from April to June. The relatively high predation (10%) on smolts in May could select for earlier and later out-migrants. However, heritability of this trait has not been assessed, so we assume a moderate to low heritability. Because this predation occurs at the peak of migration, the impact of this selective factor is **low risk**.

There is only one trait that has a moderate rating for one selective activity. Therefore, the overall selectivity rating for this population is **low risk.**

Spatial Structure and Diversity Summary

The integrated spatial structure/diversity rating is **Moderate Risk** (Table 4) for the South Fork John Day River population. The rating for Goal A (allowing natural rates and levels of spatially mediated processes) was **very low risk**. Although the current spawner distribution mimics the intrinsic distribution, only three MaSAs exist within the population. Good continuity exists between spawning areas and gaps between areas have remained relatively unchanged.

The rating for Goal B (maintaining natural levels of variation) is **moderate risk**. As is the case for all John Day River steelhead populations there is uncertainty in ratings of metrics "genetic variation" and "proportion of spawners that are out-of-DPS strays." We have limited genetics data for South Fork steelhead to determine if the current population variation is similar to historic conditions and to examine the degree of hatchery fish introgression. The metric for proportion of out-of-DPS strays rated as high risk. However, the analyses relied on composite data from four John Day River populations. Additional population-specific spawner composition data are needed to better inform the risk rating and to reduce the associated uncertainty.

Table 4. South Fork John Day River summer steelhead population spatial structure and diversity risk rating.

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
A.1.a	L (1)	L (1)	Very Low Risk (Mean = 1.67)	Very Low Risk (Mean = 1.67)	**Moderate Risk**
A.1.b	VL (2)	VL (2)			
A.1.c	VL (2)	VL (2)			
B.1.a	L (1)	L (1)	Low Risk (1)	Moderate Risk (Mean = 0.5)	
B.1.b	L (1)	L (1)			
B.1.c	L (1)	L (1)			
B.2.a(1)	H (-1)	High Risk (-1)	High Risk (-1)		
B.2.a(2)	L (1)				
B.2.a(3)	VL (2)				
B.2.a(4)	VL (2)				
B.3.a	L (1)	L (1)	L (1)		
B.4.a	L (1)	L (1)	L (1)		

Overall Viability Rating

The South Fork John Day River summer steelhead population does not currently meet the ICTRT criteria for viable status (Figure 7). However, the population does meet criteria to be rated as **MAINTAINED**. Overall abundance and productivity is rated at **Moderate Risk.** The 10-year geometric mean abundance of natural-origin spawners is 259, which is only 52% of the minimum abundance threshold of 500. The 20-year geometric mean productivity (2.06 R/S; Table 6) exceeds the minimum required productivity of 1.56 R/S at the abundance threshold. Overall spatial structure and diversity is rated at **Moderate Risk.** Improvement in abundance will allow this population to achieve viable status. There is considerable uncertainty regarding the spawner composition data. Enhanced monitoring of the hatchery-origin/natural-origin ratios on the South Fork John Day River spawning grounds should be conducted to improve the hatchery fraction estimate and reduce the degree of uncertainty.

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	**HV**	**HV**	**V**	**M**
	Low (1-5%)	**V**	**V**	**V**	**M**
	Moderate (6 – 25%)	**M**	**M**	**M** **South Fork John Day River**	**HR**
	High (>25%)	**HR**	**HR**	**HR**	**HR**

Figure 7. South Fork John Day River summer steelhead population risk ratings integrated across the four viable salmonid population (VSP) metrics. ***Viability Key: HV – Highly Viable; V – Viable; M – Maintained; HR – High Risk; Shaded cells – does not meet viability criteria (darkest cells are at greatest risk).***

Data Summary – South Fork John Day River

Data type: Redd count expansion - Index area redd counts expanded to total population estimate by applying ratio of average redd densities (samples across all areas to samples from index reaches) from EMAP surveys. Assumed 2.1 fish per redd.
Smolt-to-Adult Return rate (SAR): Mid-Columbia composite series (see *Methods*).

Table 5. South Fork John Day River steelhead population abundance and productivity data used for curve fits and R/S analysis. Bold values were used in estimating the current productivity (Table 6).

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	SAR Adj. Factor	Adj. Rtns	Adj. R/S
1979	**214**	**1.00**	**214**	**819**	**3.83**	**1.94**	**1588**	**7.43**
1980	451	1.00	451	1058	2.34	0.50	534	1.18
1981	467	1.00	467	1316	2.82	0.68	899	1.92
1982	824	1.00	824	1546	1.87	0.46	706	0.86
1983	821	1.00	821	1782	2.17	0.52	933	1.14
1984	687	1.00	687	1025	1.49	0.65	663	0.96
1985	1423	1.00	1423	290	0.20	0.46	133	0.09
1986	1069	1.00	1069	345	0.32	0.94	326	0.30
1987	1947	1.00	1947	399	0.20	2.18	868	0.45
1988	1958	1.00	1958	429	0.22	0.99	425	0.22
1989	**239**	**1.00**	**239**	**417**	**1.74**	**0.96**	**401**	**1.67**
1990	**332**	**1.00**	**332**	**325**	**0.98**	**2.83**	**920**	**2.77**
1991	**331**	**1.00**	**331**	**154**	**0.46**	**2.33**	**359**	**1.08**
1992	480	0.99	473	150	0.31	1.88	281	0.59
1993	**372**	**0.99**	**367**	**138**	**0.37**	**1.18**	**163**	**0.44**
1994	536	0.97	522	123	0.23	1.07	131	0.24
1995	**180**	**0.94**	**168**	**217**	**1.21**	**1.23**	**266**	**1.48**
1996	**145**	**0.93**	**135**	**436**	**3.01**	**1.03**	**450**	**3.10**
1997	**182**	**0.95**	**173**	**676**	**3.71**	**0.76**	**516**	**2.84**
1998	**115**	**0.96**	**110**	**719**	**6.28**	**0.49**	**353**	**3.08**
1999	105	0.98	103					
2000	288	0.91	263					
2001	576	0.91	525					
2002	922	0.90	830					
2003	761	0.89	679					
2004	452	0.87	393					
2005	197	0.87	172					

Table 6. South Fork John Day River steelhead population geometric mean abundance and productivity estimates (values used for current productivity and abundance are shown in boxes).

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
delimited	median	75% threshold	median	75% threshold	1987-1998	1979-1998	geomean
Point Est.	1.72	1.66	1.95	2.06	0.96	1.14	259
Std. Err.	0.30	0.33	0.25	0.27	0.26	0.25	0.24
count	10	9	10	9	12	20	10

Table 7. South Fork John Day River steelhead population stock-recruitment curve fit parameter estimates. Biologically unrealistic or highly uncertain values are highlighted in grey.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	0.99	0.25	n/a	n/a	0.68	0.68	66.0	0.97	0.23	n/a	n/a	0.90	0.45	63.9
Const. Rec	453	82	n/a	n/a	n/a	n/a	53.0	445	66	n/a	n/a	n/a	n/a	44.8
Bev-Holt	50	0	466	0	0.18	0.85	55.8	50	233	457	89	0.37	0.40	47.6
Hock-Stk	3.99	0.13	113.60	0.72	0.18	0.85	55.8	3.09	1.42	146	71	0.36	0.41	47.5
Ricker	2.34	0.68	0.00134	0.00035	0.26	0.80	57.7	2.37	0.60	0.00140	0.00030	0.47	0.38	52.1

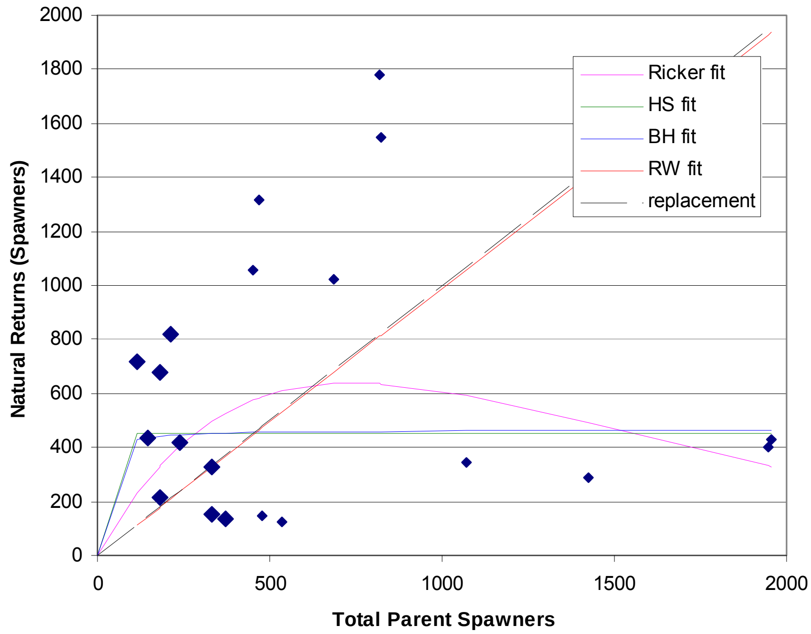

Figure 8. South Fork John Day River steelhead population stock recruitment curves. Bold points were used in estimating the current productivity. Data were not adjusted for marine survival.

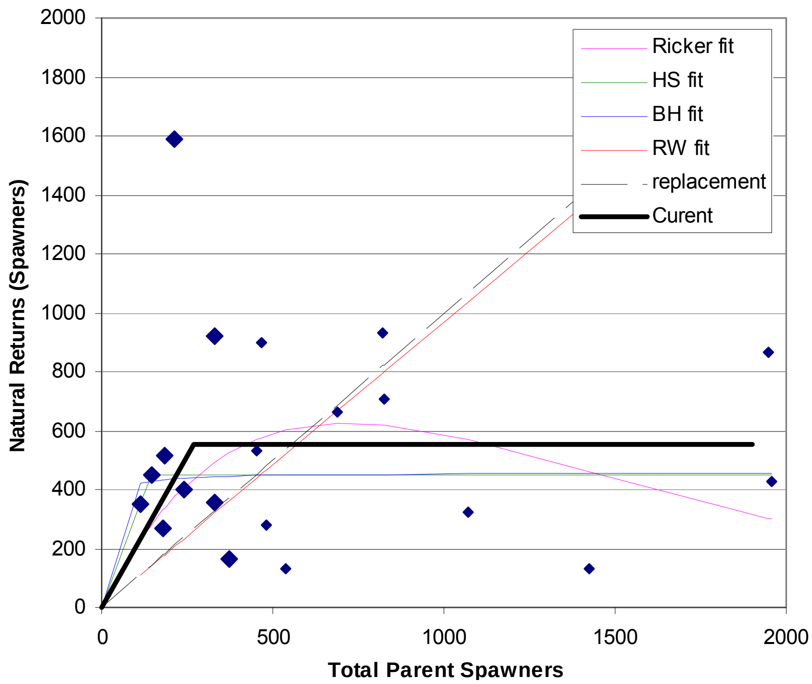

Figure 9. South Fork John Day River steelhead population stock recruitment curves. Bold points were used in estimating the current productivity. Data were adjusted for marine survival. Function labeled "Current" is a Hockey Stick function derived by fixing the slope of the ascending limb at the geometric mean productivity at low to moderate abundance (Table 2) and fitting a capacity estimate to the data series.

Upper Mainstem John Day River Summer Steelhead Population

The Upper Mainstem John Day River summer steelhead population (Figure 1) is one of five populations in the John Day River MPG within the Mid-Columbia River DPS. All five populations in this MPG are summer run.

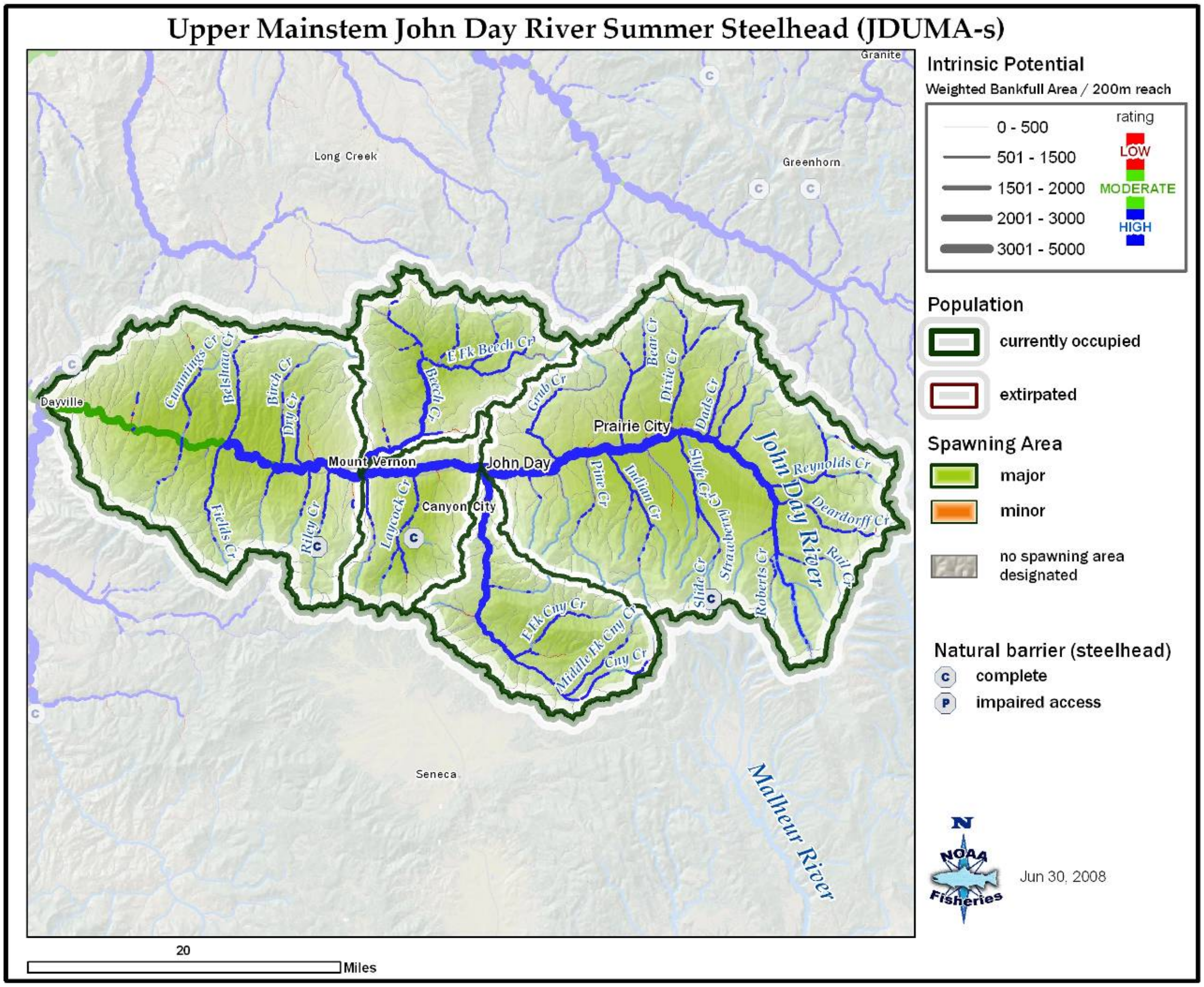

Figure 1. Upper Mainstem John Day River summer steelhead population boundary and major (MaSA) and minor (MiSA) spawning areas.

The Interior Columbia Technical Recovery Team (ICTRT) classified the Upper Mainstem John Day River population as “intermediate” in size and complexity (Table 1) based on historical habitat potential (ICTRT 2007). A steelhead population classified as intermediate has a minimum abundance threshold of 1,000 natural-origin spawners with sufficient intrinsic productivity (≥ 1.35 recruits per spawner at the minimum abundance threshold) to achieve a 5% or less risk (“low risk”) of extinction over a 100-year timeframe. In order for the Upper Mainstem population to achieve a 1% or less risk (“very low risk”) of extinction over 100 years, productivity would need to be at or greater than 1.64 recruits per spawner at the minimum abundance threshold.

Table 1. Upper Mainstem John Day River summer steelhead population basin statistics and intrinsic potential analysis summary.

Drainage area (km^2)	2,511
Stream lengths km (total) [a]	801
Stream lengths km (below natural barriers) [a]	767
Branched stream area weighted by intrinsic potential (km^2)	3.091
Branched stream area km^2 (weighted and temp. limited) [b]	3.091
Total stream area weighted by intrinsic potential (km^2)	3.346
Total stream area weighted by intrinsic potential (km^2) temp limited [b]	3.346
Size / Complexity category	Intermediate / “B” (dendritic structure)
Number of major spawning areas (MaSAs)	5
Number of minor spawning areas (MiSAs)	0

a. All stream segments ≥ 3.8m bankfull width were included.
b. Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was > 22°C.

Current Abundance and Productivity

Current (1965-2005) total spawner abundance (number of adult spawners in natural production areas) has ranged from 197 in 1995 to 4,235 in 1988 (Figure 2). Abundance estimates are based on expanded redd counts. Index surveys of steelhead redds from the Oregon Department of Fish and Wildlife (ODFW), John Day District, were used for the historical dataset. We used index surveys that showed relatively consistent visitation through years (Belshaw, Bear, Beech, East Fork Beech, Canyon, Middle Fork Canyon, McClellan, Riley, and Tinker creeks). The current spawning distribution was used for the miles of available habitat within each population’s range. The index redd densities were then multiplied by a correction factor to estimate the annual redd densities for the entire spawning distribution, based on the ratio of index redd densities to EMAP (Environmental Monitoring and Assessment Program) redd densities for 2004-2005; the ratio was consistent for these years (0.36, 0.35). The estimated redd density for the entire spawning area (0.355 x index density) was multiplied by the total miles of spawning habitat currently utilized. Total annual redds were converted to fish by multiplying the total annual number of redds by the number of fish per redd. Fish per redd ratios were developed from four years of data of complete and repeated surveys (censuses) on Deer Creek in the Grande Ronde River basin of redds above a weir where there was a complete fish count; the calculated average fish per redd estimate was 2.1.

The hatchery-origin/natural-origin composition of spawners was computed separately for the Lower Mainstem John Day River population and combined for all other populations in the MPG. Data used to represent the Upper Mainstem population included observations of positively identified fin-clipped spawners (1992-present) from spawning survey observations in the four populations above the Lower Mainstem, and observations from rotary screw trap and seine collections of adults (2000-present). Evidence from the Deschutes River indicates that hatchery straying was substantially lower before 1992; because the source of strays in the John Day River subbasin is the same as in the Deschutes River we assumed a similar trend. No data are available for earlier years so the hatchery fraction was set at zero. Age composition was derived from scale readings of creel sampled unmarked fish collected during the 1980s above Tumwater Falls.

Recent year natural spawners include recruits from naturally spawning parents and a small fraction of strays from Snake and Columbia River hatchery programs. Spawners originating from naturally spawning parents have comprised an average of 93% since hatchery strays were documented in 1992. Since then, the percentage of natural spawners has ranged from 87%-99%.

Abundance in recent years has been moderately variable. The 10-year (1994-2003) geometric mean abundance of natural-origin spawners was 524 (572 total spawners). During the period 1969-1998, recruits per spawner (R/S, in terms of spawner to spawner) for steelhead in the Upper Mainstem John Day River ranged from 0.19 in 1992 to 5.43 in 1979. The annual R/S estimates were adjusted to reflect the average smolt-to-adult return rate (SAR). The 20-year (1979-1998) geometric mean productivity was 2.14 R/S, adjusted for SAR and delimited at 75% (750 spawners) of the abundance threshold.

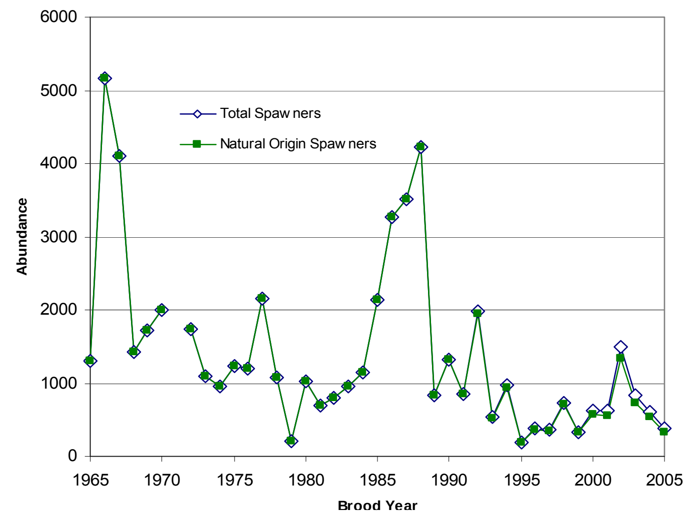

Figure 2. Upper Mainstem John Day River summer steelhead population spawner abundance (1960-2003).

Table 2. Upper Mainstem John Day River summer steelhead population abundance and productivity.

Abundance/Productivity Statistics	Estimate	(Range)	
Abundance: natural-origin spawners (10-year geometric mean, range)	524	(185-5169)	
Proportion: natural-origin spawners (10-year geometric mean, range)	0.93	(0.87-1.00)	
	Estimate	**(90% CI)[b]**	**SE**
Intrinsic productivity (20-year R/S, SAR adjusted & delimited) [a]	2.14	(1.52-2.76)	0.33
Productivity (20-year Beverton-Holt fit, SAR adjusted)	n/a		n/a
Trend Statistics (1980-2005)	**Estimate**	**(95% CI)**	**P>1.0**
ln(natural-origin spawner abundance)	0.95	(0.92-1.03)	
Population growth rate (λ): Hatchery effectiveness = **1.0**	0.99	(0.77-1.27)	0.44
Population growth rate (λ): Hatchery effectiveness = **0.0**	0.99	(0.77-1.28)	0.47

a. Delimited productivity excludes any recruit/spawner pair where the spawner number >75% of the population's minimum abundance threshold. This approach attempts to remove density dependence effects that may influence the productivity estimate.
b. Lower end of the 90% CI on productivity is used in evaluating the impact of parameter uncertainty on risk.

The Upper Mainstem John Day River population is at **Moderate Risk** based on current abundance and productivity. The point estimate for abundance and productivity resides between the 5% and 25% risk curves (Figure 3).

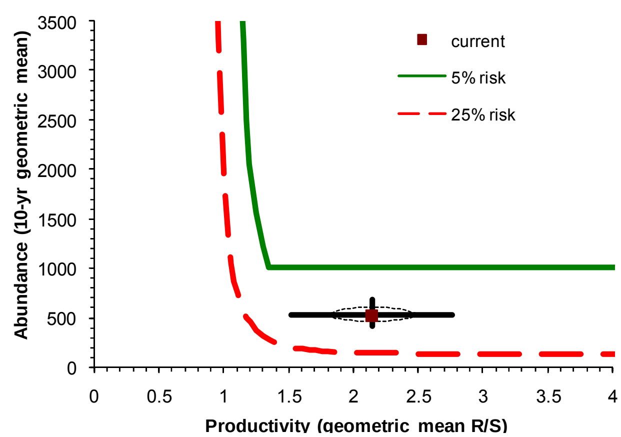

Figure 3. Figure 3. Upper Mainstem John Day River steelhead population current abundance/productivity (A/P) compared to the DPS viability curve. Ellipse = 1 SE about the point estimate. Error bars = 90% CI for A/P.

The average trend in abundance over the most recent 20 years has been below 1.0 based on both the trend in ln(natural-origin spawner abundance) and the population growth rate metric (λ) with no adjustment for relative hatchery-origin spawner effectiveness (Table 2). Like most Mid-Columbia DPS steelhead populations, the estimated number of spawners in the Upper Mainstem John Day increased in the mid 1980s, and then dropped back down by the early 1990s. Annual returns since 1999 have generally been below the early 1980s levels, except for increased returns peaking in 2002. The estimated proportion of hatchery-origin spawners has been relatively constant over the period at 7% (Table 3.5.5–2). The relative effectiveness of hatchery-origin spawners in contributing to natural production in this population is not known. Setting the value to 0.0, the opposite extreme from 1.0, does not substantially alter the estimated population growth rate given the relatively low proportion of hatchery-origin spawners recorded for this population.

Spatial Structure and Diversity

The ICTRT has identified five major spawning areas (MaSAs) and no minor spawning areas (MiSAs) within the Upper Mainstem John Day River steelhead population (Figure 4). Most of the production area resides in the Upper John Day MaSA. Spawning is distributed broadly across the population including mainstem reaches in the Upper John Day River, Canyon Creek, and Beech Creek, as well as in numerous tributaries from the town of Dayville, OR, upstream to the headwaters. Spawners within the Upper John Day River are primarily natural-origin fish, although a small proportion of out-of-DPS hatchery fish, primarily from Snake River stocks, are present in the Upper Mainstem population.

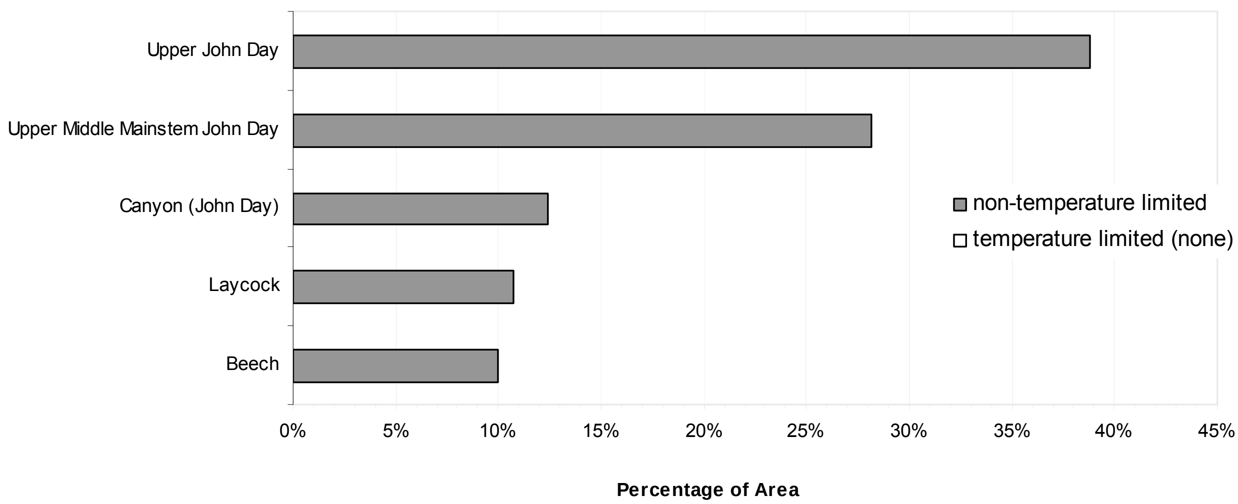

Figure 4. Upper Mainstem John Day River summer steelhead population distribution of intrinsic potential habitat across major (MaSAs) and minor spawning areas (MiSAs).

Factors and Metrics

A.1.a. Number and spatial arrangement of spawning areas

The Upper Mainstem John Day River population has five MaSAs (no MiSAs) which are distributed in a complex dendritic pattern. Based on the ODFW spawner distribution database all of the MaSAs are currently occupied and a total of 489 km are presently used for spawning (Figure 5). The Upper Mainstem John Day River population rates at **very low risk** because all five MaSAs are occupied in a dendritic configuration.

A.l.b. Spatial extent or range of population

All of the historical MaSAs are currently occupied (Figure 5). This population rates at **very low risk** for spatial extent and range, since greater than 90% of the historical MaSAs are occupied. There are nine spawning survey index sites in the Upper Mainstem John Day River population covering all five MaSAs. Recent survey results will be analyzed for future viability assessments.

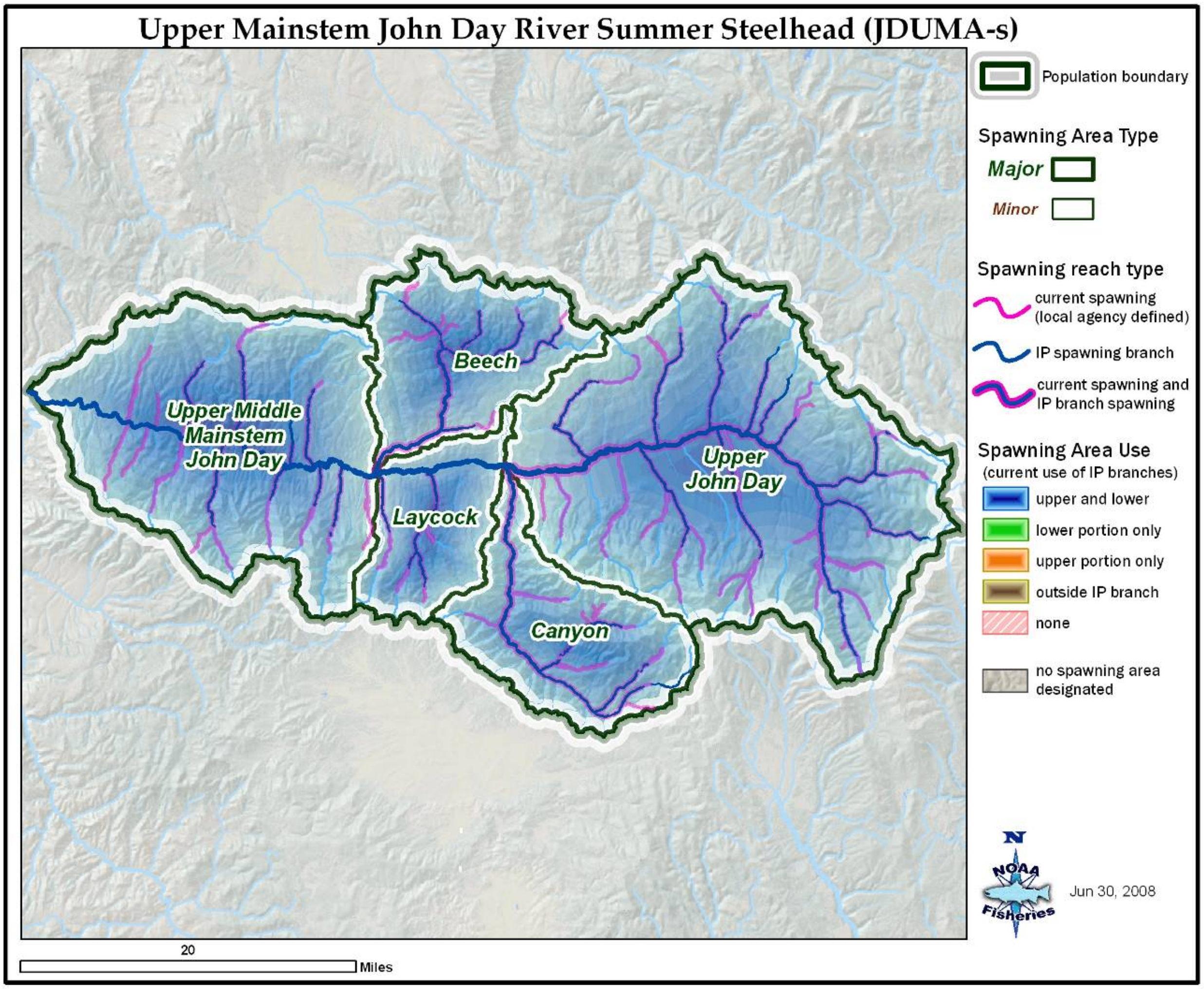

Figure 5. Upper Mainstem John Day River summer steelhead population current spawning distribution and spawning area occupancy designations.

A.1.c. Increase or decrease in gaps or continuities between spawning aggregates

There have been no increases or decreases in gaps between spawning areas relative to historic distribution. Spawning connectivity appears to be unchanged, thus the population rates at **very low risk** for this metric.

B.1.a. Major life history strategies

There are no direct observations to assess loss in major life history strategies for the Upper Mainstem population; therefore we infer changes in life history from habitat information. Habitat conditions have been altered resulting in decreased flows and increased temperatures. The habitat changes limit juvenile movement patterns and rearing distribution during summer. The age-at-migration and ocean residence data are based on scale analyses from angler caught fish and represent a composite for John Day River populations. Smolt age-at-migration and ocean residence appear to be normal for A-run steelhead. There is no evidence for loss of major life history pathways. We have rated this metric as **moderate risk** because of the significant loss of summer rearing in the upper mainstem and tributaries.

B.1.b. Phenotypic variation

Mainstem Columbia River temperatures, as well as temperatures within the John Day River basin, have likely reduced the variation in both adult and juvenile migration. Warmer temperatures in the summer and autumn hinder or prevent adult movement upstream into the John Day River. Warmer temperatures in early summer have likely truncated the smolt migration timing so that fewer fish migrate at the tail end of the distribution. The reduction in these phenotypic traits results in a rating of **low risk** for the Upper Mainstem John Day River population.

B.1.c. Genetic variation

There are limited genetics data for the John Day River steelhead populations and only one sample from the Upper Mainstem population. We have no indications of past bottlenecks and the only major genetics concern is related to introgression from out-of-DPS hatchery fish. Overall the John Day River samples are not well differentiated. Samples were taken from a relatively small geographic area for only one year. We have rated the population as **low risk**. This rating is driven by balance between apparent similarity within and between populations and relative degree of differentiation. There is the need for better genetic assessment of this population to characterize genetic diversity and hatchery fish genetic introgression. Samples were collected in 2005 to provide better information for assessing genetic variation.

B.2.a. Spawner composition

(1) *Out-of-DPS spawners*: Inadequate data exist to estimate the out-of-DPS hatchery fraction specifically for the Upper Mainstem population. Estimates we used in this assessment are based on data from a composite of the four populations (South Fork, Middle Fork, North Fork and Upper Mainstem) in the John Day River that are above the Lower Mainstem population. These estimates are based on observations from spawning surveys and kelt collections seined from the mainstem. Since 1992, the estimated hatchery fraction ranged from 0.01-0.13. The mean hatchery fraction was 0.067. Based on coded wire tags (CWTs) recovered primarily from angler caught fish, the majority of stray hatchery fish originate from Snake River hatcheries. Given that the hatchery fraction of out-of-DPS strays is estimated to be greater than 0.05 for two or more generations, the rating is **high risk** for this metric.

(2) *Out-of-MPG spawners from within the DPS*: There have been four fish with CWTs recovered in the John Day River from out-of-MPG within-DPS origin. Three originated from the Umatilla Hatchery program and one from the Deschutes. It appears very few within-DPS hatchery fish stray into the John Day River, thus the rating is **low risk** for this metric.

(3) *Out-of-population spawners from within the MPG*: There are no steelhead hatchery programs operated within the John Day River basin, and this metric is rated as **very low risk**.

(4) *Within-population hatchery spawners*: There are no steelhead hatchery programs operated within the John Day River basin, therefore this metric is rated as **very low risk**.

The overall spawner composition rating is **high risk** due to the high proportion of out-of-DPS strays that spawn naturally in this population**.**

B.3.a. Distribution of population across habitat types

The initial distribution of the Upper Mainstem population encompassed four ecoregions of which only two were greater than 10% of the distribution (Figure 6). The John Day Clarno Uplands is the dominant ecoregion. There has been very little change in ecoregion distribution as the current distribution mimics the intrinsic potential (Table 3). The risk level is **low risk** only because two ecoregions have proportions greater than 10%.

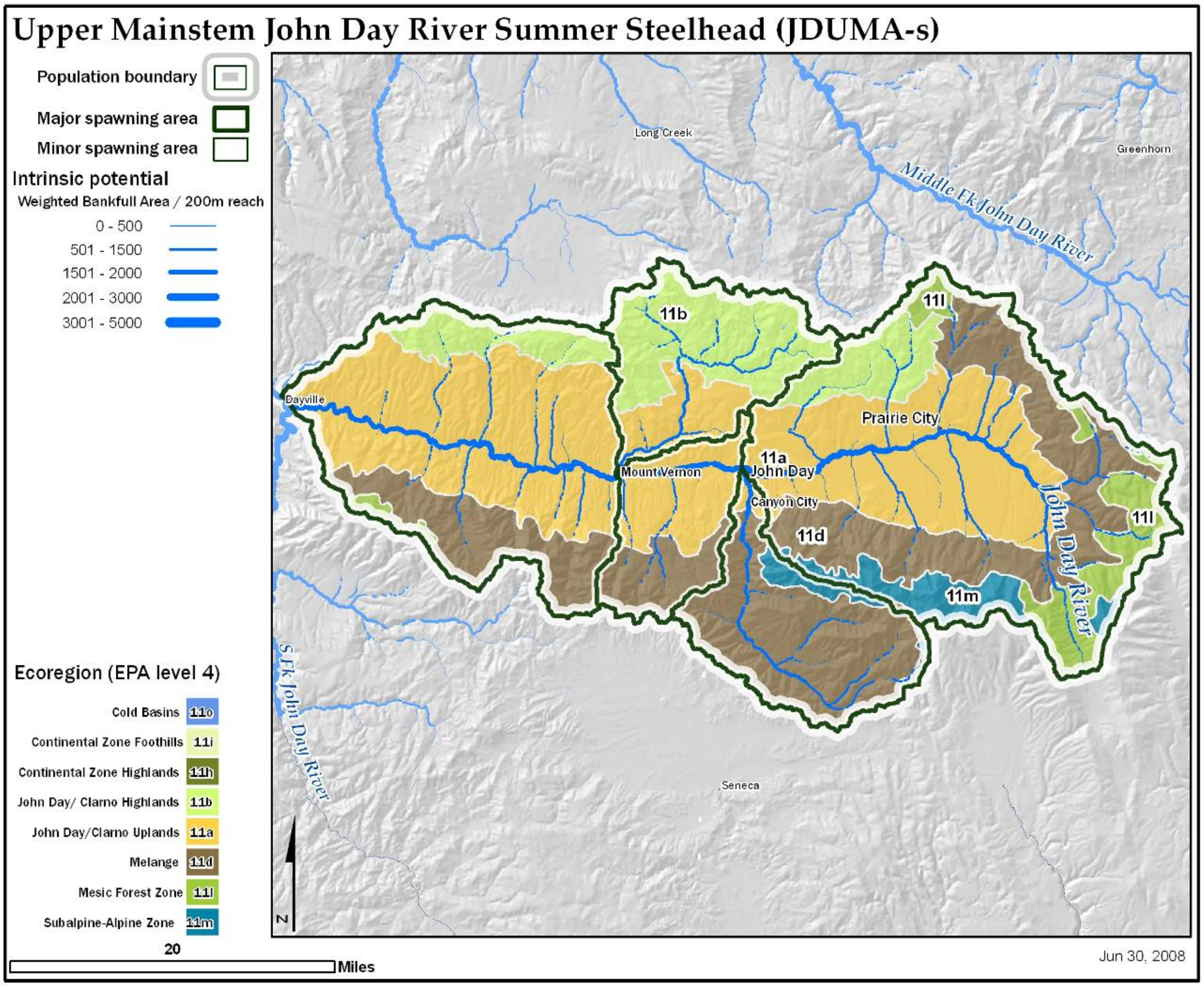

Figure 6. Upper Mainstem John Day River summer steelhead population spawning distribution across EPA level IV ecoregions.

Table 3. Upper Mainstem John Day River summer steelhead population proportion of current spawning areas across EPA level IV ecoregions.

Ecoregion	% of historical spawning area (non-temp. limited)	% of currently occupied spawning area (non-temp. limited)
John Day Clarno Highlands	7.0	9.4
John Day Clarno Uplands	72.5	63.2
Melange	18.3	24.7
Mesic Forest Zone	2.2	2.7

B.4.a. Selective change in natural processes or selective impacts

Hydropower system: This population crosses three dams on the lower mainstem Columbia River in its seaward and spawning migrations. The hydropower system and associated reservoirs appear to impose some selection on smolt and adult migration timing. All hydropower effects have persisted for multiple generations and are ongoing.

> *Adult migration timing:* These dams establish a thermal barrier in the reservoirs that delays and potentially induces some mortality of migrating adults. This barrier is diminished later in the migration season. Because the timing of the barrier varies from year to year and does not develop in some years, and the degree of differential survival is likely low and not well-understood, we rate the selection intensity as low. Heritability of this trait is high, thus the hydropower rating for this trait is **moderate risk**.

Harvest: Harvest has the potential to affect migration timing, maturation timing and size. However, recent harvest rates for A-run steelhead in the Columbia River mainstem are generally less than 10% annually. Although some harvest may be size-selective for larger fish, the selective mortality would affect slightly more than 2% of the total population. There may be a very slight advantage for earlier returning fish as a result of the timing of the Chinook salmon fishery, and while heritability of adult migration timing is high, the impacts are slight enough to be negligible. There is very limited tribal harvest of natural-origin fish within the John Day River subbasin; impacts from the recreational fishery are incidental to hatchery-origin fish harvest and are not selective. No phenotypic traits appear to be at risk as a result of this activity. The harvest rating is **low risk** for all traits.

Hatcheries: There are no steelhead hatchery programs operated within the population; therefore, the hatchery rating is **very low risk** for all traits.

Habitat: Altered flow profiles and increased temperatures have been in place for many generations and are ongoing; there is likely some selection on juvenile and adult migration timing.

> *Adult migration timing:* Low flows in the late summer and early fall in the John Day River likely expose adults that enter the river early to above normal mortality rates. Adult migration timing is highly heritable, but a negligible proportion of the population is likely subject to these effects. Thus, the impact of habitat changes on this trait is **low risk.**
>
> *Juvenile migration timing:* Late spring and early summer temperatures are elevated relative to historical conditions. There has likely been some effect on juvenile migration timing as temperatures can reach stressful levels in the John Day River mainstem in late spring and early summer in some years. Selection intensity is considered negligible and the heritability of this trait is moderate to low. The rating for this trait is **low risk**.

Other: A population of Caspian terns in the estuary has been artificially enhanced by a combination of increased habitat (created by dredge spoils) and artificially increased food availability (large-scale releases of hatchery smolts). These terns appear to exert a size-selective predation pressure that primarily impacts the large steelhead smolts. The rate of predation is highest during tern nesting season in May. This pressure may affect smolt migration timing.

> *Juvenile migration timing:* Steelhead smolts pass through the estuary from April to June. The relatively high predation (10%) on smolts in May could select for earlier and later

out-migrants. However, heritability of this trait has not been assessed, so we assume a moderate to low heritability. Because this predation occurs at the peak of migration, the impact of this selective factor is **low risk**.

There is only one trait that has a moderate rating for one selective activity. Therefore, the overall selectivity rating for this population is **low risk.**

Spatial Structure and Diversity Summary

The integrated spatial structure/diversity rating is **Moderate Risk** for the Upper Mainstem John Day River population (Table 4). The rating for Goal A (allowing natural rates and levels of spatially mediated processes) was **very low risk** since the current distribution is nearly identical to the historic distribution.

The rating for Goal B (maintaining natural levels of variation) was **moderate risk**. This risk rating was a result of a moderate rating for changes in major life history strategies. Additional genetics information needs to be assessed to determine current genetic variation and to examine for the degree of introgression of hatchery fish. The population was rated as high risk for out-of-DPS hatchery strays based on a limited time series of composite John Day River population hatchery fish observation data. Better population-specific spawner composition data are needed to better determine the out-of-DPS hatchery fraction. If there is significant hatchery introgression which affects the genetic variation of this population through time, then the risk rating for Goal B will increase, and the overall risk rating for spatial structure/diversity will increase.

Table 4. Upper Mainstem John Day River steelhead population spatial structure and diversity risk rating.

<table>
<tr><th rowspan="2">Metric</th><th colspan="5">Risk Assessment Scores</th></tr>
<tr><th>Metric</th><th>Factor</th><th>Mechanism</th><th>Goal</th><th>Population</th></tr>
<tr><td>A.1.a</td><td>VL (2)</td><td>VL (2)</td><td rowspan="3">Very Low Risk (Mean = 2)</td><td rowspan="3">Very Low Risk (Mean = 2)</td><td rowspan="12">Moderate Risk</td></tr>
<tr><td>A.1.b</td><td>VL (2)</td><td>VL (2)</td></tr>
<tr><td>A.1.c</td><td>VL (2)</td><td>VL (2)</td></tr>
<tr><td>B.1.a</td><td>M (0)</td><td>M (0)</td><td rowspan="3">Moderate Risk (0)</td><td rowspan="9">Moderate Risk (0)</td></tr>
<tr><td>B.1.b</td><td>L (1)</td><td>L (1)</td></tr>
<tr><td>B.1.c</td><td>L (1)</td><td>L (1)</td></tr>
<tr><td>B.2.a(1)</td><td>H (-1)</td><td rowspan="4">High Risk (-1)</td><td rowspan="4">High Risk (-1)</td></tr>
<tr><td>B.2.a(2)</td><td>L (1)</td></tr>
<tr><td>B.2.a(3)</td><td>L (1)</td></tr>
<tr><td>B.2.a(4)</td><td>VL (2)</td></tr>
<tr><td>B.3.a</td><td>L (1)</td><td>L (1)</td><td>L (1)</td></tr>
<tr><td>B.4.a</td><td>L (1)</td><td>L (1)</td><td>L (1)</td></tr>
</table>

Overall Viability Rating

The Upper Mainstem John Day River summer steelhead population does not currently meet the ICTRT criteria for viable status (Figure 7). However, the population does meet criteria to be rated as **MAINTAINED**. Overall abundance and productivity is rated at **Moderate Risk.** The 10-year geometric mean abundance of natural-origin spawners is 524, which is only 52% of the minimum abundance threshold of 1,000. The 20-year geometric mean productivity (2.14 R/S; Table 6) exceeds the minimum required productivity of 1.35 R/S at the abundance threshold and the lower end of the adjusted standard error is above the 25% risk level. Overall spatial structure and diversity is also rated at **Moderate Risk** due to loss in life history diversity and high risk for spawner composition. In order for this population to achieve a viable rating, an increase in abundance is required so that abundance/productivity risk is reduced to low risk.

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	**HV**	**HV**	**V**	**M**
	Low (1-5%)	**V**	**V**	**V**	**M**
	Moderate (6 – 25%)	**M**	**M**	**M** **Upper Mainstem John Day River**	**HR**
	High (>25%)	**HR**	**HR**	**HR**	**HR**

Figure 7. Upper Mainstem John Day River summer steelhead population risk ratings integrated across the four viable salmonid population (VSP) metrics. ***Viability Key: HV – Highly Viable; V – Viable; M – Maintained; HR – High Risk; Shaded cells - does not meet viability criteria (darkest cells are at greatest risk).***

Data Summary – Upper Mainstem John Day River

Data type: Redd count expansion - Index area redd counts expanded to total population estimate by applying ratio of average redd densities (samples across all areas to samples from index reaches) from EMAP surveys. Assumed 2.1 fish per redd.
Smolt-to-Adult Return rate (SAR): Mid-Columbia composite series (see *Methods*).

Table 5. Upper Mainstem John Day River steelhead population abundance and productivity data used for curve fits and R/S analysis. Bold values were used in estimating the current productivity (Table 6).

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	SAR Adj. Factor	Adj. Rtns	Adj. R/S
1979	**215**	**1.00**	**215**	**1168**	**5.43**	**1.94**	**2265**	**10.53**
1980	1031	1.00	1031	1808	1.75	0.50	913	0.89
1981	**701**	**1.00**	**701**	**2790**	**3.98**	**0.68**	**1905**	**2.72**
1982	801	1.00	801	3470	4.33	0.46	1586	1.98
1983	964	1.00	964	3576	3.71	0.52	1873	1.94
1984	1150	1.00	1150	2419	2.10	0.65	1564	1.36
1985	2143	1.00	2143	1060	0.49	0.46	487	0.23
1986	3275	1.00	3275	1169	0.36	0.94	1102	0.34
1987	3520	1.00	3520	1315	0.37	2.18	2862	0.81
1988	4235	1.00	4235	1209	0.29	0.99	1198	0.28
1989	839	1.00	839	680	0.81	0.96	654	0.78
1990	1321	1.00	1321	545	0.41	2.83	1542	1.17
1991	853	1.00	853	281	0.33	2.33	655	0.77
1992	1979	0.99	1950	385	0.19	1.88	723	0.37
1993	**535**	**0.99**	**528**	**503**	**0.94**	**1.18**	**595**	**1.11**
1994	968	0.97	943	521	0.54	1.07	558	0.58
1995	**197**	**0.94**	**185**	**460**	**2.33**	**1.23**	**564**	**2.86**
1996	**387**	**0.93**	**361**	**641**	**1.66**	**1.03**	**662**	**1.71**
1997	**359**	**0.95**	**341**	**931**	**2.59**	**0.76**	**711**	**1.98**
1998	**736**	**0.96**	**704**	**993**	**1.35**	**0.49**	**487**	**0.66**
1999	333	0.98	326					
2000	622	0.91	567					
2001	619	0.91	564					
2002	1494	0.90	1344					
2003	828	0.89	738					
2004	617	0.87	536					
2005	375	0.87	326					

Table 6. Upper Mainstem John Day River steelhead population geometric mean abundance and productivity estimates (values used for current productivity and abundance are shown in boxes).

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
delimited	median	75% threshold	median	75% threshold	1987-1998	1979-1998	geomean
Point Est.	1.78	2.23	1.73	2.14	0.93	1.01	524
Std. Err.	0.28	0.23	0.26	0.33	0.13	0.19	0.15
count	10	7	10	7	12	20	10

Table 7. Upper Mainstem John Day River steelhead population stock-recruitment curve fit parameter estimates. Biologically unrealistic or highly uncertain values are highlighted in grey.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	1.07	0.24	n/a	n/a	0.54	0.69	62.1	1.05	0.21	n/a	n/a	0.76	0.24	57.1
Const. Rec	1000	160	n/a	n/a	n/a	n/a	48.1	981	120	n/a	n/a	n/a	n/a	37.2
Bev-Holt	9.20	12.17	1181	325	0.11	0.88	50.2	18.52	40.52	1063	228	0.27	0.27	39.8
Hock-Stk	3.56	1.80	291	155	0.11	0.88	50.3	4.58	0.56	215	0	0.26	0.32	39.7
Ricker	2.38	0.62	0.00061	0.00015	0.24	0.75	52.6	2.15	0.48	0.00055	0.00013	0.43	0.02	47.2

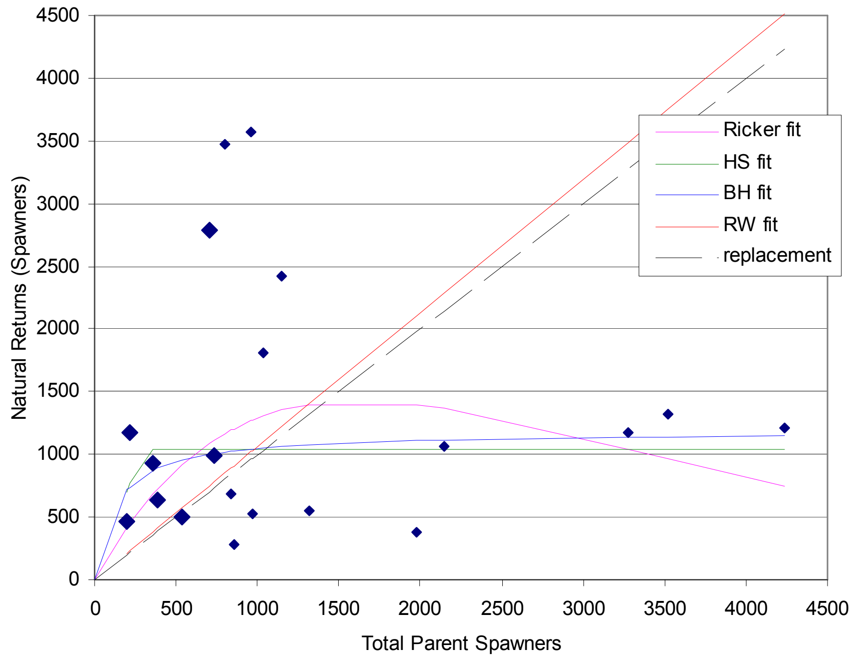

Figure 8. Upper Mainstem John Day River summer steelhead population stock recruitment curves. Bold points were used in estimating the current productivity. Data were not adjusted for marine survival.

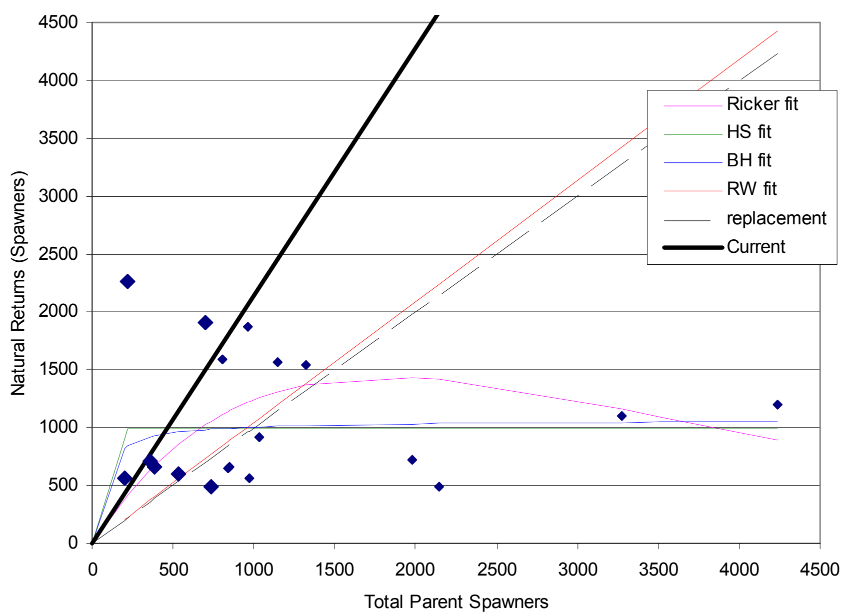

Figure 9. Upper Mainstem John Day River summer steelhead population stock recruitment curves. Bold points were used in estimating the current productivity. Data were adjusted for marine survival. Function labeled "Current" is a Hockey Stick function derived by fixing the slope of the ascending limb at the geometric mean productivity at low to moderate abundance (Table 2) and fitting a capacity estimate to the data series.

Umatilla River Summer Steelhead Population

The Umatilla River summer steelhead population (Figures 1, 2) is one of three populations in the Umatilla/Walla Walla Rivers MPG within the Mid-Columbia River DPS. All three populations in this MPG are summer run.

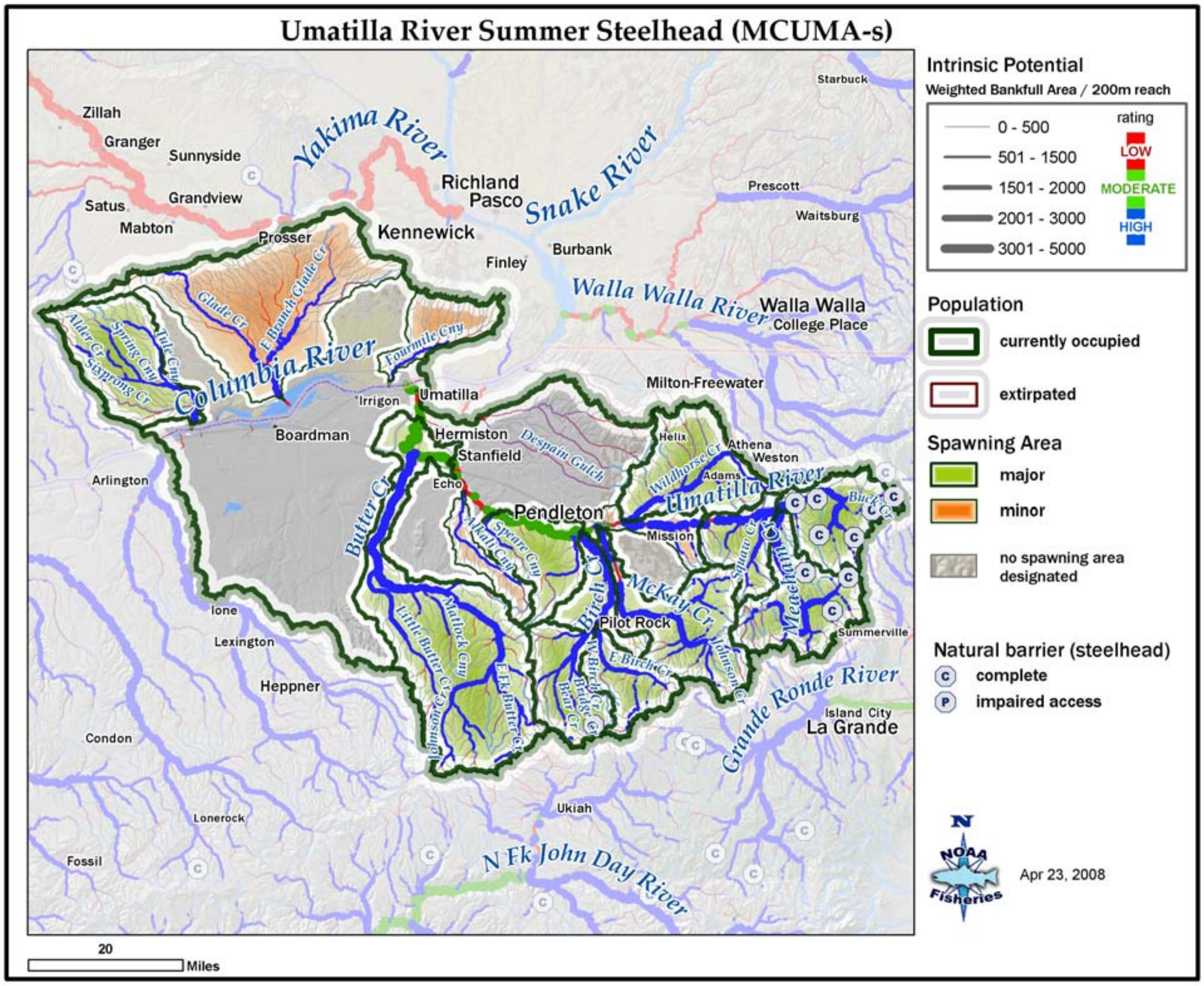

Figure 1. Umatilla River summer steelhead population boundary and major (MaSA) and minor (MiSA) spawning areas.

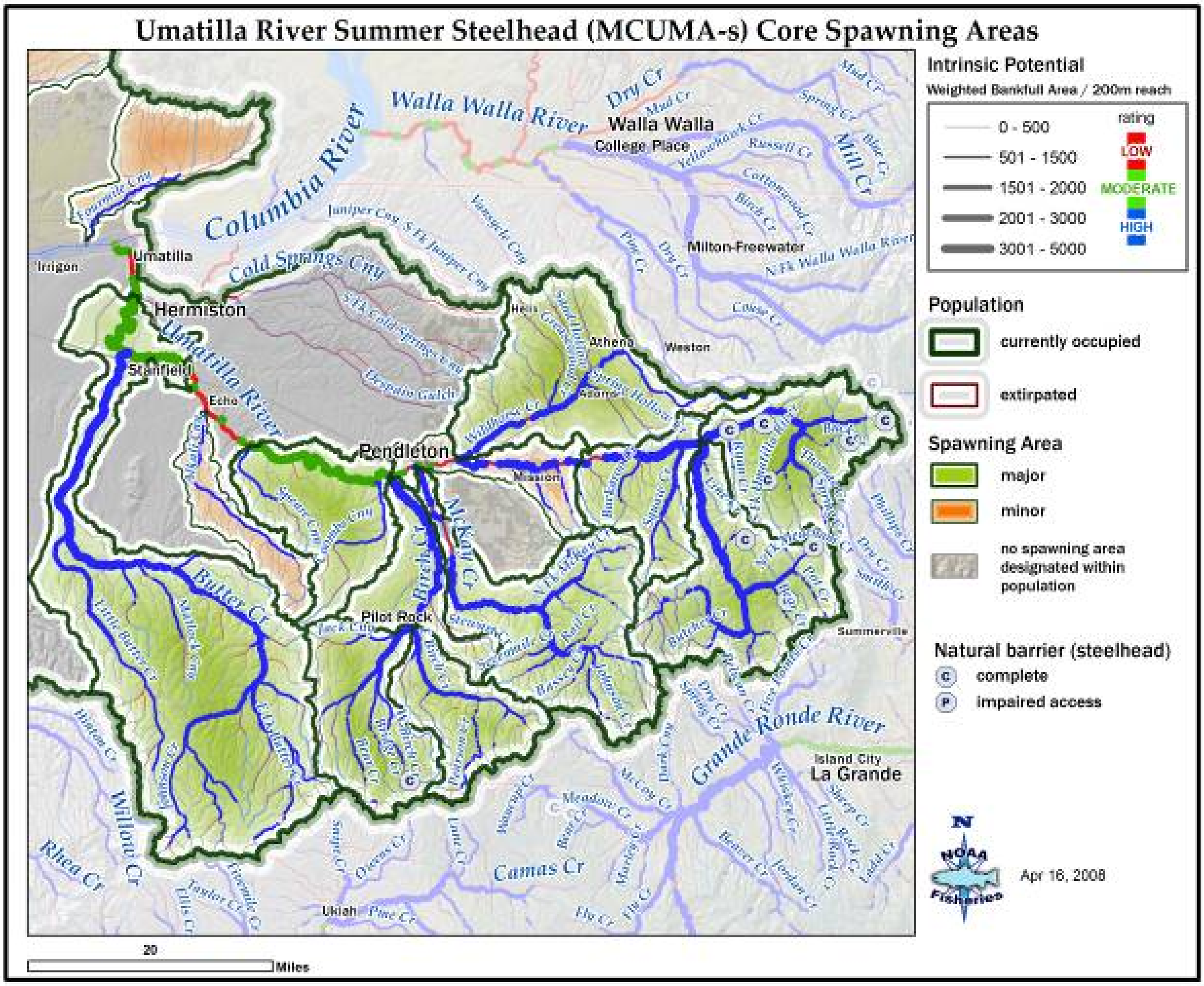

Figure 2. Umatilla River summer steelhead population boundary and core major (MaSA) and minor (MiSA) spawning areas.

The Interior Columbia Technical Recovery Team (ICTRT) classified the Umatilla River population as "large" in size and complexity (Table 1) based on historical habitat potential. A steelhead population classified as large has a mean minimum abundance threshold of 1,500 natural-origin spawners with sufficient intrinsic productivity (≥ 1.26 recruits per spawner at the minimum abundance threshold) to achieve a 5% or less risk ("low risk") of extinction over a 100-year timeframe. In order for the Umatilla River population to achieve a 1% or less risk ("very low risk") of extinction over 100 years, productivity would need to be at or greater than 1.53 recruits per spawner at the minimum abundance threshold. The core production area for this population is the Umatilla River drainage (Figure 2). The population as defined by the ICTRT includes production from small, relatively isolated tributaries to the mainstem Columbia River entering downstream of the Umatilla River. Annual estimates of abundance for the downstream tributaries included as components of this population are not available. The Umatilla River drainage contains sufficient intrinsic potential habitat by itself to meet the definition of a large population. Given those considerations, the current abundance and productivity metrics for the Umatilla River are used to characterize abundance and productivity of the population.

Table 1. Umatilla River summer steelhead basin statistics and intrinsic potential analysis summary.

Drainage area (km^2)	10,457
Stream lengths km (total) [a]	2,322
Stream lengths km (below natural barriers) [a]	2,278
Branched stream area weighted by intrinsic potential (km^2)	7.531
Branched stream area km^2 (weighted and temp. limited) [b]	7.456
Total stream area weighted by intrinsic potential (km^2)	9.070
Total stream area weighted by intrinsic potential (km^2) temp limited [b]	3.415
Size / Complexity category	Large / "B" (dendritic structure)
Number of major spawning areas (MaSAs)	13
Number of minor spawning areas (MiSAs)	3

a. All stream segments ≥ 3.8m bankfull width were included.
b. Temperature limited areas were assessed by subtracting area where mean weekly modeled water temperature was > 22^{o}C.

Current Abundance and Productivity

Current (1967 to 2004) total abundance (number of adult spawners in natural production areas) has ranged from 771 in 1998 to 5,172 in 2002 (Figure 3). Spawner abundance estimates for natural and hatchery summer steelhead in the entire Umatilla River Basin were determined from complete counts of adult returns to Three Mile Falls Dam (TMFD) at river mile 3.7. These counts did not include removals or mortality at and above the dam in all years except brood years (BY) 1984-1987. Fish were enumerated using electronic counters (BY 1967-1983), trapping (BY 1988-2000), and a combination of trapping and video monitoring (BY 2001-present). For BYs 1984-1987 abundance estimates were made with mark-recapture estimates. Missing abundance data for BY 1971, 1972, and 1979 were reconstructed using the known mean brood age structure from BY 1991-1998 and all available counts of brood returns in years before and after the missing counts. Counts in BY 1976 and 1978 were also incomplete but not reconstructed. In these years, electronic counters only operated from 24 December – 31 May and 13 December – 9 March, respectively. Age structure was determined by reading about 100-150 scales per year collected from adults returning in BY 1994-2004. Missing run year age structure data before BY 1994 were estimated as the BY 1994-2004 mean age structure.

Several sets of missing data for removals and mortalities at and above TMFD were estimated from the best available data. Missing harvest removals were estimated from creel survey data collected from the non-tribal fishery from BY 1993-2004 and the tribal fishery from BY 1993-2001. Harvest of hatchery fish from BY 1988-1992 was estimated as the mean percent harvest of the hatchery run passed above TMFD from the later time period (2.5% non-tribal and 6.4% tribal). All harvested fish were assumed to be natural-origin before BY 1988. For years when harvest of natural-origin fish was allowed in the non-tribal fishery (before BY 1993), harvest was estimated as mean percent catch of the natural-origin run passed above TMFD (6.8 %) (1993-2004) corrected by the mean percent of catch released (26%). Tribal harvest for BYs 1967-1987 of hatchery and natural-origin steelhead was estimated as their respective mean percent harvest of their runs passed above TMFD (6.7% of the combined natural and hatchery run passed above TMFD). Missing broodstock removals in BY 1981 and 1982 were estimated as one natural-origin fish collected for brood per 750 smolts produced based on the ratio of brood collected and smolts released in the early 1980s. All 95 hatchery fish collected for brood in BY 1991 were assumed to have coded wire tags (CWTs) and were included in the total removal of 124 hatchery fish at TMFD for CWT recovery.

Recent year natural spawners include returns originating from naturally spawning parents, Umatilla River hatchery-origin fish and out-of-DPS spawners, primarily from the Snake River basin. Natural-origin fish have comprised an average of 73% of natural spawners since documentation of hatchery returns began in 1988. Since that time, the percentage of natural-origin spawners has ranged from 41% to 96%.

Abundance in recent years has been moderately variable. The 10-year (1995-2004) geometric mean abundance of natural-origin spawners was 1,472 (2,347 total spawners). During the period 1967-2000, recruits per spawner (R/S, in terms of spawner to spawner) for steelhead in the Umatilla River ranged from 0.3 in 1978 to 4.98 in 1998. The annual R/S estimates were adjusted to reflect the average smolt-to-adult return rate (SAR). The 20-year (1981-2000) geometric mean productivity was 1.50 R/S, adjusted for SAR and delimited at 75% (1,125 spawners) of the abundance threshold (Table 2).

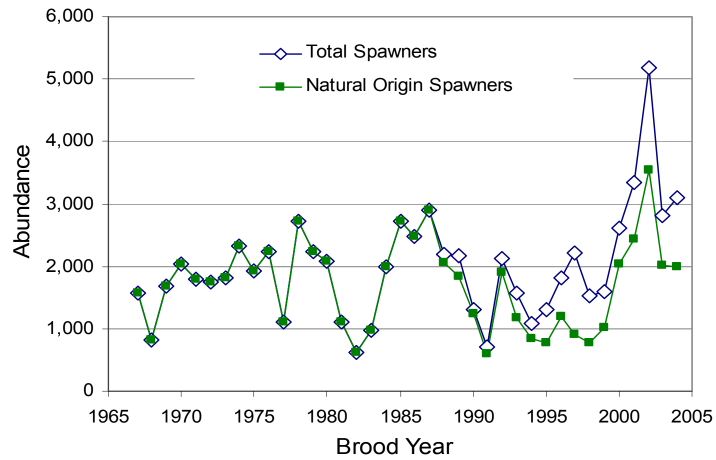

Figure 3. Umatilla River summer steelhead population spawner abundance estimates (1967-2004).

Table 2. Umatilla River summer steelhead population abundance and productivity.

Abundance/Productivity Statistics	Estimate	(Range)	
Abundance: natural-origin spawners (10-year geometric mean, range)	1472	(592-3542)	
Proportion: natural-origin spawners (10-year geometric mean, range)	0.73	(0.41-1.00)	
	Estimate	**(90% CI)[b]**	**SE**
Intrinsic productivity (20-year R/S, SAR adjusted & delimited) [a]	1.50	(1.11-2.03)	0.15
Productivity (20-year Beverton-Holt fit, SAR adjusted)	n/a		n/a
Trend Statistics (1980-2004)	**Estimate**	**(95% CI)**	**P>1.0**
ln(natural-origin spawner abundance)	1.01	(0.98-1.13)	
Population growth rate (λ): Hatchery effectiveness = **1.0**	0.99	(0.83-1.17)	0.41
Population growth rate (λ): Hatchery effectiveness = **0.0**	1.04	(0.86-1.25)	0.68

a. Delimited productivity excludes any recruit/spawner pair where the spawner number >75% of the population's minimum abundance threshold. This approach attempts to remove density dependence effects that may influence the productivity estimate.
b. Lower end of the 90% CI on productivity is used in evaluating the impact of parameter uncertainty on risk.

The Umatilla River summer steelhead population is at **Moderate Risk** for abundance and productivity metrics. The productivity is at **low risk** because the point estimate is above the 5% risk level and the adjusted standard error is above the 25% risk level. Abundance is at **moderate risk** because the point estimate is slightly below the 5% risk level (Figure 4).

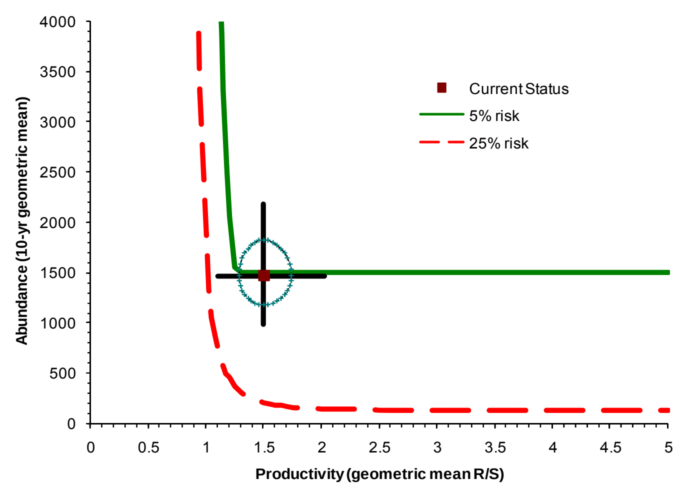

Figure 4. Umatilla River summer steelhead population current abundance/productivity (A/P) compared to the DPS viability curve. Ellipse = 1 SE about the point estimate. Error bars = 90% CI for A/P.

The trend in annual spawner abundance has been slightly positive since 1983; the population growth rate metric with no adjustment for relative hatchery effectiveness is 0.99. Annual variations in the estimated annual numbers of steelhead spawners in the Umatilla River fluctuated considerably over the 1980-2005 period. The general timing of peaks and declines in annual spawning numbers is similar to many other Mid-Columbia DPS steelhead populations—peak in the mid-1980s, increasing returns beginning in 2000 followed by an abrupt decline to early 1980s levels. The relative effectiveness of hatchery-origin spawners in this basin is not known. Hatchery proportions on the spawning grounds have averaged 27% over the recent period. As a sensitivity analysis, we recalculated the recent average population growth rate after setting the assumed relative hatchery effectiveness value to 0.0. The average population growth rate generated from the sensitivity model run was 1.04.

Spatial Structure and Diversity

The ICTRT has identified 13 historic major spawning areas (MaSAs) and 3 minor spawning areas (MiSAs) within the Umatilla River summer steelhead population. In addition, two MaSAs (Alder Creek and Glade Creek) and one MiSA (Fourmile Canyon) are direct tributaries to the Columbia River on the Washington side and were included in the Umatilla River population. We do consider these areas in the assessment of spatial structure/diversity for the Umatilla River steelhead population (Figure 5). Current spawning distribution is somewhat limited relative to historic and is concentrated in Birch Creek, Iskulpa Creek, Meacham Creek, Upper Umatilla River, and the North and South Forks of the Umatilla River. There is documented recent year spawning in both Glade Creek and Alder Creek subbasins (Yakama Indian Nation Fisheries Program 2005); however, we are uncertain if the distribution of spawners and the frequency of use meet the occupancy criteria.

Spawners within the Umatilla River population include natural-origin returns, hatchery-origin returns of Umatilla River origin broodstock, and hatchery strays primarily originating from the Snake River basin. Hatchery-origin fish comprise a significant proportion of the naturally spawning fish in most recent years.

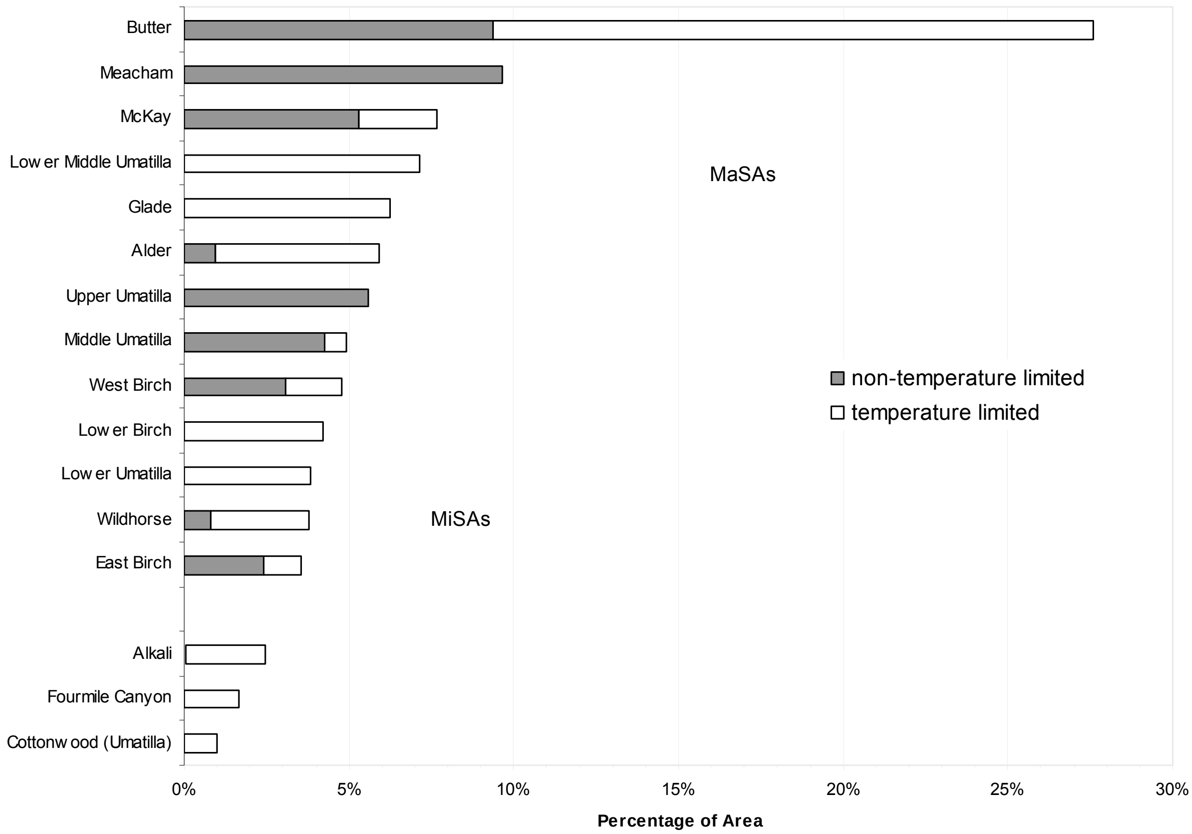

Figure 5. Umatilla River summer steelhead distribution of intrinsic potential habitat across major (MaSAs) and minor spawning areas (MiSAs). White bars represent current temperature limited areas that could potentially have had historical temperature limitations.

Factors and Metrics

A.1.a. Number and spatial arrangement of spawning areas

The Umatilla River population has 13 MaSAs and 3 MiSAs which are distributed in a complex dendritic pattern. Historically the major production areas included Butter Creek, Meacham Creek, McKay Creek, Iskulpa Creek, Birch Creek, and the middle and upper Umatilla River. Spawning distribution has been reduced significantly from the intrinsic historic distribution. Currently 8 of the 13 MaSAs are occupied. The Butter Creek, Lower Umatilla, Lower Middle Umatilla, and McKay MaSAs are unoccupied. One of the three MiSAs is currently occupied (Cottonwood Creek). Figure 6 shows both Alder and Glade MaSAs as unoccupied; however, recent information indicates that these MaSAs may be occupied. The map has not been updated because the actual spawner distribution has not been determined. Although there has been a significant reduction in spawner distribution, the Umatilla River population rates at **low risk** because it has more than four occupied MaSAs in a dendritic configuration. We have rated this metric as low risk instead of very low risk because of the uncertainty in occupancy of the Alder and Glade MaSAs.

A.l.b. Spatial extent or range of population

The current spawner distribution is reduced substantially from the intrinsic distribution. Based on the Oregon Department of Fish and Wildlife (ODFW) spawner database and the Washington Department of Fish and Wildlife (WDFW) information, 8 of 13 (61.5%) MaSAs are currently occupied and only 1 of 3 (33.3%) MiSAs is occupied (Figure 6). The spatial extent and range of spawning distribution has been reduced to an extent that this population rates as **moderate risk** for this metric. There are 12 index area spawning survey sites in the Umatilla River population. Recent survey results will be analyzed for use in future viability assessments.

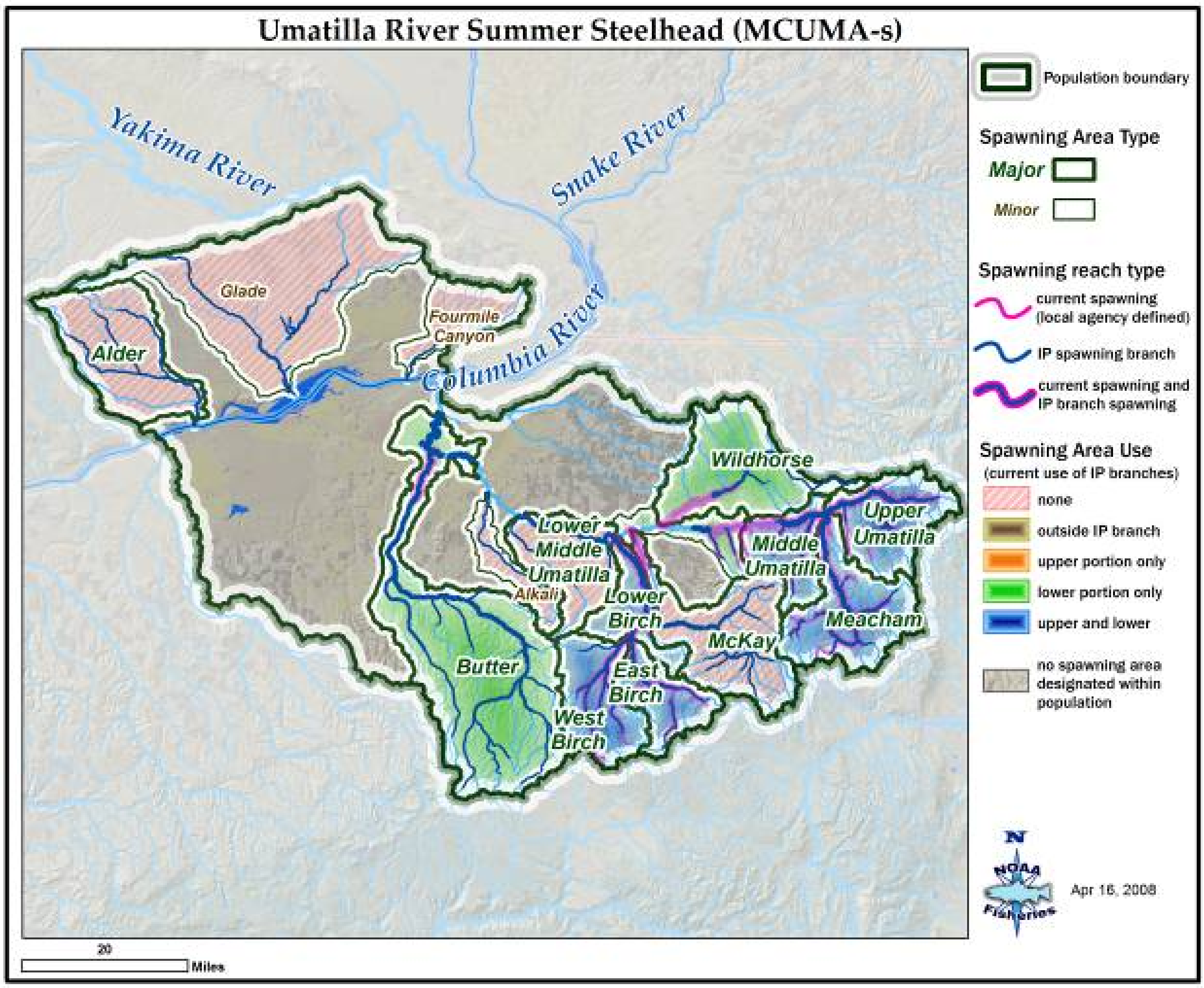

Figure 6. Umatilla River summer steelhead population current spawning distribution and spawning area occupancy designations.

A.1.c. Increase or decrease in gaps or continuities between spawning aggregates

There has been a change in gaps and continuity as a result of the loss of spawning in the McKay Creek and Lower Middle Umatilla River drainages as well as very limited production in the lower portion of the Butter Creek MaSA. Although some spawning occurs in lower Butter Creek, habitat conditions are such that no significant sustained production occurs. Due to the low level of production in Butter Creek it does not serve any connectivity role within or between populations. In addition, less than 75% of the intrinsic MaSAs are currently occupied, thus the rating is **moderate risk** for this metric.

B.1.a. Major life history strategies

We have no observational data to allow any direct comparisons of historic and current life history strategies. Therefore, we have used EDT (Ecosystem Diagnosis and Treatment) analyses and habitat conditions to infer loss of life history strategies. Flow and temperature changes in the Umatilla River basin have limited movement patterns for both juvenile and adult steelhead. Juvenile steelhead cannot move into some mainstem rearing reaches above McKay Creek for over-summer rearing due to high temperatures. Adults are unable to enter the Umatilla River in early fall in many years because of the lack of flow as well as high water temperatures. Large areas, such as Butter and McKay Creek drainages, no longer support production. Flow enhancement projects have improved conditions for adult fall migration and summer rearing, particularly below McKay Creek. Past habitat changes have undoubtedly reduced diversity in life history pathways. However, it does not appear that any major pathways have been lost, and improved fall flows have provided conditions allowing adult migration throughout the fall season. The Umatilla River summer steelhead population still exhibits a diverse age structure, including multiple ages at smolt migration, multiple years of ocean residence, and repeat spawning. The population rated at **moderate risk** because all pathways exist but there has been significant reduction in variability and changes in distribution.

B.1.b. Phenotypic variation

We have no data to assess loss or substantial change is phenotypic traits, therefore we infer based on habitat changes. The changes in flow patterns and temperature profile within the Umatilla River and the mainstem Columbia River have likely resulted in reduced variation in adult and juvenile migration patterns. Juveniles have a much narrower window to successfully migrate out of the Umatilla River in the spring because water temperatures increase earlier than historically. Even though flow enhancement has improved conditions for adult fall migration, the run-timing distribution is likely truncated from historic. Adults cannot enter the river in early fall in some years because of flow and temperature limitations. We have rated the Umatilla River population at **moderate risk** because two or more phenotypic traits have changed.

B.1.c. Genetic variation

The genetics data for Umatilla River summer steelhead indicate that there is significant within-population variation between Umatilla River steelhead and other populations in the MPG (Touchet River and Walla Walla River). In addition, the within-population diversity shows no indication of impairment. The hatchery fish are similar to natural-origin fish as expected, since they are offspring of natural-origin fish. There are out-of-DPS spawners, primarily from Snake River stocks, spawning naturally in the Umatilla River basin. Given the degree of genetic variation, the Umatilla River population rated at **low risk** for this metric. Given that the genetics samples used in the analyses were collected in the mid-1980s prior to significant hatchery influence, the genetic analyses need to be updated with recent samples.

B.2.a. Spawner composition

(1) *Out-of-DPS spawners*: A significant number of out-of-DPS spawners enter the Umatilla River. Estimates of out-of-DPS spawners are based on expanded CWT recoveries of hatchery fish at TMFD. From 1993-2004, out-of-DPS spawners have comprised from 1.8-9.7% (mean = 4.8%) of the fish that arrived at TMFD. These strays are not selectively removed because they are not distinguishable from Umatilla Hatchery supplementation steelhead. Given the length of time of influence and the hatchery fraction, we have rated the Umatilla River population at **moderate risk** for out-of-DPS spawners. This risk rating assumes that strays were present at a similar rate for the past three generations and that the proportion observed at TMFD represents proportions on the spawning grounds.

(2) *Out-of-MPG spawners from within the DPS:* There have been few, if any, out-of-MPG within-DPS spawners recovered in the Umatilla River basin, thus the rating is **very low risk** for this metric.

(3) *Out-of-population spawners from within the MPG:* There are two out-of-population within-MPG hatchery programs which could provide stray fish to the Umatilla River: Lyons Ferry Fish Hatchery releases in the Walla Walla River and Touchet River hatchery fish. No strays from these two programs have been observed. The rating is **very low risk** for this metric.

(4) *Within-population hatchery spawners:* The Umatilla River population is supplemented annually with hatchery fish produced from natural-origin broodstock collected at TMFD. The supplementation program has been ongoing since the late 1980s. Since 1993, Umatilla Hatchery fish have comprised an average of 29.4% of the naturally spawning fish. We characterize this program as using "best management practices" based on the following:

- Most of the broodstock collected annually are natural-origin fish.
- Mating protocols provide for a high number of family groups annually.
- There presently is no culling or grading of parr or smolts.
- Hatchery smolts are released in localized areas of the middle and upper mainstem.
- There does not appear to be any genetic differentiation between hatchery and natural-origin fish.

Given that best practices are used, the average hatchery fraction is 29%, and the program has been underway for three generations, the rating is **moderate risk** for within-population hatchery fish.

The spawner composition rating is **high risk** due to the moderate risk ratings for both the out-of-DPS spawners and the within-population hatchery proportions.

B.3.a. Distribution of population across habitat types

The intrinsic potential distribution encompasses seven ecoregions, four of which account for at least 10% of the distribution (Figure 7, Table 3). There has been only one significant shift greater than 67% in the ecoregion distribution (Pleistocene Lake Basins). This population rates at **low risk**.

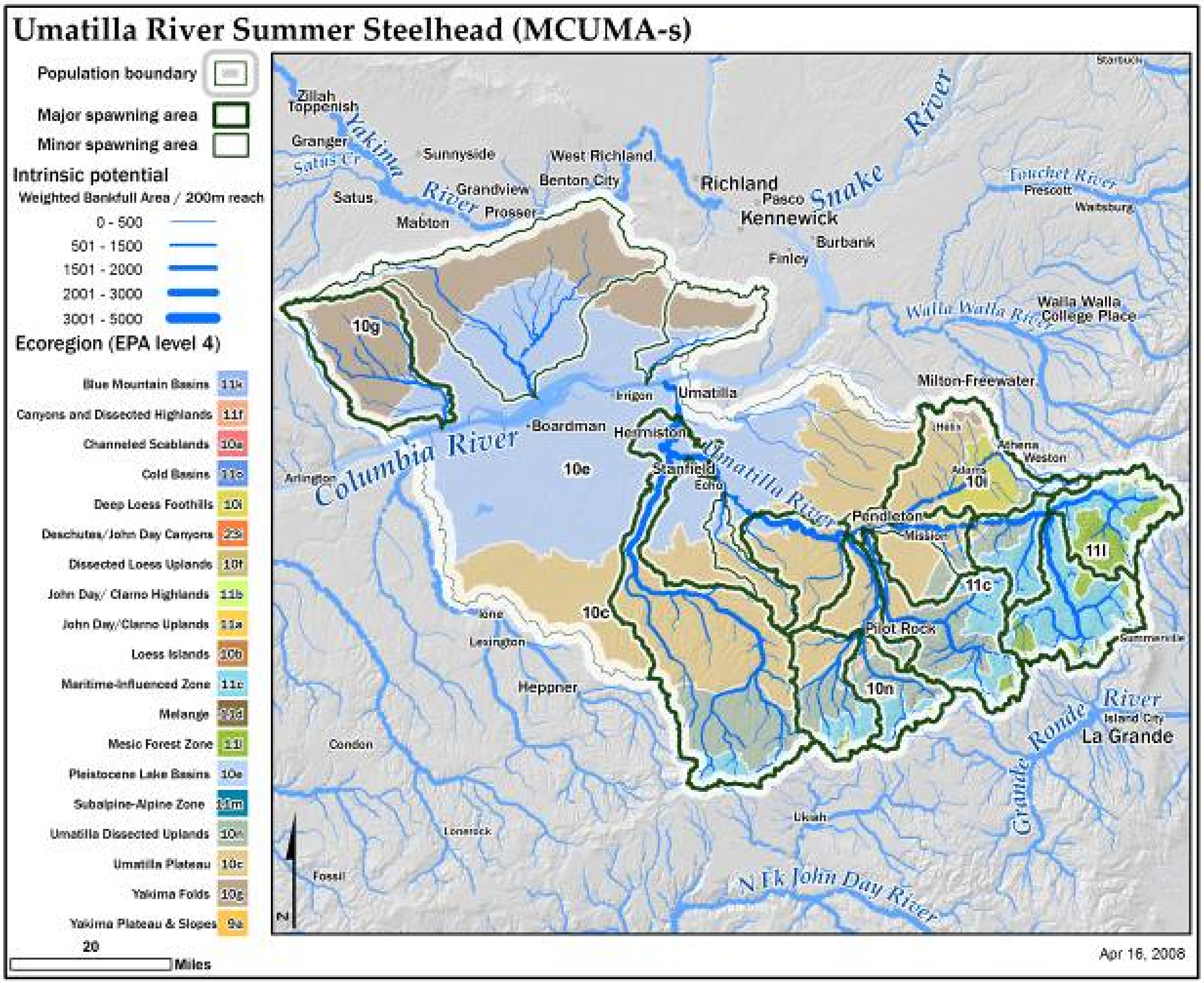

Figure 7. Umatilla River steelhead population spawning distribution across EPA level IV ecoregions.

Table 3. Umatilla River steelhead population proportion of current spawning areas across EPA level IV ecoregions.

Ecoregion	% of historical spawning area (non-temp. limited)	% of currently occupied spawning area (non-temp. limited)
Umatilla Plateau	32.4	27.0
Pleistocene Lake Basins	25.0	6.2
Yakima Folds	5.3	0.0
Deep Loess Foothills	2.7	1.2
Umatilla Dissected Uplands	15.3	19.3
Maritime-influenced Zone	17.7	42.9
Mesic Forest Zone	1.7	3.4

B.4.a. Selective change in natural processes or selective impacts

Hydropower system: This population passes three dams on the lower mainstem Columbia River in its seaward and spawning migrations. The hydropower system and associated reservoirs appear to impose some selection on smolt and adult migration timing. All hydropower effects have persisted for multiple generations and are ongoing.

> *Juvenile migration timing:* Changes in flow and temperature patterns likely inhibit out-migration in late spring as temperatures rise and flow decreases, causing increased travel time, increased energy expenditure and greater physiological stresses. Given the number of dams that this population must cross, and likely increased mortality as the season progresses, overall selection intensity on the population is likely moderate. Heritability of this trait has not been assessed so we assume a moderate to low heritability. Therefore the impact of the hydrosystem on this trait is **moderate**.

> *Adult migration timing:* Umatilla River adult migrants are affected by thermal blocks that are larger in size and longer in duration relative to historic conditions in the Columbia River system. These result in delays, likely result in increased energy expenditure (due to increased temperatures) and may result in increased straying. Adult migration timing is highly heritable. The proportion of fish in the population affected is relatively unknown, although the effect likely results in low mortality. The effect is highly variable from year to year and in some years no thermal barriers develop. We rated the selection intensity as low. Thus, the impact of the hydrosystem on this trait is **moderate.**

Harvest: Harvest has the potential to affect migration timing, maturation timing and size. However, recent harvest rates for A-run steelhead in the Columbia River mainstem are generally less than 10% annually. Although some harvest may be size-selective for larger fish, the selective mortality would affect only slightly more than 2% of the total population. There may be a very slight advantage for earlier returning fish as a result of the timing of the Chinook salmon fishery, and while heritability of adult migration timing is high, the impacts are slight enough to be negligible. There is very limited tribal harvest of natural-origin fish within the Umatilla River subbasin and impacts from the recreational fishery are incidental to hatchery fish harvest. No phenotypic traits appear to be at risk as a result of this activity. The harvest rating is **low risk** for all traits.

Hatcheries: Hatchery broodstock collection has the potential to disproportionately remove specific fish (e.g., of a certain size or timing) from the wild population. The Umatilla River summer steelhead hatchery program is operated to provide hatchery fish for harvest and to supplement natural production. Broodstock are collected at TMFD. Typically, 100 natural-origin and 20 hatchery-origin fish are collected for broodstock. Broodstock are collected representatively so that their run-timing, sex, and age of broodstock mimic that of the total run at TMFD. We are uncertain of the degree of substructure within the basin or if there are different characteristics between spawning aggregates in the basin. If life history characteristics differ between different aggregates, there is the possibility that collection of broodstock representing TMFD timing may be differentially impacting spawning aggregates. However, the broodstock removal does not appear to be selective at the population level and no phenotypic traits appear to be at risk as a result of this activity. The hatchery rating is **low risk** for all traits.

Habitat: Altered flow profiles and increased temperatures, which have been in place for many generations and are ongoing, likely impose some selection on juvenile and adult migration timing.

> *Juvenile migration timing:* Late spring and early summer temperatures are substantially elevated relative to historical conditions. There has likely been some impact on juvenile migration timing as temperatures reach stressful levels early in the summer, essentially truncating migration timing. Heritability of this trait is moderate to low and the selection intensity is assumed to be low, thus the habitat rating for this trait is **low**.

> *Adult migration timing:* Late summer and early fall flows are often low in the Umatilla River and likely expose adults that enter the river early to above normal mortality rates. Adult migration timing is highly heritable but a relatively low proportion of the population is likely subject to these effects, and we rated the selection intensity as moderate. Thus, the impact of habitat changes on this trait is **moderate.**

Other: A population of Caspian terns in the estuary has been artificially enhanced by a combination of increased habitat (created by dredge spoils) and artificially increased food availability (large-scale releases of hatchery smolts). These terns appear to exert a size-selective predation pressure that primarily impacts the large steelhead smolts. The rate of predation is highest during tern nesting season in May. This pressure may affect smolt migration timing.

> *Juvenile migration timing.* Steelhead smolts pass through the estuary from April to June. The relatively high predation (10%) on smolts in May could select for earlier and later out-migrants. However, heritability of this trait has not been assessed, so we assume a moderate to low heritability. Because this predation occurs at the peak of migration, the impact of this selective factor is **low risk**.

The adult migration timing trait has two moderate ratings and the juvenile migration timing trait has one moderate rating. Therefore, the overall selectivity rating for the Umatilla River steelhead population is **moderate risk**.

Spatial Structure and Diversity Summary

The integrated spatial structure/diversity rating is **Moderate Risk** (Table 4) for the Umatilla River summer steelhead population. The rating for Goal A (allowing natural rates and levels of spatially mediated processes) was **moderate risk**. There has been significant reduction in spawner distribution relative to intrinsic potential distribution. This reduction has caused significant increases in gaps between spawning areas as well as disrupted continuity.

The rating for Goal B (maintaining natural levels of variation) was **moderate risk**. Habitat changes have been significant in the Umatilla River basin resulting in changes to flow profiles and elevated temperatures. These changes have resulted in impacts to life history diversity and phenotypic trait variation. The out-of-DPS spawners in combination with local origin hatchery fish spawning naturally put the population at high risk for spawner composition. Hydrosystem effects and within-basin habitat changes have likely resulted in selective mortality of the adult run timing phenotypic trait, resulting in a moderate risk rating for the selectivity metric.

Table 4. Umatilla River summer steelhead population spatial structure and diversity risk rating summary.

<table>
<tr><th rowspan="2">Metric</th><th colspan="5">Risk Assessment Scores</th></tr>
<tr><th>Metric</th><th>Factor</th><th>Mechanism</th><th>Goal</th><th>Population</th></tr>
<tr><td>A.1.a</td><td>L (1)</td><td>L (1)</td><td rowspan="3">Moderate Risk
(Mean = 0.33)</td><td rowspan="3">Moderate Risk
(Mean = 0.33)</td><td rowspan="12">**Moderate Risk**</td></tr>
<tr><td>A.1.b</td><td>M (0)</td><td>M (0)</td></tr>
<tr><td>A.1.c</td><td>M (0)</td><td>M (0)</td></tr>
<tr><td>B.1.a</td><td>M (0)</td><td>M (0)</td><td rowspan="3">Moderate Risk (0)</td><td rowspan="9">Moderate Risk (0)</td></tr>
<tr><td>B.1.b</td><td>M (0)</td><td>M (0)</td></tr>
<tr><td>B.1.c</td><td>L (1)</td><td>L (1)</td></tr>
<tr><td>B.2.a(1)</td><td>M (0)</td><td rowspan="4">High Risk
(-1)</td><td rowspan="4">High Risk (-1)</td></tr>
<tr><td>B.2.a(2)</td><td>VL (2)</td></tr>
<tr><td>B.2.a(3)</td><td>VL (2)</td></tr>
<tr><td>B.2.a(4)</td><td>M (0)</td></tr>
<tr><td>B.3.a</td><td>L (1)</td><td>L (1)</td><td>L (1)</td></tr>
<tr><td>B.4.a</td><td>M (0)</td><td>M (0)</td><td>M (0)</td></tr>
</table>

Overall Viability Rating

The Umatilla River summer steelhead population does not meet viability criteria. However, the population does meet criteria to be rated as **MAINTAINED** (Figure 8). Overall abundance and productivity is rated at **Moderate Risk.** The 10-year geometric mean abundance of natural-origin spawners is 1,472, which is 98.1% of the minimum abundance threshold of 1,500. The 20-year geometric mean productivity is 1.50 R/S with the lower end of the adjusted standard error above the 25% risk level. This productivity exceeds the minimum intrinsic productivity criteria of 1.26 R/S, thus placing the productivity at low risk. Overall spatial structure and diversity is also rated at **Moderate Risk.** Improvement in many of the spatial structure/diversity metrics and a small increase in the average abundance will raise the population to viable status.

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	**HV**	**HV**	**V**	**M**
	Low (1-5%)	**V**	**V**	**V**	**M**
	Moderate (6 – 25%)	**M**	**M**	**M Umatilla River**	**HR**
	High (>25%)	**HR**	**HR**	**HR**	**HR**

Figure 8. Umatilla River summer steelhead population risk ratings integrated across the four viable salmonid population (VSP) metrics. ***Viability Key: HV – Highly Viable; V – Viable; M – Maintained; HR – High Risk; Shaded cells - does not meet viability criteria (darkest cells are at greatest risk).***

Data Summary – Umatilla River Summer Steelhead Population

Data type: Estimated number of annual spawners estimated based on annual counts at Three Mile Falls Dam in the lower Umatilla River. Natural-origin proportion estimated based on hatchery and natural-origin counts, adjusted for removals or mortalities above the dam.
SAR: Mid-Columbia SAR index (incorporates the Deschutes, Umatilla, Snake, and Upper Columbia River steelhead series).

Table 5. Umatilla River steelhead population abundance and productivity data used for curve fits and R/S analysis. Bold values were used in estimating the current productivity (Table 6).

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	SAR Adj. Factor	Adj. Rtns	Adj. R/S
1981	**1,115**	**1.00**	**1,115**	**2,635**	**2.36**	**0.68**	**1799**	**1.61**
1982	**609**	**1.00**	**609**	**2,640**	**4.33**	**0.46**	**1207**	**1.98**
1983	**974**	**1.00**	**974**	**2,525**	**2.59**	**0.52**	**1322**	**1.36**
1984	1,998	1.00	1,998	1,943	0.97	0.65	1257	0.63
1985	2,732	1.00	2,732	1,559	0.57	0.46	716	0.26
1986	2,487	1.00	2,487	1,017	0.41	0.94	959	0.39
1987	2,911	1.00	2,911	1,144	0.39	2.18	2490	0.86
1988	2,201	0.93	2,050	1,573	0.71	0.99	1558	0.71
1989	2,179	0.84	1,841	1,105	0.51	0.96	1062	0.49
1990	1,301	0.96	1,247	873	0.67	2.83	2471	1.90
1991	**700**	**0.85**	**592**	**593**	**0.85**	**2.33**	**1384**	**1.98**
1992	2,118	0.90	1,915	1,380	0.65	1.88	2594	1.22
1993	1,572	0.74	1,165	713	0.45	1.18	842	0.54
1994	**1,074**	**0.79**	**847**	**885**	**0.82**	**1.07**	**948**	**0.88**
1995	1,298	0.60	783	1,154	0.89	1.23	1414	1.09
1996	1,811	0.66	1,194	2,975	1.64	1.03	3070	1.70
1997	2,215	0.41	914	2,210	1.00	0.76	1687	0.76
1998	1,529	0.50	771	3,836	2.51	0.49	1880	1.23
1999	1,595	0.64	1,020	1,071	0.67	0.52	554	0.35
2000	2,621	0.77	2,030	2,584	0.99	1.00	2584	0.99
2001	3,353	0.73	2,444					
2002	5,172	0.68	3,542					
2003	2,822	0.71	2,015					
2004	3,109	0.64	2,003					

Table 6. Umatilla River steelhead population geometric mean abundance and productivity estimates (values used for current productivity and abundance are shown in boxes).

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
delimited	median	75% threshold	median	75% threshold	1989-2000	1981-2000	geomean
Point Est.	1.24	1.79	1.14	1.50	1.07	1.06	1472
Std. Err.	0.24	0.33	0.19	0.15	0.02	0.06	0.22
count	10	5	10	5	12	20	10

Table 7. Umatilla River steelhead population stock-recruitment curve fit parameter estimates. Biologically unrealistic or highly uncertain values are highlighted in grey (included for comparison only - not used in the assessment of current abundance/productivity).

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	0.94	0.14	n/a	n/a	0.27	0.60	44.5	0.89	0.12	n/a	n/a	0.31	0.31	40.3
Const. Rec	1512	174	n/a	n/a	n/a	n/a	34.8	1438	147	n/a	n/a	n/a	n/a	30.2
Bev-Holt	22.07	116.06	1587	446	0.21	0.44	37.5	8.48	15.93	1625	425	0.20	-0.15	32.7
Hock-Stk	1.92	0.70	806	310	0.21	0.45	38.1	1.98	0.64	735	249	0.20	-0.18	32.8
Ricker	2.70	0.88	0.00060	0.00017	0.22	0.45	38.0	2.35	0.69	0.00055	0.00016	0.21	-0.14	33.4

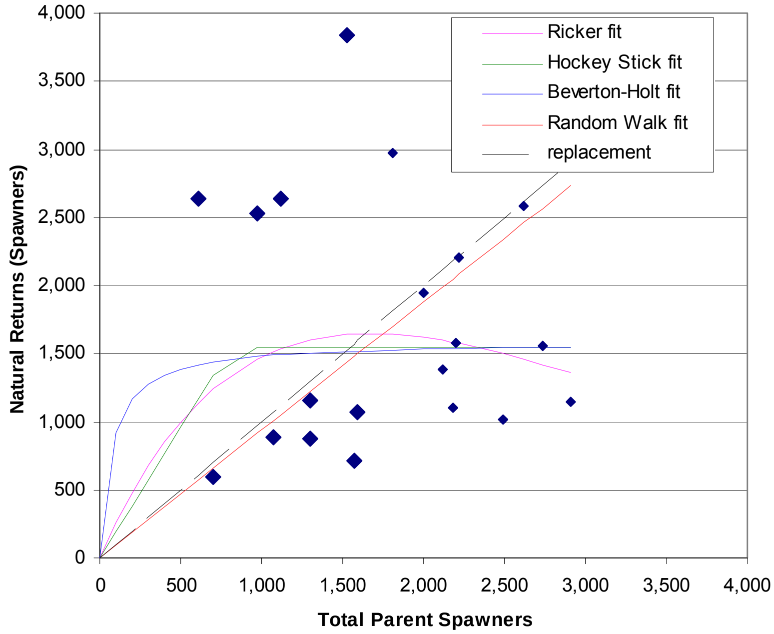

Figure 9. Umatilla River summer steelhead population stock recruitment curves. Bold points were used in estimating the current productivity. Data were not adjusted for marine survival.

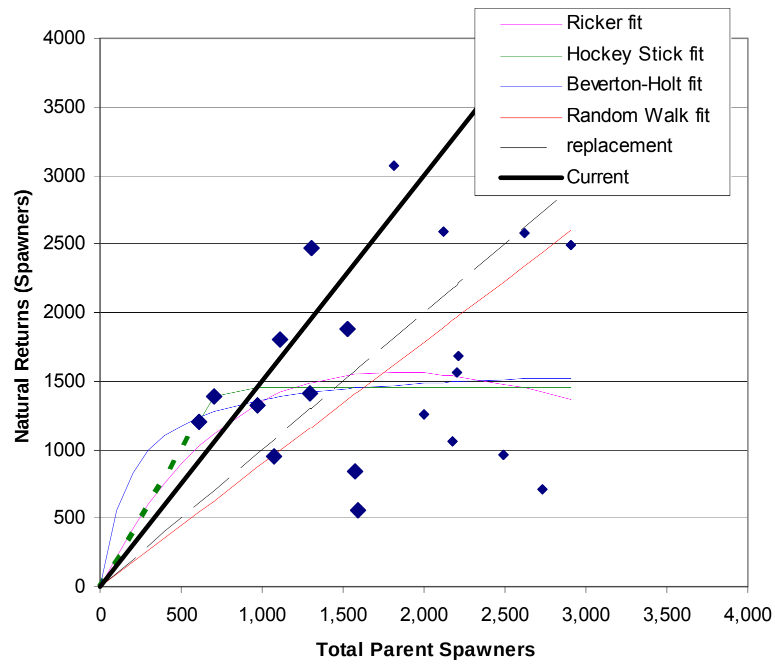

Figure 10. Umatilla River summer steelhead population stock recruitment curves. Bold points were used in estimating the current productivity. Data were adjusted for marine survival. Function labeled "Current" is a Hockey Stick function derived by fixing the slope of the ascending limb at the geometric mean productivity at low to moderate abundance (Table 2) and fitting a capacity estimate to the data series.

Walla Walla River Summer Steelhead Population

The Walla Walla River summer steelhead population (Figure 1) is one of three populations in the Umatilla/Walla Walla Rivers MPG within the Mid-Columbia River DPS. All three populations in this MPG are summer run.

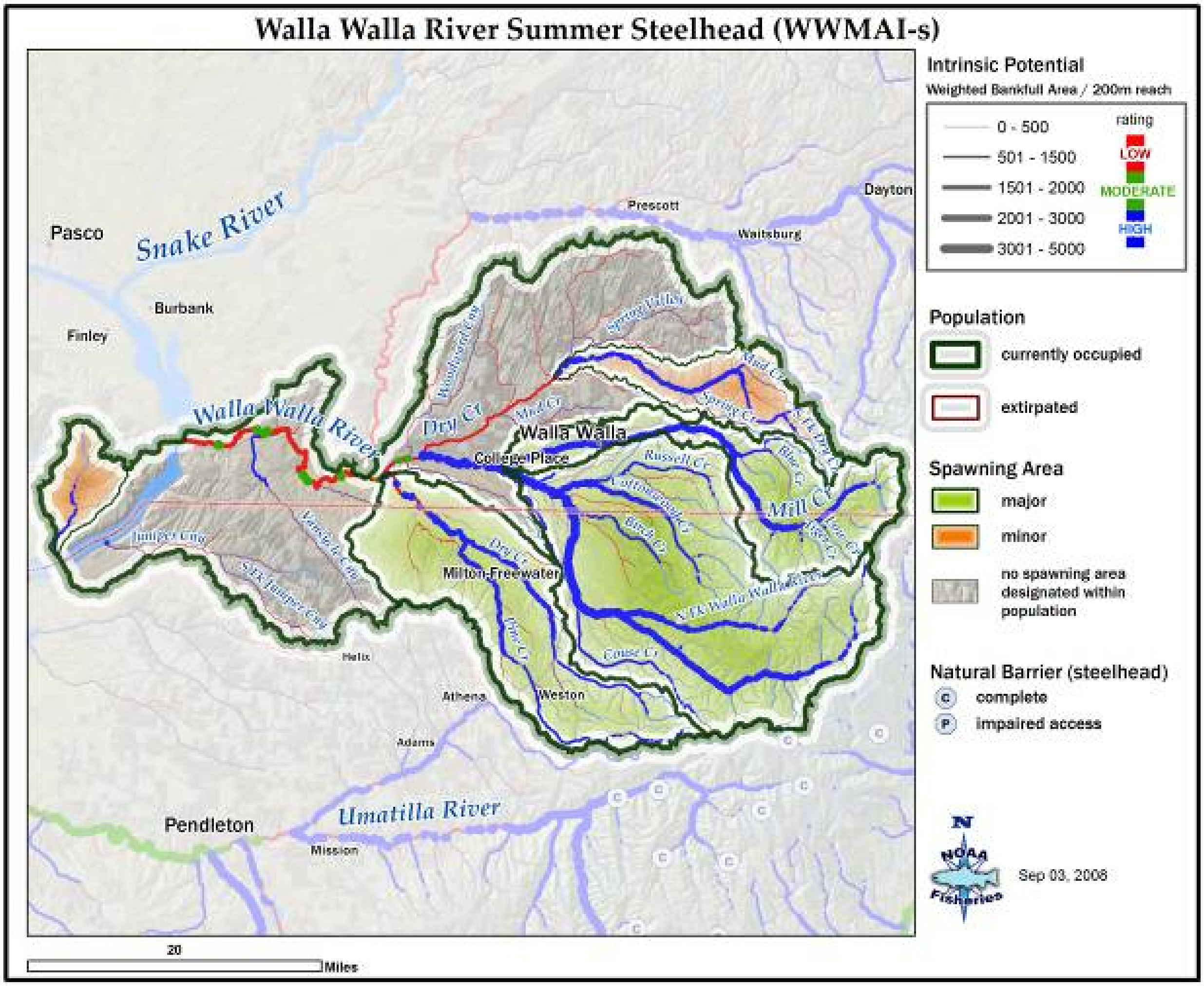

Figure 1. Walla Walla River summer steelhead population boundary and major (MaSA) and minor (MiSA) spawning areas.

The Interior Columbia Technical Recovery Team (ICTRT) classified the Walla Walla River population as "intermediate" in size and complexity based on historical habitat potential (Table 1). A steelhead population classified as intermediate has a mean minimum abundance threshold of 1,000 natural-origin spawners with sufficient intrinsic productivity (≥ 1.35 recruits per spawner at the minimum abundance threshold) to achieve a 5% or less risk ("low risk") of extinction over a 100-year timeframe. In order for the Walla Walla River population to achieve a 1% or less risk ("very low risk") of extinction over 100 years, productivity would need to be at or greater than 1.64 recruits per spawner at the minimum abundance threshold.

Table 1. Walla Walla River summer steelhead population basin statistics and intrinsic potential analysis summary.

Drainage area (km^2)	2,988
Stream lengths km (total) [a]	1,147
Stream lengths km (below natural barriers) [a]	1,111
Branched stream area weighted by intrinsic potential (km^2)	2.448
Branched stream area km^2 (weighted and temp. limited) [b]	0.774
Total stream area weighted by intrinsic potential (km^2)	3.711
Total stream area weighted by intrinsic potential (km^2) temp limited [b]	0.907
Size / Complexity category	Intermediate / "B" (dendritic)
Number of major spawning areas (MaSAs)	3
Number of minor spawning areas (MiSAs)	2

a. All stream segments ≥ 3.8m bankfull width were included.
b. Temperature limited areas were assessed by subtracting area where mean weekly modeled water temperature was > 22°C.

Current Abundance and Productivity

Current (1993 to 2003) total spawner abundance (number of adult spawners in natural production areas) has ranged from 421 in 1999 to 1,811 in 2002 (Figure 2). Abundance of natural-origin summer steelhead in the portion of the Walla Walla River basin above Nursery Bridge Dam (NBD; North Fork, South Fork, and Couse Creek) was determined from counts of adult returns to NBD at river mile 44. These counts did not include removals or mortality at and above the dam. Fish were enumerated using trap counts and mark-recapture methods from brood years (BY) 1993-2001, and video counts in BY 2002, 2003, and 2005. Mark-recapture methods were used to account for fish that jumped the dam. Mark-recapture methods were discontinued following dam modifications that are thought to prevent fish from jumping the dam (T. Bailey, Oregon Department of Fish & Wildlife, personal communication). Almost all hatchery fish trapped at NBD were removed during BY 1993-1999. The BY 2003 count (547) was incomplete as the west side ladder was opened from February 21 through March 11 due to passage problems with the east side ladder. Fish passing through the west bank ladder were not counted. The number of uncounted fish in BY 2003 was estimated as the mean percent of the run that passed NBD from February 21-March 11 during BY 1993-2001 (12.3%). The percent of the run passing NBD during that time period ranged from 5.4 % to 18.7% during BY 1993-2001. Counts were not available for BY 2004 because video equipment was inoperable during most of the migration season. Missing abundance data for BY 2004 were reconstructed using mean brood age structure estimated from BY 1991-1998 data and all available counts of brood returns in years before and after the 2004 missing count. Age structure was determined by scale analyses from adults returning in 1993-1995. Missing run year age structure data after 1995 were estimated as the 1993-1995 mean age structure. Origin (natural or hatchery) could not be determined from video monitoring (2002-2005) and was estimated as the 1993-2001 mean percent of natural (96.4%) and hatchery (3.6%) origin fish in the run to NBD. Spawner abundance for the entire Walla Walla River natural-origin summer steelhead population was estimated by expanding abundance of spawners above NBD by a factor of 1.503. The expansion estimate was developed from the ratio of current smolt capacity of the entire population divided by the current smolt capacity above NBD. The current smolt capacity estimates were developed based on Ecosystem-Diagnosis-Treatment (EDT) analyses of current conditions. Harvest removals were not factored into the estimate of spawning escapement above NBD. Tribal and non-tribal fishing pressure is thought to be minimal (T. Bailey, personal communication).

Recreational angling was prohibited from 1996-2002 and limited to retention of hatchery-origin fish after 2002.

Recent natural spawners include returns originating from naturally spawning adults and from outside-DPS spawners that originate from Lyons Ferry Hatchery releases in the lower Walla Walla River. Natural-origin fish have comprised an average of 98% over the 11 years of available data. Throughout the period, the percentage of natural-origin fish has ranged from 95.4% to 99.8%.

Abundance in recent years has been moderately variable. The 10-year (1996-2005) geometric mean abundance of natural-origin spawners was 650 (Table 3.3.2-2). During the period 1993-2000, recruits per spawner (R/S, in terms of spawner to spawner) for steelhead in the Walla Walla River ranged from 0.39 in 1993 to 2.65 in 1998. The annual R/S estimates were adjusted to reflect the average smolt-to-adult return rate (SAR). The 8-year (1993-2000) geometric mean productivity was 1.34 R/S, adjusted for SAR and delimited at 75% (750 spawners) of the abundance threshold (Table 2).

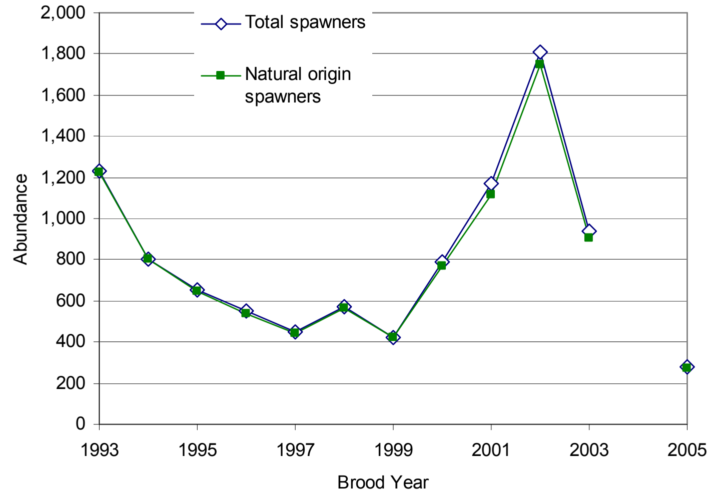

Figure 2. Walla Walla River summer steelhead population spawner abundance estimates (1993-2005).

Table 2. Walla Walla River summer steelhead population abundance and productivity estimates.

Abundance/Productivity Statistics	**Estimate**	**(Range)**	
Abundance: natural-origin spawners (10-year geometric mean, range)	650	(270-1746)	
Proportion: natural-origin spawners (10-year geometric mean, range)	0.98	(0.95-1.00)	
	Estimate	**(90% CI)**[b]	**SE**
Intrinsic productivity (8-year R/S, SAR adjusted & delimited) [a]	1.34	(1.05-1.71)	0.12
Productivity (8-year Beverton-Holt fit, SAR adjusted)	n/a		n/a
Trend Statistics (1980-2005) [c]	**Estimate**	**(95% CI)**	**P>1.0**
ln(natural-origin spawner abundance)	n/a		
Population growth rate (λ): Hatchery effectiveness = **1.0**	n/a		
Population growth rate (λ): Hatchery effectiveness = **0.0**	n/a		

a. Delimited productivity excludes any recruit/spawner pair where the spawner number >75% of the population's minimum abundance threshold. This approach attempts to remove density dependence effects that may influence the productivity estimate.
b. Lower end of the 90% CI on productivity is used in evaluating the impact of parameter uncertainty on risk.
c. Insufficient data series to calculate 1980- 2005 trend metrics.

The Walla Walla River summer steelhead population is at **Moderate Risk** based on current abundance and productivity. The point estimate falls between the 5% and 25% risk curves (Figure 3). The moderate risk rating should be viewed with caution given two considerations: 1) the time series is short, with only eight brood years, and there is considerable uncertainty if the data adequately represent the true value; and 2) there is considerable uncertainty associated with the amount of spawning and production that occurs within the

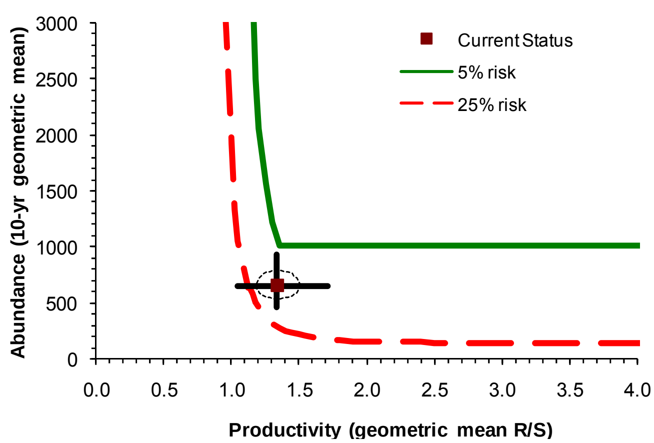

Figure 3. Walla Walla River summer steelhead population current abundance/productivity (A/P) compared to the DPS viability curve. Ellipse = 1 SE about the point estimate. Error bars = 90% CI for A/P.

population outside of the area above Nursery Bridge Dam, particularly in Mill Creek. Better information relating abundance above Nursery Bridge Dam to the remaining area in the population is needed to reduce this data uncertainty.

The natural-origin spawner abundance series for the Walla Walla steelhead population was initiated in 1993; therefore it was not possible to calculate the 1980-present trend metrics. The general pattern over the 1993 to 2005 period is similar to the patterns in returns over the same period for other Mid-Columbia DPS steelhead populations: declining annual abundance followed by a short increasing trend beginning in 1999 and then an abrupt decline after 2003.

Spatial Structure and Diversity

The ICTRT has identified three historic major spawning areas (MaSAs) and two minor spawning areas (MiSAs) within the Walla Walla River steelhead population (Figure 4). Two small watersheds, which are classified as MiSAs and which empty directly into the Columbia River below the Walla Walla River confluence, are included in the Walla Walla population boundaries (Juniper Canyon, OR and Switzler, WA). Current spawning distribution is substantially reduced relative to the historic intrinsic distribution. Current production is concentrated in the North and South Fork Walla Walla River, Couse Creek, Mill Creek and Dry Creek (WA). It should be noted that the map does not show Yellowhawk Creek, which runs between Mill Creek and Cottonwood Creek, and there is spawning in the lower reaches of Yellowhawk Creek. Spawners within the Walla Walla population are primarily natural-origin fish with a small proportion of hatchery strays which are Snake River-origin fish produced at Lyons Ferry Hatchery and released into the lower Walla Walla River. Hatchery fish were removed at NBD by trapping until 1999 when it was discontinued and replaced with video monitoring. Currently, hatchery fish pass above NBD to spawn naturally.

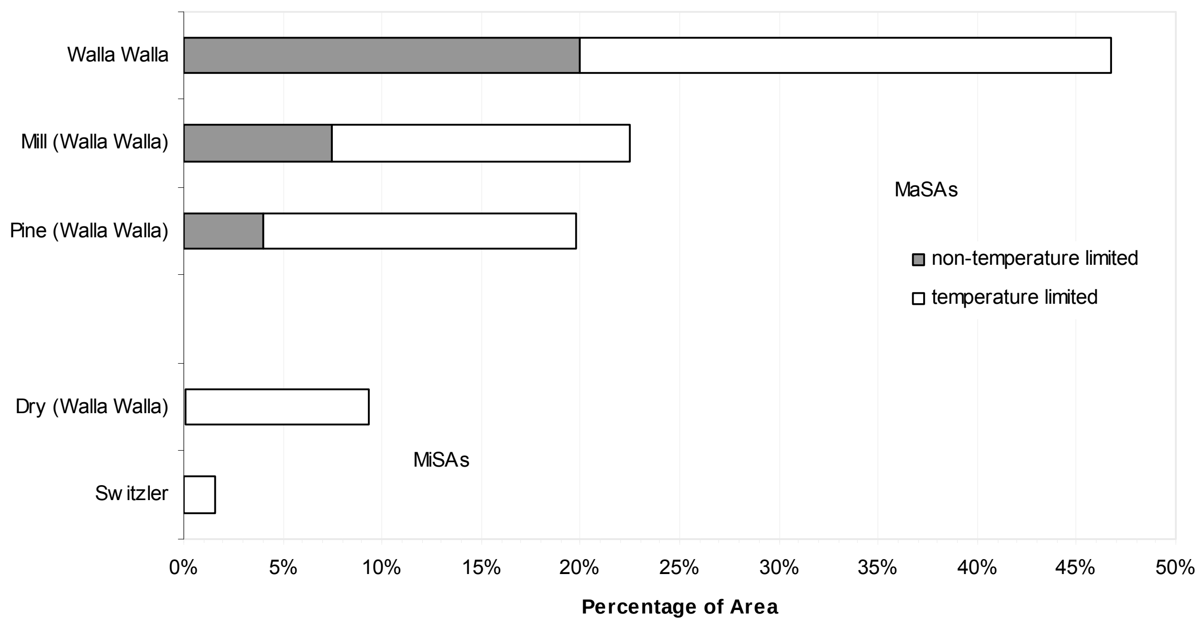

Figure 4. Walla Walla River summer steelhead population distribution of intrinsic potential habitat across major and minor spawning areas. White bars represent current temperature limited areas that could potentially have had historical temperature limitations.

Factors and Metrics

A.1.a Number and spatial arrangement of spawning areas

The Walla Walla River population has three MaSAs and two MiSAs distributed in a dendritic pattern. Historically, major production areas included Pine Creek, South Fork Walla Walla River, North Fork Walla Walla River, Mill Creek, Cottonwood Creek and Dry Creek (WA). Spawning distribution has been reduced significantly relative to historic distribution. Currently two of three of the MaSAs are occupied, including Walla Walla and Mill. Spawning and rearing do not occur in the Pine Creek MaSA. One of two MiSAs is occupied—Dry Creek. Even though there has been significant reduction in distribution, the population rated at **low risk** because it has two MaSAs occupied in a dendritic pattern.

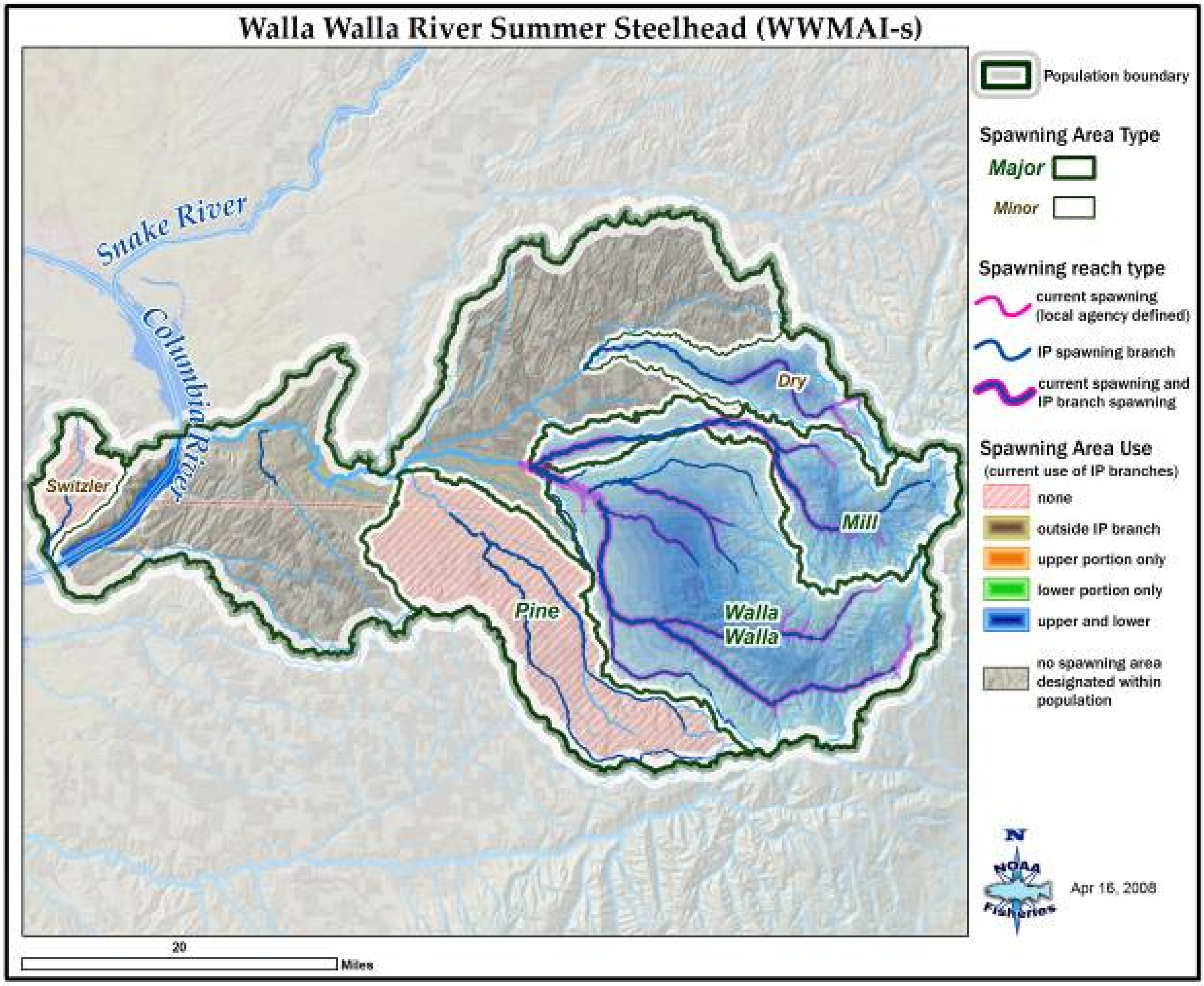

Figure 5. Walla Walla River summer steelhead population current spawning distribution and spawning area occupancy designations.

A.l.b. Spatial extent or range of population

Based on comparisons of the current spawner distribution databases from the Oregon Department of Fish and Wildlife (ODFW) and the Washington Department of Fish and Wildlife (WDFW) with the intrinsic distribution, there has been substantial reduction in the range. Currently two of three MaSAs (67%) and one of two MiSAs (50%) are occupied (Figure 5). Due to the significant reduction, the population is rated at **moderate risk** because less than 75% (but greater than 50%) of the historical MaSAs are currently occupied. . There are limited spawning survey data to evaluate occupancy for this population. Additional spawning survey data needs to be collected to improve future viability assessments.

A.1.c. Increase or decrease in gaps or continuities between spawning aggregates

There have been significant changes in gaps and continuity as a result of the loss of spawning in the Pine Creek MaSA and the Switzler MiSA. The loss of occupancy in these areas has increased the distance between the Walla Walla population and other Mid-Columbia DPS steelhead populations. Due to these considerations, and because less than 75% of the historical MaSAs are occupied, the population is rated at **moderate risk** for this metric.

B.1.a. Major life history strategies

We have no data to allow any direct comparisons between historic and current life history strategies. Flow and temperature changes and barriers in the Walla Walla River basin have limited movement patterns of juvenile and adult steelhead during recent decades. Juvenile steelhead are unable to use many of the mainstem areas during the summer months due to high temperatures and low flows. Adults are unable, in some years, to enter the Walla Walla River in early fall. These types of changes have likely resulted in reduced life history diversity. However, it does not appear that any major life history pathways have been lost. The age structure and run-timing of adults is within the range observed for other summer steelhead populations. The population exhibits multiple ages of smolt out-migration and ocean residence time, as well as repeat spawners. The habitat changes have likely resulted in significant reduction in variability as well as a change in distribution of life history pathways, thus we have rated the population at **moderate risk** for this metric.

B.1.b. Phenotypic variation

There are no data to assess loss or substantial change in phenotypic traits, therefore we infer from habitat changes. The changes in flow patterns and temperature profile within the Walla Walla River, as well as the effects of adult passage barriers, have likely resulted in reduced adult and juvenile phenotypic traits. Juveniles have narrower windows for successful out-migration through the Walla Walla River as well as through the Columbia River. Adults cannot enter and migrate through the Walla Walla River during late summer and early fall in some years due to temperature limitations. The Walla Walla population rated at **moderate risk** because of likely change in mean and variability of two or more phenotypic traits.

B.1.c. Genetic variation

The genetic information for the Walla Walla population demonstrates levels of within and between-population differentiation that are healthy and do not indicate any substantial change from likely historical condition. In addition, there is little signal of introgression of outside-DPS hatchery fish which are known to be present in spawning areas. The population rated at **low risk** for genetic variation.

B.2.a. Spawner composition

(1) *Out-of-DPS spawners*: There are out-of-DPS spawners present in the population that originate from Lyons Ferry hatchery releases into the mainstem Walla Walla River. Until 1999, wandering hatchery fish destined for the upper Walla Walla River basin were removed at Nursery Bridge Dam. Since that time, hatchery fish have passed upstream to spawn naturally. The removal of these out-of-basin hatchery-origin fish had reduced the hatchery proportion and the risk to the natural population. We estimated that about 2% of the natural spawners have been out-of-basin hatchery-origin fish for recent generations. With 2% out-of-DPS spawners for the past three generations the population is rated at **moderate risk**. It should be noted that two management actions may influence the future proportion of the out-of-DPS spawners. Annual smolt releases from Lyons Ferry Hatchery have been reduced substantially which will reduce the source of hatchery adults. On the other hand, hatchery fish are no longer removed at Nursery Bridge Dam which results in an increase in the proportion of hatchery spawners above this location. The overall effect of these two offsetting management changes is unknown.

(2) *Out-of-MPG spawners from within the DPS*: There are no documented out-of-MPG within-DPS strays in this population, so the rating is **very low risk** for this metric.

(3) *Out-of-population spawners within the MPG*: There are no documented out-of-population within-MPG strays, so the rating is **very low risk** for this metric. However, this risk rating may increase in the future due to potential within-population Touchet River hatchery strays.

(4) *Within-population hatchery spawners*: There is no within population hatchery program, so the population is rated at **very low risk** for this metric.

The overall spawner composition rating is **moderate risk** due to the moderate risk of out-of-DPS hatchery strays spawning naturally in this population.

B.3.a. Distribution of population across habitat types

The intrinsic potential distribution of the Walla Walla River population encompassed six ecoregions, of which four accounted for 10% or more of the ecoregion distribution (Figure 6, Table 3). Within these four ecoregions there have been no significant changes in the proportions from the historic intrinsic to the current distribution. The population is rated at **very low risk** because all historical ecoregions are occupied, there are more than four currently occupied, and there have been no substantial changes in ecoregion occupancy (Table 3).

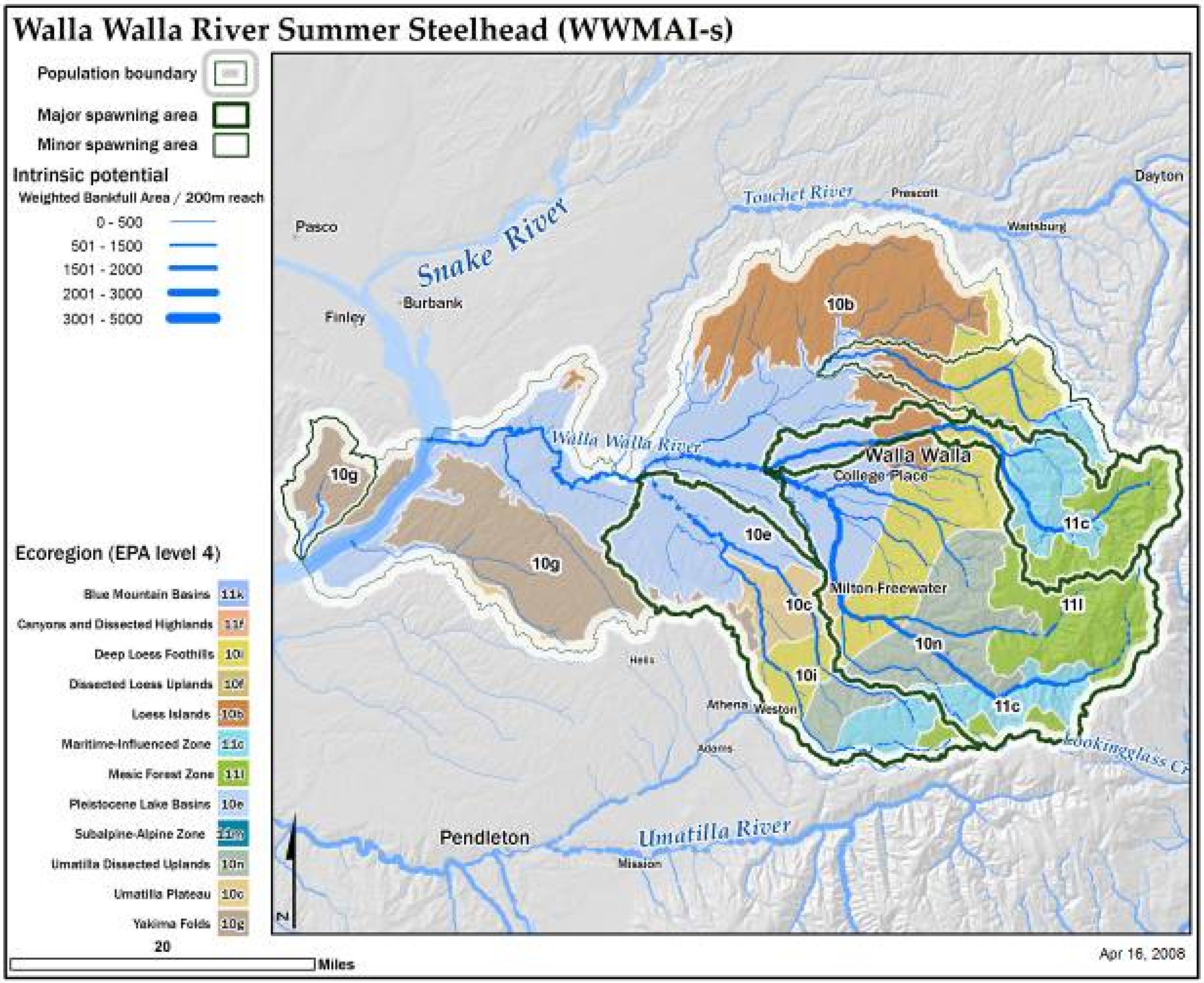

Figure 6. Walla Walla River summer steelhead population spawning distribution across EPA level IV ecoregions.

Table 3. Walla Walla River summer steelhead population proportion of current spawning areas across EPA level IV ecoregions.

Ecoregion	% of historical spawning area (non-temp. limited)	% of currently occupied spawning area (non-temp. limited)
Deep Loess Foothills	19.0	30.4
Loess Islands	8.0	0.9
Maritime-Influenced Zone	11.1	18.8
Mesic Forest Zone	4.6	6.6
Pleistocene Lake Basins	45.9	25.8
Umatilla Dissected Uplands	11.3	17.6

B.4.a. Selective change in natural processes or selective impacts

Hydropower system: This population passes four dams on the lower mainstem Columbia River in its seaward and spawning migrations. The hydropower system and associated reservoirs appear to impose some selection on smolt and adult migration timing. All hydropower effects have persisted for multiple generations and are ongoing.

> *Juvenile migration timing:* Changes in flow and temperature patterns likely inhibit out-migration in late spring as temperatures rise and flow decreases, causing increased travel time, energy expenditure and physiological stress. Given the number of dams that this population must cross, and likely increased mortality as the season progresses, overall selection intensity on the population is likely moderate. Heritability of this trait has not been assessed so we assume a moderate to low heritability. Therefore the impact of the hydrosystem on this trait is **moderate**.
>
> *Adult migration timing:* Adult migrants are affected by thermal blocks that are larger in size and longer in duration relative to historic conditions in the Columbia River system. These result in delays, likely result in increased energy expenditure (due to increased temperatures) and may result in increased straying. Adult migration timing is highly heritable. The proportion of fish in the population affected is relatively unknown, although the effect likely results in low mortality. The effect is highly variable from year to year and in some years no thermal barriers develop. We rated the selection intensity as low. Thus, the impact of the hydrosystem on this trait is **moderate.**

Harvest: Harvest has the potential to affect migration timing, maturation timing and size. However, recent harvest rates for A-run steelhead in the Columbia River mainstem are generally less than 10% annually. Although some harvest may be size-selective for larger fish, the selective mortality would affect slightly greater than 2% of the largest fish in the population. There may be a very slight advantage for earlier returning fish as a result of the timing of the Chinook salmon fishery, and while heritability of adult migration timing is high, the selection intensity is low enough to be negligible. There is very limited tribal harvest of natural-origin fish within the Walla Walla River subbasin and impacts from the recreational fishery are incidental to hatchery fish harvest No phenotypic traits appear to be at risk as a result of this activity. The harvest rating is **low risk** for all traits.

Hatcheries: No natural-origin adults are collected for broodstock within the population; therefore, the hatchery rating is **low risk** for all traits.

Habitat: Altered flow profiles and increased temperatures, which have been in place for many generations and are ongoing, likely impose some selection on juvenile and adult migration timing.

> *Juvenile migration timing:* Late spring and early summer temperatures are elevated relative to historical conditions. There has likely been some effect on juvenile migration timing as temperatures reach stressful levels early in the summer. Juvenile migration timing has likely been truncated; however we are uncertain of the degree of change. Heritability of this trait is moderate to low, and the selection intensity is assumed to be low, therefore the impact of habitat changes on this trait is **low.**

Adult migration timing: Late summer and early fall flows are often low in the Walla Walla River and likely expose adults that enter the river early to above normal mortality rates. Adult migration timing is highly heritable but a relatively low proportion of the population is likely subject to these effects, and we rated the selection intensity as moderate. Thus, the impact of habitat changes on this trait is **moderate.**

Other: A population of Caspian terns in the estuary has been artificially enhanced by a combination of increased habitat (created by dredge spoils) and artificially increased food availability (large-scale releases of hatchery smolts). These terns appear to exert a size-selective predation pressure that primarily impacts the large steelhead smolts. The rate of predation is highest during tern nesting season in May. This pressure may affect smolt migration timing.

Juvenile migration timing. Steelhead smolts pass through the estuary from April to June. The relatively high predation (10%) on smolts in May could select for earlier and later out-migrants. However, heritability of this trait has not been assessed, so we assume a moderate to low heritability. Because this predation occurs at the peak of migration, the impact of this selective factor is **low risk**.

The adult migration timing trait has two moderate ratings and the juvenile migration timing trait has one moderate rating. Therefore, the overall selectivity rating for the Walla Walla River steelhead population is **moderate risk**.

Spatial Structure and Diversity Summary

The integrated spatial structure/diversity rating for the Walla Walla River summer steelhead population is **Moderate Risk** (Table 4). The rating for Goal A (allowing natural rates and levels of spatially mediated processes) was **moderate risk**. There has been significant reduction in spawner distribution which has resulted in increased gaps and loss of continuity within the population and between the Walla Walla population and other Mid-Columbia DPS steelhead populations.

The rating for Goal B (maintaining natural levels of variation) was **moderate risk**. Water temperature and hydrograph changes as well as barriers have likely influenced life history diversity and phenotypic expression. Out-of-DPS spawners have put the population in the moderate risk category for the spawner composition metric. Hydrosystem effects and within-basin habitat changes have likely resulted in selective mortality of the adult run timing phenotypic trait, resulting in a moderate risk rating for the selectivity metric.

Table 4. Walla Walla River summer steelhead population spatial structure and diversity risk rating.

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
A.1.a	L (1)	L (1)	Moderate Risk (Mean = 0.33)	Moderate Risk (Mean = 0.33)	**Moderate Risk**
A.1.b	M (0)	M (0)			
A.1.c	M (0)	M (0)			
B.1.a	M (0)	M (0)	Moderate Risk (0)	Moderate Risk (0)	
B.1.b	M (0)	M (0)			
B.1.c	L (1)	L (1)			
B.2.a(1)	M (0)	Moderate Risk (0)	Moderate Risk (0)		
B.2.a(2)	VL (2)				
B.2.a(3)	VL (2))				
B.2.a(4)	VL (2)				
B.3.a	VL (2)	VL (2)	VL (2)		
B.4.a	M (0)	M (0)	M (0)		

Overall Viability Rating

The Walla Walla River summer steelhead population does not meet viability criteria. However, the population does meet ICTRT criteria to be rated as **MAINTAINED** (Figure 7). Overall abundance and productivity is rated at **Moderate Risk.** The 10-year geometric mean abundance of natural-origin spawners is 650, which is 65% of the minimum abundance threshold of 1,000. The 8-year geometric mean productivity (1.34 R/S; Table 6) is nearly at the 1.35 R/S minimum required at the abundance threshold. However, there is considerable uncertainty due to the short time series. Analysis of additional brood years will be critical to demonstrating sustained recruits per spawner and abundance values above the low risk criteria level. Overall spatial structure and diversity is also rated at **Moderate Risk.** Significant improvements to spatial structure and diversity are needed to improve the risk level.

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	**HV**	**HV**	**V**	**M**
	Low (1-5%)	**V**	**V**	**V**	**M**
	Moderate (6 – 25%)	**M**	**M**	**M Walla Walla River**	**HR**
	High (>25%)	**HR**	**HR**	**HR**	**HR**

Figure 7. Walla Walla River summer steelhead population risk ratings integrated across the four viable salmonid population (VSP) metrics. ***Viability Key: HV – Highly Viable; V – Viable; M – Maintained; HR – High Risk; Shaded cells – does not meet viability criteria (darkest cells are at greatest risk).***

Data Summary – Walla Walla River Summer Steelhead Population

Data type: Dataset reconstructed from dam counts
SAR: Averaged Deschutes, Umatilla, Snake, and Upper Columbia River steelhead series
Productivity: Only 8 recruit/spawner pairs for this population exist; therefore results must be interpreted carefully.

Table 5. Walla Walla River summer steelhead population abundance and productivity data used for curve fits and R/S analysis. Bold values were used in estimating the current productivity (Table 6).

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	SAR Adj. Factor	Adj. Rtns	Adj. R/S
1993	1228	99.8%	1,225	474	0.39	1.18	561	0.46
1994	806	99.8%	804	525	0.65	1.07	562	0.70
1995	**654**	**98.8%**	**646**	**497**	**0.76**	**1.23**	**609**	**0.93**
1996	**549**	**98.0%**	**538**	**753**	**1.37**	**1.03**	**777**	**1.42**
1997	**447**	**98.2%**	**439**	**1128**	**2.52**	**0.76**	**861**	**1.93**
1998	**573**	**99.1%**	**568**	**1517**	**2.65**	**0.49**	**744**	**1.30**
1999	**421**	**99.5%**	**419**	**1082**	**2.57**	**0.52**	**560**	**1.33**
2000	792	97.5%	772	618	0.78	1.00	618	0.78
2001	1172	95.4%	1,118					
2002	1811	96.4%	1,746					
2003	938	96.5%	905					
2004								
2005	281	96.1%	270					

Table 6. Walla Walla River summer steelhead population geometric mean abundance and productivity estimates (values used for current productivity and abundance are shown in boxes).

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
delimited	median	75% threshold	median	75% threshold	1993-2001	1980-1999	geomean
Point Est.	2.20	1.78	1.47	1.34	1.14	n/a	650
Std. Err.	0.16	0.25	0.09	0.12	0.01	n/a	0.19
count	4	5	4	5	9	n/a	9

Table 7. Walla Walla River summer steelhead population stock-recruitment curve fit parameter estimates. Biologically unrealistic or highly uncertain values are highlighted in grey.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	1.17	0.29	n/a	n/a	0.29	0.62	23.2	1.01	0.16	n/a	n/a	0.12	0.61	15.8
Const. Rec	756	109	n/a	n/a	n/a	n/a	14.8	653	37	n/a	n/a	n/a	n/a	-0.4
Bev-Holt	50.00	104.52	773	122	0.10	0.65	20.6	50.00	81.92	667	45	0.02	0.52	5.6
Hock-Stk	1.17	0.17	19583	0	0.29	0.62	28.8	1.47	0.08	447	0	0.02	0.56	4.6
Ricker	6.54	2.15	0.00252	0.00045	0.08	0.38	16.1	3.17	0.49	0.00167	0.00021	0.02	0.22	3.9

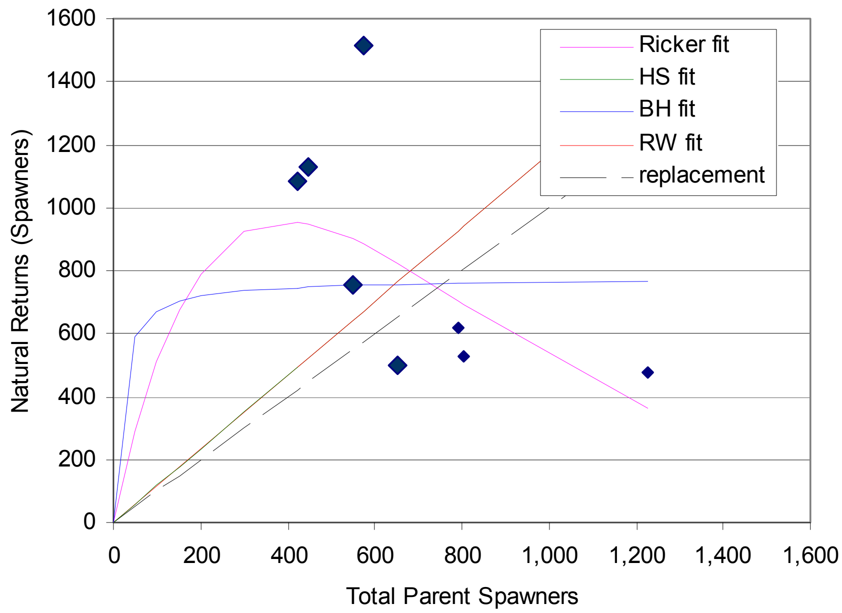

Figure 8. Walla Walla River summer steelhead population stock recruitment curves. Bold points were used in estimating the current productivity. Data were not adjusted for marine survival.

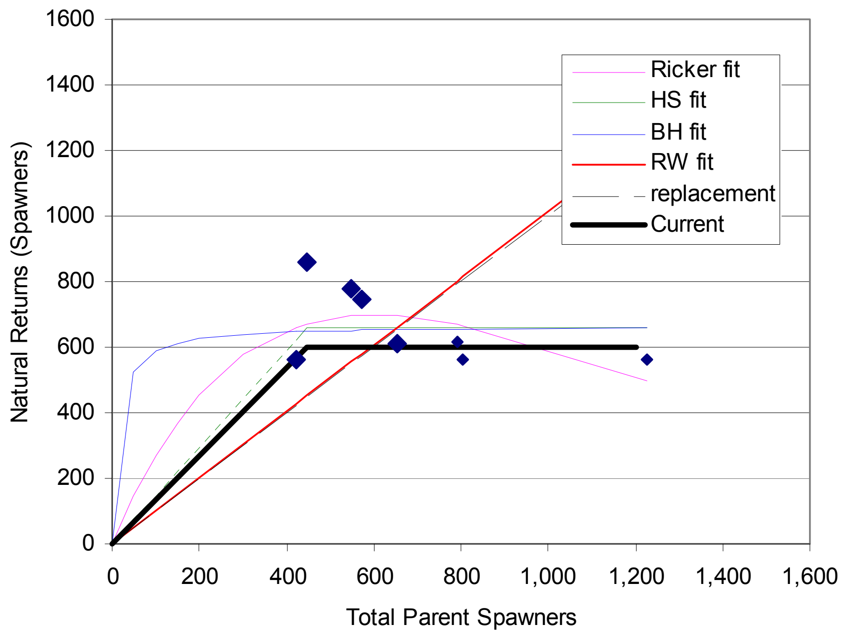

Figure 9. Walla Walla River summer steelhead population stock recruitment curves. Bold points were used in estimating the current productivity. Data were adjusted for marine survival. Function labeled "current" is a Hockey Stick function derived by fixing the slope of the ascending limb at the geometric mean productivity at low to moderate abundance (Table 2) and fitting a capacity estimate to the data series.

APPENDIX C

Summary of habitat projects completed within Oregon's Mid-Columbia River steelhead populations on private and public lands from 1995-2005

Data provided by OWEB, USFS, BLM and Watershed Councils

Summary of habitat projects completed within Oregon's Mid-Columbia River steelhead populations on private and public lands from 1995-2005 (data provided by OWEB and USFS).

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
Fifteenmile Creek Population						
20030865	Fifteenmile Cr	Instream habitat enhancement: anchored structures, bank stabilization	4 structures, 0.13 m	2003	Wasco SWCD	$112,355.00
20030866	Mosier, Chenowith	Upland	6,000 ac	2003	Wasco SWCD	$95,518.00
20030867		Upland	?	2003	Wasco County SWCD	$1,297.00
20030868		Upland	23 ac	2004	Wasco SWCD	$5,460.00
20030869	Lucky Canyon	Upland	4 ac	2003	Wasco County SWCD	$3,906.00
20020839	Fifteenmile Cr, trib of	Weather stations	?	2002	Wasco County SWCD	$46,194.00
20030871	Threemile Cr	Upland	6 ac	2003	Wasco County SWCD	$6,199.00
20030872	Brown's Cr	Upland	12 ac	2003	Wasco County SWCD	$1,263.00
20030873	Lucky Canyon	Upland erosion control, planted	1 ac	2003	Wasco County SWCD	$542.00
20030874	Brown's Cr	Upland erosion control	80 ac	2003	Wasco County SWCD	$6,522.00
20030875	Chenowith Cr	Upland	7 ac	2003	Wasco County SWCD	$1,969.00
20030876	Threemile Cr	Upland erosion control and planting	2 ac erosion, 8 ac planted	2003	Wasco County SWCD	$1,371.00
20030877	Fifteenmile Cr	Riparian fencing	0.59 miles	2001	ODFW	$10,795.00
20030878	Fifteenmile Cr	Riparian fencing	0.5 miles	2001	ODFW	$9,000.00
20030879	Fifteenmile Cr	Riparian fencing	0.5 miles	2003	ODFW	$11,000.00
20030880	Eightmile Cr	Riparian fencing	2.5 miles	2001	ODFW	$43,900.00
20030870	Douglas Hollow	Riparian fencing, upland off-channel watering	0.25 M, 2 off sites	2003	Wasco County SWCD	$9,776.00
20020838	Dry Cr	Off-channel livestock watering, upland erosion control	5 sites	2002	Wasco County SWCD	$12,729.00
990469	Fifteenmile Cr	Off-channel livestock watering	5 sites	1999	ODFW	$12,000.00
20030881	Fivemile Cr	Riparian fencing, off-channel site	0.63 M, 2 sites	2001	ODFW	$12,775.00
1281	Fifteenmile Cr	Instream habitat enhancement: deflectors, bank stabilization; riparian fencing; upland vegetation management	4.5 miles	1996	ODFW	$23,500.00
990734	Mosier Cr, trib of	Peak flow passage improvements, surface drainage improvements, road vacated; fish passage improvements: culvert removed and not replaced	1 structure, 5 ditches, 60 stations, 10 stations, 2 culverts	1999	Longview Fibre Co.	$28,429.00
20020842	Dry Cr & Mosier Cr	Irrigation systems for improved water conservation	30 ac	2001	Wasco County SWCD	$11,997.00
1282	Eightmile Cr	Instream large wood placement, deflectors, bank stabilization, boulder placement; riparian fencing; off-channel livestock watering	3.5 miles	1997	ODFW	$39,000.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
20020841	Rock Cr	Irrigation systems for improved water conservation	?	2002	Wasco County SWCD	$1,020.00
20020835	Mosier Cr	Irrigation systems for improved water conservation	20 ac	2002	Wasco County SWCD	$1,281.00
20001121	Rock Cr	Peak flow passage improvements	2 structures	2000	SDS Lumber Co.	$0.00
990467	Fifteenmile Cr	Off-channel livestock watering	?	1999	ODFW	$4,000.00
981112	Mosier Cr	Surface drainage improvements	75 stations	1998	Longview Fibre Co.	$15,072.00
981108	Mosier Cr	Surface drainage improvements	8 culverts, road	1998	Longview Fibre Co.	$16,229.00
991044	Fifteenmile Cr	Instream water rights transfers/leases		1998	Oregon Water Trust	$23,958.00
990472	West Fork Mosier Cr	Peak flow passage improvements, road vacated	1 structure removed	1999	Longview Fibre Co.	$26,942.00
20010913	West Fork Mosier Cr	Peak flow passage improvements, surface drainage improvements, road relocated, road reconstruction	1 structure, 2 cross-drain, 9 culverts	2001	Longview Fibre Co.	$46,114.00
20000725	West Fork Mosier Cr	Peak flow passage improvements, surface drainage improvements	140	2000	Longview Fibre Co.	$62,497.00
990468	Eightmile Cr	Off-channel livestock watering	1 off-channel site	1999	ODFW	$3,500.00
20030882	Fivemile Cr	Riparian fencing, off-channel	1.52 m fence, 2 sites	2002	ODFW	$45,582.00
20040791	Eightmile Cr	Riparian fencing	1.96 m	2004	ODFW	$11,289.00
20040790	Fivemile Cr	Riparian fencing	1.75 m	2004	ODFW	$9,715.00
20040789	Eightmile Cr	Riparian fencing	1 m	2004	ODFW	$8,226.00
20040788	Fifteenmile Cr	Riparian, off-channel	1.5 m, 1 site	2004	ODFW	$21,034.00
20040754	Fifteen Mile Cr	Upland no-till ag	3,501 ac	2005	Wasco SWCD	$284,928.00
20050680	Mill Cr	Upland irrigation improvements	9 ac	2005	Wasco SWCD	$14,351.00
20050678	Fifteenmile Cr	Guzzlers	2	2005	Wasco SWCD	$9,517.00
20050677	Mill Cr	Upland irrigation improvement	5 ac	2005	Wasco SWCD	$1,814.00
20030888	Dry Cr	Riparian fencing, off-channel watering site	0.56 m fence, 1 sites	2003	ODFW	$11,350.00
20030891	Fivemile Cr	Riparian fencing	0.25 m	2003	ODFW	$6,890.00
20030887	Fifteenmile Cr	Riparian fence, off-channel	1.38 m, 3 sites	2003	ODFW	$16,249.00
20030886	Dry Cr	Riparian fencing, off-channel	2.5 m, 8 sites	2002	ODFW	$72,400.00
20030885	Fivemile Cr	Riparian fencing	0.5 m	2001	ODFW	$8,000.00
20030884	Fivemile Cr	Riparian fencing	0.25 m	2001	ODFW	$4,400.00
20030883	Eighmile Cr Rail Hollow	Riparian fencing	1.26 m	2002	ODFW	$22,500.00
20030889	Fifteenmile Cr	Riparian fencing	1.4 m	2003	ODFW	$16,600.00
20030890	Eightmile Cr	Riparian fencing	1.5 m	2003	ODFW	$22,200.00
	Fifteenmile Cr	Underburn	585 ac	1995	USFS	$58,500.00
	Fifteenmile Cr	Instream and floodplain LWD placement	1 RM	1995	USFS	$27,000.00
	Eightmile Cr	Underburn	834 ac	1997	USFS	$83,400.00
	MF Fivemile Cr	Instream and floodplain LWD placement	0.5 RM	1997	USFS	$14,000.00
	Fifteenmile Cr	Floodplain LWD placement	10 ac	1998	USFS	$14,500.00
	MF Fivemile Cr	Replaced round culvert with bridge	1 site	1999	USFS	$150,000.00
	SF Fivemile Cr	Replaced round culvert with bottomless pipe arch	1 site	1999	USFS	$85,000.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
	Ramsey Cr	Instream and floodplain LWD placement	3 RM	2000-2002	USFS	$269,745.00
	Eightmile Cr	Round pipe culvert replacements with bottomless arch culverts	4	2002	USFS	$260,428.00
	Fifteenmile Cr	Instream and floodplain LWD placement	0.25 RM	2003	USFS	$21,000.00
	Ramsey Cr	Underburn	815 ac	2003	USFS	$95,000.00
	Ramsey Cr	Riparian and in-stream restoration	2 mi	2000	USFS Mt. Hood NF	$30,700
Deschutes River Eastside Population						
20050687		Upland irrigation improvement	?	2005	Jefferson SWCD	$5,668.00
990909	Fulton Canyon & Gordon Canyon	Erosion control: terraces & WASCOB systems	78 ac; 15 w/s basins	1999	Sherman SWCD	$21,283.00
20040725	Deschutes, trib of	WASCOB	600 ac	2004	Sherman SWCD	$3,242.00
20030849		Upland	1,080 ac	2003	Sherman SWCD	$6,656.00
20030926		Upland, invasive plants	?	2003	Sherman County Weed District	$14,756.00
990938	Warm Springs R & Skookum Cr	Riparian fencing	9.5 m	1999	Deschutes Resources Conservancy	$153,000.00
20020526		WASCOBs, Terraces	500 ac	2002	Sherman SWCD	$55,603.00
20040753	Fifteen Mile Cr	No-till; off-channel watering; WASCOB	4,173 ac; 5 off; 19 WACOBs	2004	Wasco SWCD	$292,855.00
20010914	Neal Cr & Mosier Cr	Peak flow passage improvements, surface drainage improvements, road relocated, road reconstruction	2 cross-drains, 18 culverts, 60 rocking, 3 relocation, 220 other	2001	Longview Fibre Co.	$47,790.00
20020577	East Fork Neal Cr & Mosier Cr	Surface drainage improvements, road reconstruction	?	2002	Longview Fibre Co.	$24,459.00
20020833		Beaver management	?	1999	Confederated Tribes of Warm Springs Reservation	$21,686.00
20050777	Rock Cr	Road, upland	8 cross-drains, 1 m road seeded, 3 structures	2003	Umatilla SWCD	$84,248.00
20050613	Pine Cr	Upland veg. management	11 ac	2004	Umatilla SWCD	$6,961.00
990910	Gerking Canyon	Erosion control: terraces & WASCOB systems	1,700 ac	1999	Sherman SWCD	$56,852.00
990466	Taylor Lake	Instream air diffuser	1	1999	ODFW	$31,500.00
20030923	Macks Canyon	WASCOB, off-channel watering,	468 ac, 2 off	2003	Sherman SWCD	$34,664.00
20020834	Bakeoven Cr	Off-channel livestock watering, other grazing management, upland erosion control	33 off, 15,527 ft cross fence, 1,048 ac, 77 ac plant, 804 ac no till,14 WASCOB,	2002	Wasco County SWCD	$307,816.00
20040726	Macks Canyon, Area of	Upland terrace, off-channel watering	2,120 ft, 1 site	2004	Sherman SWCD	$3,245.00
545	Willow Cr & Higgins Cr	Bank stabilization	?	1995	Ochoco Lumber Company	$3,500.00
20040724	Elder Cr, Area of	Upland fence	3,749 ft	2004	Sherman SWCD	$4,024.00
20030919	Mud Springs (Trout C. trib)	Up. Irrigation improvement	?	2003	Jefferson County SWCD	$13,165.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
20001189	Trout Cr	Boulder placement; grass seeding; fish passage improvements: 3 push-up dams removed and replaced with infiltration galleries	3 dams; unknown boulders, stabilization	1999	Jefferson County SWCD	$98,802.00
20050690	Deschutes R	Upland irrigation improvement	20 ac	2005	Jefferson SWCD	$26,933.00
20040687	Willow Cr	Up. WASCOB, planting	3 ac, 4.5 ac plant	2004	Jefferson SWCD	$13,416.00
20030922	Macks Canyon	WASCOB, off-channel	46 ac, 1 off site	2003	Sherman SWCD	$8,673.00
1201	Willow Cr	Instream habitat enhancement: weirs, bank stabilization; riparian tree planting, riparian fencing; peak flow passage improvements	6 weirs, 14.5 ac treated/planted, 1 mile fence, 20 trees anchored	1997	Central Oregon Small Woodlands Association	$25,700.00
20030924	Buck Hollow Cr	Upland erosion control	30 ac	2003	Sherman SWCD	$2,364.00
20030768	Foley Cr, (Trout C. trib)	Rip. fence, off channel watering site	5 m, 2 sites	2003	Jefferson County SWCD	$56,880.00
20030769	Willow Cr	Upland irrigation improvements	?	2003	Jefferson County SWCD	$25,079.00
20030770	Frog Springs	Upland irrigation improvements	?	2003	Jefferson County SWCD	$7,067.00
20050685	Willow Cr	Riparian planting	2.35 m	2005	Deschutes River Conservancy	$5,162.00
20030928	Buck Hollow Cr	Upland WASCOB, fenced, treated, erosion	300 ac fenced, 16 WASCOB, 565 ac treated, 245 ac erosion, 4 off-channel,	2003	Wasco SWCD	$251,285.00
997	Trout Cr	Instream habitat enhancement: weirs, deflectors, bank stabilization, boulder placement; riparian fencing	40 boulders, 20 deflectors, 5 weirs, 70 miles fence	1997	ODFW	$200,000.00
998	Trout Cr	Fish passage improvements: 1 gravel push-up dam replaced with concrete diversion and fish ladder	1 push-up dam, 1 ladder	1997	ODFW	$67,000.00
20050780	Bakeoven Cr, Buck Hollow Cr	Upland fencing	163,891 ft	2004	Wasco SWCD	$138,517.00
990905	Willow Cr	Riparian fencing	1.5 m	1999	Willow Creek Watershed Council, Jeff County SWCD	$19,150.00
20001129	Tenmile Cr (Trout C. trib)	Upland pasture fencing	989 ac treated, 1 off-channel site	2000	Trout Creek Watershed Council	$57,521.00
980495	Fulton Canyon & Gordon Canyon	Erosion control: terraces & WASCOB systems	13 WASCOB	1998	Sherman SWCD	$28,510.00
990906	Trout Cr	Instream habitat enhancement: anchored structures, bank stabilization	16 anchored structs, 0.066 M stabilized	1999	Trout Creek Watershed Council, Jeff County SWCD	$58,900.00
20020811	Trout Cr	Fish passage improvements: 6 push-up dams removed, replaced with infiltration galleries	6	2002	Jefferson County SWCD	$115,681.00
20010980	Trout Cr	Fish passage improvements: 3 push-up dams removed, replaced with infiltration galleries	3	1998	Jefferson County SWCD	$64,705.00
20010981	Trout Cr	Fish passage improvements: 1 push-up dam removed, replaced with infiltration gallery	1	2002	Jefferson County SWCD	$124,400.00
20040756	Ward Cr	Upland off-channel watering site	1	2004	Wasco SWCD	$3,482.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
20020784		Upland erosion control	65 acres	2002	Sherman SWCD	$3,100.00
20050683	Trout Cr	Upland fence, off-channel watering site, grazing management	76 ac fenced, 2 off-channel sites, 76 ac grazing	2005	Jefferson SWCD	$30,975.00
20040747	Newcomb Draw	Upland fence	5,998 ft	2004	Wasco SWCD	$2,925.00
	Auger Cr	Ingram Meadows structure repair, riparian planting and riparian fencing	6 mi	2000	USFS Ochoco NF	$55,425.00
	Trout Cr and tribs	Culvert replacement for flow and fish passage	13 sites	1996-2005	USFS Ochoco NF	$1 million
	Trout Cr watershed	Road closures in Trout watershed along streams and culverts pulled	50 mi	1996-2006	USFS Ochoco NF	$100,000.00
	Trout Cr watershed	Grazing changed from livestock to sheep, improve riparian vegetation to stabilize streambanks		1989	USFS Ochoco NF	
	Auger Creek	Ingram Meadows structure repair, riparian planting and riparian fencing	6 miles	2000	USFS Ochoco NF	$55,425.00
	Trout Cr and tribs	Culvert replacement for flow & fish passage	13 sites	1996-2005	USFS Ochoco NF	$1 million
	Trout Cr watershed	50 miles of road closures in Trout Watershed along streams and culverts pulled	50 mi	1996-2006	USFS Ochoco NF	$100,000.00
	Trout Cr watershed	Grazing changed from livestock to sheep, improve riparian vegetation to stabilize streambanks		1989	USFS Ochoco NF	
	Deschutes River	Harpham Flat Riparian Exclosure	.5 mile	2000	BLM	$10,000.00
	Trout Cr	OHV area closure fence and rehab to protect riparian area	1 mile fence	2001	BLM	$10,000.00
	Trout Cr	Widen boat ramp, eliminate indiscriminate boat launching to protect riparian area	1 site	2001	BLM	$6,000.00
Deschutes River Westside Population						
20020837	Rock Creek Res. (White R)	Irrigation systems for improved water conservation	?	2002	Wasco County SWCD	$120,717.00
20020836	Boulder Cr	Irrigation systems for improved water conservation	?	2002	Wasco County SWCD	$104,912.00
990939	Deschutes R	Instream habitat enhancement: anchored structures	175 structures	1999	Deschutes Resources Conservancy	$73,141.00
20040748	Threemile Cr	Upland irrigation	4.4 ac	2004	Wasco SWCD	$13,483.00
990940	Deschutes R	Instream water right transfer		1999	Deschutes Resources Conservancy	$425,400.00
20030728	Deschutes R	Riparian treatment	2 M treated	2003	Deschutes SWCD	$11,123.00
20030930	Threemile Cr	Upland irrigation	200 ac	2003	Wasco County SWCD	$23,028.00
20030929	unnamed draw	Wetland creation	?	2003	Wasco County SWCD	$25,730.00
20030927	Deschutes R	Riparian fencing	0.8 miles	2003	Upper Deschutes Watershed Council	$14,110.00
20050781	Jordan Cr (White R)	Riparian fence/plant, upland erosion	1.5 m rip fence, 0.75 m planted, 2 crossings	2004	Wasco SWCD	$49,462.00
20050688	Threemile Cr	Upland irrigation improvements	375 ac	2005	Wasco SWCD	$13,518.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
20040755	Tygh Cr	Upland water storage	?	2004	Wasco SWCD	$6,546.00
20040805	Trout Cr	Wetland improvement	0.15 ac	2004	Upper Deschutes Watershed Council	$28,856.00
	Middle and Upper Whychus	Riparian/floodplain protection/road closure	15 mi	2006	USFS Deschutes NF	$29,000.00
	Middle Whychus	Riparian planting	1 mi	2006	USFS Deschutes NF	$2,000.00
	Middle Whychus	Riparian planting	1 mi	1995	USFS Deschutes NF	$1,000.00
	Middle Whychus	Riparian planting	1 mi	2007	USFS Deschutes NF	$1,000.00
	Deschutes River	Bully Point Fence. Construct .75 mile of fencing to improve livestock management in riparian area	.75 mile	2000	BLM	$6,000.00
	Oak Canyon Creek	Riparian fencing exclosure	1 mile	2002	BLM	$10,000.00
996	Whychus Cr	instream water transfers/leases	0.86 cfs	1998	Deschutes Watershed Council	$42,900
990941	Whychus Cr	instream water right transfer	1.81 cfs	1999	Deschutes River Conservancy	$78,950
990942	Whychus Cr	instream water right transfer	0.6 cfs	2000	Deschutes River Conservancy	$105,000
991045	Whychus Cr	instream water rights transfers/leases		1998	Oregon Water Trust	$54,343
991046	Whychus Cr	instream water rights transfers/leases	1.61 cfs	1999	Oregon Water Trust	$17,211
20010982	Whychus Cr	instream water right transfer/lease		2001	Deschutes River Conservancy	$581,698
20020571	Whychus Cr	instream water rights transfer; irrigation systems for improved water conservation	1.5 cfs, 377 acres	2002	Deschutes SWCD	$548,233
20040775	Whychus Cr	upland tree planting, upland vegetation planting	0.1 acre	2004	Deschutes Basin Land Trust	$20,914
20050067	Whychus Cr	instream habitat enhancement: anchored structures	0.75 mile	2001	ODFW	$6,262
20060760	Whychus Cr	instream water right transfers/leases	1.2 cfs	2006	Deschutes River Conservancy	$914,000
20020862	Tumalo Cr	irrigation systems for improved water conservation		2002	Tumalo Irrigation District	$1,350,000
20020863	Tumalo Cr	irrigation systems for improved water conservation		2002	Tumalo Irrigation District	$760,000
20050821	Tumalo Cr			2004	Tumalo Irrigation District	$1,180,695
20060534	Deschutes R		0.09	2006	Upper Deschutes Watershed Council	$9,686
20040805	Trout Cr	wetland improvement	0.15 acre	2004	Upper Deschutes Watershed Council	$28,856
20050779	Tumalo Cr			2003	Tumalo Irrigation District	$1,002,984
20060532	Captain Jack Cr	riparian tree planting, riparian fencing, riparian vegetation planting;	4 acres	2006	Upper Deschutes	$19,080

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
		off-channel livestock watering			Watershed Council	
20060533	Trout Cr	wetland restoration, wetland invasive plant control	28 acres	2006	Upper Deschutes Watershed Council	$35,003
20060535	Whychus Cr	instream water right transfers/leases	2.22 cfs	2005	Deschutes River Conservancy	$143,291
20070030	Tumalo Cr			2007	Upper Deschutes Watershed Council	$541,694
996	Whychus Cr	instream water transfers/leases	0.86 cfs	1998	Deschutes Watershed Council	$42,900
990941	Whychus Cr	instream water right transfer	1.81 cfs	1999	Deschutes River Conservancy	$78,950
990942	Whychus Cr	instream water right transfer	0.6 cfs	2000	Deschutes River Conservancy	$105,000
991045	Whychus Cr	instream water rights transfers/leases		1998	Oregon Water Trust	$54,343
991046	Whychus Cr	instream water rights transfers/leases	1.61 cfs	1999	Oregon Water Trust	$17,211
20010982	Whychus Cr	instream water right transfer/lease		2001	Deschutes River Conservancy	$581,698
20020571	Whychus Cr	instream water rights transfer; irrigation systems for improved water conservation	1.5 cfs, 377 acres	2002	Deschutes SWCD	$548,233
20040775	Whychus Cr	upland tree planting, upland vegetation planting	0.1 acre	2004	Deschutes Basin Land Trust	$20,914
20050067	Whychus Cr	instream habitat enhancement: anchored structures	0.75 mile	2001	ODFW	$6,262
20060760	Whychus Cr	instream water right transfers/leases	1.2 cfs	2006	Deschutes River Conservancy	$914,000
20020862	Tumalo Cr	irrigation systems for improved water conservation		2002	Tumalo Irrigation District	$1,350,000
20020863	Tumalo Cr	irrigation systems for improved water conservation		2002	Tumalo Irrigation District	$760,000
20050821	Tumalo Cr			2004	Tumalo Irrigation District	$1,180,695
20060534	Deschutes R		0.09	2006	Upper Deschutes Watershed Council	$9,686
20040805	Trout Cr	wetland improvement	0.15 acre	2004	Upper Deschutes Watershed Council	$28,856
20050779	Tumalo Cr			2003	Tumalo Irrigation District	$1,002,984
20060532	Captain Jack Cr	riparian tree planting, riparian fencing, riparian vegetation planting; off-channel livestock watering	4 acres	2006	Upper Deschutes Watershed Council	$19,080
20060533	Trout Cr	wetland restoration, wetland invasive plant control	28 acres	2006	Upper Deschutes Watershed Council	$35,003

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
20060535	Whychus Cr	instream water right transfers/leases	2.22 cfs	2005	Deschutes River Conservancy	$143,291
20070030	Tumalo Cr			2007	Upper Deschutes Watershed Council	$541,694
Crooked River Population						
992	Mill Cr	Riparian fencing	0.33 mile	1996	Central Oregon Small Woodlands Association	$1,100
994	Lawson Cr	Riparian tree planting, riparian fencing; off-channel livestock watering; legacy road improvements	0.28 mile	1997	Dixie Meadows Co.	$8,225
	McKay Creek	Riparian fencing	1.5 mile	1998	ODFW R&E	$59,250
	South Fork Crooked R.	Riparian fencing	3.0 mile	1998	ODFW R&E	$93,250
	Wolf Cr	Riparian fencing	1.75 mile	1998	ODFW R&E	$57,815
995	Lawson Cr	Riparian tree planting, riparian fencing; off-channel livestock watering, upland vegetation management	3.5 mile	1995	Dixie Meadows Co.	$28,700
980009	Cadle, Wolf, Boardtree, Veazie, Crusher, Tamarack, Sheep, South Fork Wolf crks	Instream large wood placement; riparian fencing; livestock removal, livestock exclusion; road relocated; fish passage improvements: 3 culverts replaced	,0.75 riparian,10 mile instream,3 crossing	1998	U.S. Timberlands	$16,300
981101	Mill Cr & McKay Cr	Instream large wood placement, anchored log structures, weirs, deflectors; riparian tree planting, riparian fencing	2.5 mile instream, 4 mile fence	1998	ODFW	$22,125
990735	Mill Cr	Instream habitat enhancement: anchored structures, weirs, deflectors, boulder placement, bank stabilization	1 mile instream, riparian fence	2000	ODFW	$41,000
990804	Dixie Cr	Riparian fencing; grazing management: deferred grazing		2000	U.S. Timberlands	$10,530
990805	South Fork Wolf Cr	Peak flow passage improvements, road vacated	2 crossings	1999	U.S. Timberlands	$4,767
990806	Cadle Cr	Road closed		1999	U.S. Timberlands	$16,321
20001144	Ochoco Cr	Instream habitat enhancement: deflectors, natural boulder placement; riparian tree planting, riparian fencing	2 miles	2000	Crook SWCD	$104,592
	Crooked River (near Post)	Riparian fencing, CREP	3 miles	2000	ODFW, NRCS	$150,000
20010956	Bear Cr	Fish passage improvements: 1 culvert with weirs installed below outlet	1 crossing, 1 mile	2001	Crook County Road Department	$133
20010957	Newsome Cr	Fish passage improvements: 3 culverts with weirs installed below outlet	3 crossing, 4 miles	2000	Crook County Road Department	$3,200
20010958	South Fork Crooked R, trib of	Fish passage improvements: 1 culvert with weirs installed below outlet	1 crossing, 6 miles	2000	Crook County Road Department	$1,637
20010959	Lawson Cr	Road vacated, road relocated		2001	ODF	$613
20010960	McKay Cr	Riparian tree planting, riparian	4.5 miles	2001	Crooked River	$12,500

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
		fencing			Watershed Council	
20010961	McKay Cr	Riparian tree planting	1 mile	2001	Crooked River Watershed Council	$1,450
20010962	Crooked R	Riparian tree planting	0.25 mile	2001	Crooked River Watershed Council	$200
20010964	Wolf Cr	Riparian fencing	0.5 mile	2001	Crooked River Watershed Council	$1,500
20010965	Duncan Cr	Riparian tree planting	2 miles	2001	Crooked River Watershed Council	$6,850
20010966	South Fork Crooked R	Riparian fencing	4 miles	2001	Crooked River Watershed Council	$13,000
20010967	Little Bear Cr	Riparian fencing	5 miles	2001	Crooked River Watershed Council	$14,000
20010968	Little Bear Cr	Riparian tree planting	4 miles	2001	Crooked River Watershed Council	$2,100
20010969	Bear Cr	Riparian tree planting	4 miles	2001	Crooked River Watershed Council	$1,000
20010970	Ochoco Cr	Riparian tree planting	0.5 mile	2001	Crooked River Watershed Council	$500
20010971	Mill Cr	Riparian fencing	0.5 mile	2001	Crooked River Watershed Council	$1,500
20010972	Mill Cr	Riparian tree planting, riparian fencing	0.5 mile	2001	Crooked River Watershed Council	$2,000
20010973	Mill Cr	Riparian fencing	1 mile	2001	Crooked River Watershed Council	$2,500
20010974	Mill Cr	Riparian tree planting, riparian fencing	1 mile	2001	Crooked River Watershed Council	$2,650
20010975	Ochoco Cr	Riparian tree planting	0.5 mile	2001	Crooked River Watershed Council	$1,100
20010976	Ochoco Cr	Riparian tree planting	0.5 mile	2001	Crooked River Watershed Council	$300
20011142	Mill Cr & Allen Cr	instream habitat enhancement: anchored structures, full spanning weirs, deflectors, bank stabilization; riparian tree planting, riparian fencing	2 miles	2001	ODFW	$55,000
20020573	Mill Cr	instream habitat enhancement: anchored structures, engineered structures: full spanning weirs, deflectors	1 mile	2002	ODFW, Crooked River Watershed Council	$37,600
20020574	Crooked R/ Shotgun Cr/ Pine Cr	instream natural boulder placement; engineered structures: deflectors; riparian tree planting, riparian fencing; off-channel livestock	0.25 mile, 2.5 miles, 100 acres	2002	Crooked River Watershed Council	$63,993

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
		watering, noxious weed control				
20020575	Wickiup Cr	wetland improvement	5 acres	2002	Private Landowner	$25,147
20020854	Bear Cr	off-channel livestock watering, other grazing management, upland erosion control	25 acres	2002	Crook SWCD	$16,681
20020855	Pine Cr	upland erosion control	200 acres	2002	Crook SWCD	$21,013
20020856	Ochoco Cr	natural boulder placement; riparian fencing	0.7 mile	2002	Crook SWCD	$11,822
20020864		off-channel livestock watering		2002	Bedortha Ranches, Inc.	$10,717
20020868	Eagle Cr	upland vegetation management: juniper removal	40 acres	2002	Crook SWCD	$2,300
20030717	Freeman Cr	instream habitat enhancement: weirs; gss (410 pc)	0.75 mile	2003	Crook SWCD	$14,736
20030719	McKay Cr	fish passage improvements: 1 fish ladder installed, 2 flash boards modified	14 miles	2003	Crooked River Watershed Council	$188,727
20030720	McKay Cr	Instream habitat enhancement: anchored structures, deflectors; riparian tree planting, riparian fencing	0.3 mile	2003	Crooked River Watershed Council	$10,926
20030721	McKay Cr	Deflectors, channel alteration; riparian tree planting, riparian fencing	1.5 miles	2003	Crooked River Watershed Council	$93,650
	Little McKay Cr	Instream boulder and large wood placement, riparian protection	1.7 miles	2003	US Forest Service	$183,135
20030722	Mill Cr	Instream habitat enhancement: anchored structures, weirs, deflectors	1 mile	2002	Crooked River Watershed Council	$17,911
20030723	Duncan Cr	Riparian tree planting, riparian fencing; other upland activity; fish passage improvement: other diversions modified	0.3 mile, 4 mile hab	2003	Crooked River Watershed Council	$34,875
20030724	Mill Cr	Riparian tree planting, riparian fencing, water gap development	0.3 mile	2002	Crooked River Watershed Council	$6,642
20030725	Mill Cr	Water gap elimination; irrigation systems for improved water conservation	0.2 mile	2002	Crooked River Watershed Council	$3,329
20030726	South Fork Crooked R	Riparian tree planting, riparian fencing	2.3 miles	2003	Crooked River Watershed Council	$12,259
20030762		Upland vegetation management (juniper control), other upland activity	20 miles	2003	Crook SWCD	$1,658
20030763	Japanese Cr	Off-channel livestock watering		2003	Crook SWCD	$12,987
20030764	Duncan Cr	Riparian tree planting	0.7 mile	2003	Crooked River Watershed Council	$6,950
20030765	McKay Cr	Riparian fencing	1 mile	2003	Crooked River Watershed Council	$13,680
20030921	Lost Cr	Riparian tree planting, riparian fencing, riparian invasive plant control; peak flow passage improvements, other road activity	1.4 mile	2002	The Nature Conservancy	$54,449
20040656	Long Hollow Cr	Upland grazing management, upland vegetation management, upland vegetation planting	200 acres	2004	Crook SWCD	$17,524

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
20040657	Clover Cr	Off-channel livestock watering, upland erosion control		2004	Crook SWCD	$13,839
20040658	Wickiup Cr	Off-channel livestock watering		2004	Crook SWCD	$7,956
20040659	Long Hollow Cr	Upland vegetation management	100 acres	2004	Crook SWCD	$5,244
20040772	Crooked R	Riparian invasive plant control; upland invasive plant control	5.5 miles	2003	Crooked River Weed Management Area	$185,906
20040773	Crooked R	Riparian tree planting, riparian fencing; off-channel livestock watering	0.5 mile	2003	Crooked River Watershed Council	$57,270
20040906	Pine Cr	Upland vegetation management (juniper control), upland vegetation planting	680 acres	2003	Crook SWCD	$40,686
20040909	Little Bear Cr	Off-channel livestock watering		2003	Crooked River Watershed Council	$44,727
20040910	McKay Cr	Off-channel livestock watering		2003	Crooked River Watershed Council	$31,551
20040911	Camp Cr	Off-channel livestock watering		2003	Crooked River Watershed Council	$7,690
20040912	Wolf Cr	Off-channel livestock watering		2003	Crooked River Watershed Council	$20,062
20040913	McKay Cr	Instream anchored habitat structure placement, rock/boulder flow deflector installed, riparian tree planting, riparian fencing, peak flow passage improvements	0.5 mile	2004	Crooked River Watershed Council	$109,000
20050048	South Fork Crooked R	Riparian tree planting	3 miles	2004	ODFW	$5,500
20050685	Willow Cr	Riparian tree planting	2.35 miles	2005	Deschutes River Conservancy	$5,162
20050686	Shotgun Cr	Off-channel livestock watering, upland vegetation management, upland vegetation planting	300 acres	2005	Crook SWCD	$44,931
20050693	McKay Cr	Irrigation system improvement	50 acres	2005	Crook SWCD	$10,550
20050697	Crooked R	Riparian tree planting, riparian fencing, bank sloping/floodplain bench creation	0.5 mile	2005	Crooked River Watershed Council	$29,500
20050698	Crooked R	Instream habitat enhancement: deflectors; riparian tree planting, riparian fencing, sloping/floodplain bench creation	2 miles	2005	Crooked River Watershed Council	$162,300
20050699	Crooked R	Riparian tree planting, riparian fencing, bank sloping/floodplain bench creation	0.5 mile	2005	Crooked River Watershed Council	$39,300
20050700	Crooked R	Riparian tree planting, riparian fencing	1 mile	2005	Crooked River Watershed Council	$32,500
20050701	Crooked R	Instream habitat enhancement: deflectors; riparian tree planting, bank sloping/floodplain bench creation	0.5 mile	2005	Crooked River Watershed Council	$33,400
20050702	Crooked R	Riparian tree planting, bank sloping/floodplain bench creation	0.25 mile	2005	Crooked River Watershed	$25,000

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
					Council	
20050703	Mill Cr	Other instream activity; irrigation system improvement		2005	Crooked River Watershed Council	$29,466
20050797	Marks Cr	Main stream channel modified/created, instream rock weirs installed, riparian tree planting, riparian fencing	0.75 mile	2005	Crooked River Watershed Council	$37,224
20050798	Marks Cr	Main stream channel modified/created, instream rock weirs installed, riparian tree planting, riparian fencing	1 mile	2005	Crooked River Watershed Council	$58,775
20050799	Marks Cr	Fish passage improvements: other diversions modified; irrigation diversions with fish screens installed	15 mile hab	2005	Crooked River Watershed Council	$44,250
20060540	North Fork Beaver Cr	Grazing management, upland fencing	1200 acres	2006	Crook SWCD	$24,464
20060542	Little Bear Cr	Stream bank stabilized: bank resloped	0.1 mile	2006	Crooked River Watershed Council	$14,538
20060543	South Fork Crooked R	Upland fencing	38 acres	2006	Crooked River Watershed Council	$5,429
20060544	Marks Cr	Riparian tree planting	1 mile	2006	Crooked River Watershed Council	$10,620
20060545	McKay Cr	Riparian tree planting	0.5 mile	2006	Crooked River Watershed Council	$5,430
20060546	Little McKay Cr	Rock/boulder flow deflector installed, instream rock weirs installed, instream large wood placement; riparian tree planting; other upland activity; peak flow passage improvements	2 crossing, 1 mile	2006	Crooked River Watershed Council	$165,599
20060547	Crooked R	Irrigation system improved: tailwater collection system improved	0.2 acre	2006	Crooked River Watershed Council	$6,749
20060548	Crooked R	Riparian tree planting	2.5 miles	2006	Crooked River Watershed Council	$22,572
20060549	McKay Cr	Other instream activity; riparian tree planting, riparian fencing; off-channel livestock watering	1 mile	2006	Crooked River Watershed Council	$47,170
20060550	Mill Cr	Other instream activity; riparian tree planting, riparian fencing	1 mile	2006	Crooked River Watershed Council	$22,347
20060551	Mill Cr	Instream rock weirs installed, other instream activity; riparian tree planting, riparian fencing; off-channel livestock watering	1 mile	2006	Crooked River Watershed Council	$41,648
20060770	Ochoco R, trib of	Upland vegetation management (juniper control)	20 acres	2004	Crook SWCD	$1,928
20070027	Crooked R	Other instream activity	1 splitter wall	2007	Crooked River Watershed Council	$292,440
20070496	Pine Cr	Upland vegetation planting	100 acres	2007	Crook SWCD	$4,470
20070497	Shotgun Cr	Upland vegetation planting	200 acres	2007	Crook SWCD	$8,549

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
20070498	No Name Cr	Upland erosion control, upland vegetation management (juniper control)	50 acres	2007	Crook SWCD	$13,387
20070499	Yank Gulch	Off-channel livestock watering, water/sediment control basins	40 acres	2007	Crook SWCD	$13,311
20070500	Ochoco Cr	Instream boulder placement, instream rock flow deflectors installed, stream bank stabilized: bioengineering	0.02 mile	2007	Crook SWCD	$4,120
20070501	Wolf Cr	Riparian fencing	0.5 mile	2007	Crook SWCD	$6,718
20070502	Long Hollow Cr	Upland vegetation management (juniper control), upland vegetation planting	125 acres	2007	Crook SWCD	$9,859
20070503	Bear Cr	Off-channel livestock watering		2007	Crook SWCD	$13,884
20070504	Pine Cr	upland vegetation planting	50 acres	2007	Crook SWCD	$4,767
20070505	Newsome Cr	upland vegetation planting	45 acres	2007	Crook SWCD	$3,467
20070506		upland vegetation management (juniper control)	65 acres	2008	Crook SWCD	$6,503
20070507	Johnson Cr	upland vegetation management (juniper control)	50 acres	2008	Crook SWCD	$6,470
20070538	McKay Cr & Mill Cr	riparian tree planting	2 miles	2007	Crooked River Watershed Council	$12,500
	McKay Cr	instream boulder and wood placement, riparian protection	4 miles	2007	US Forest Service	$144,825
20070539	South Fork Crooked R	riparian fencing, other upland activity	0.36 mile	2007	Crooked River Watershed Council	$17,504
20070540	Lower Crooked R	stream bank stabilized; riparian tree planting	0.06 mile	2007	Crooked River Watershed Council	$13,073
20070541	South Fork Beaver Cr	stream bank stabilized, riparian vegetation planting; off-channel livestock watering sites developed, Livestock stream access/crossing created or improved, upland fencing, upland vegetation management (juniper control)	25 miles	2007	Crooked River Watershed Council	$513,425
20070749	Lost Cr	fish ladder installed	3 miles hab	2006	The Nature Conservancy	$237,693
Lower Mainstem John Day Population						
20040813	John Day R	Riparian fencing	2 m	2002	ODFW	$12,400.00
20050666	Ferry Canyon	Upland veg management	360 ac	2005	Gilliam SWCD	$15,769.00
20040816	John Day R	Riparian fencing	0.25 m	1997	ODFW	$1,750.00
20050665	Coyote Canyon Spring	Upland wildlife	1 ac	2005	Gilliam SWCD	$468.00
20040759	Parrish Cr	Upland fence, off-channel	280 ac, 1 site	2003	Wheeler SWCD	$13,369.00
20040779	Rock Cr, Hay Cr, & John Day R	Upland off-channel watering site	4 sites	2004	Gilliam-East John Day Watershed Council	$54,955.00
20050663	Lonerock Cr	Upland	80 ac	2005	Gilliam SWCD	$3,926.00
20050662	Lost Valley Cr	Instream, riparian planting	5 weirs, 0.03 m planting	2005	Wheeler SWCD	$4,731.00
20040811	Lake Cr	Riparian fencing	2 m	2002	ODFW	$12,400.00
990741	Lake Cr	Fish passage improvements: culvert	1 culvert	1998	Wheeler County	$10,300.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
		upgraded				
20050668		Upland terracing	6,362 ft	2005	Sherman SWCD	$7,446.00
20040809	Johnny Cr	Riparian fencing	1 m	2002	ODFW	$5,000.00
20040810	Lake Cr	Riparian fencing	1.25 m	2002	ODFW	$12,500.00
20040815	John Day R	Riparian fencing	0.33 m	1997	ODFW	$2,310.00
20020786		Other grazing management: fencing	?	2002	Sherman SWCD	$5,008.00
20040730	Cottonwood Canyon	Off-channel watering site	1	2004	Sherman SWCD	$2,832.00
20040731	Fulton Canyon	Upland WASCOB	440 ac	2004	Sherman SWCD	$2,604.00
20040732	Bell Canyon	Upland fencing	600 ac	2004	Sherman SWCD	$6,894.00
20020830	Pine Cr	Off-channel livestock watering	8	2002	Wheeler SWCD	$8,614.00
20020829	Little Muddy Cr	Off-channel livestock watering	1	2002	Wheeler SWCD	$14,102.00
20050670		Upland terracing	7,765 ft	2005	Sherman SWCD	$7,603.00
20020790	West Branch Bridge Cr	Upland vegetation management: juniper control	160 ac	2002	Wheeler SWCD	$10,700.00
20011016	Rock Cr	Fish passage improvements: 1 culvert retrofitted	1	2000	ODOT	$15,000.00
20020788	Nelson Cr, trib of	Riparian juniper removal; other grazing management: planned livestock grazing, upland vegetation management: juniper control	0.25 m, 10 ac	2002	Wheeler SWCD	$1,950.00
990740	Alder Cr	Riparian tree planting, riparian fencing	0.25 m fenced, 1.21 ac planted	1999	Wheeler County	$400.00
20050669		WASCOB	2	2005	Sherman SWCD	$1,254.00
20040826	John Day R	Riparian fencing	0.27 m	1998	ODFW	$1,890.00
990907	several	Riparian tree planting; reseeding/brush harvest, erosion control: grassed waterways	0.02 m, 6 ac riparian planted, 452 ac upland treated	1999	Sherman SWCD	$62,263.00
20040757	Cove Cr	Off-channel site	5	2004	Wheeler SWCD	$6,775.00
20040758	Alder Cr, trib of	Upland irrigation	5.5 ac	2004	Wheeler County	$2,799.00
20050667	East Fork Thirty Mile Cr	Riparian fencing	4.17 m	2005	Gilliam SWCD	$38,130.00
20020582	Rock Cr	Fish passage improvements: 1 push-up dam permanently removed and replaced with permanent lay-flat stachion diversion structure	1	2002	Grant SWCD	$32,160.00
20020789	Nelson Cr	Other grazing management	19 ac	2002	Wheeler SWCD	$2,550.00
20010883	John Day R	Fish passage improvements: 1 push-up dam removed, replaced with pump station	1	2001	Grant SWCD	$65,232.00
20001169	Rock Cr	Instream habitat enhancement: anchored structures, weirs, deflectors, off-channel habitat	2 weirs, 2 deflectors, 1 side channel (50 ft), 1 off-channel site	1996	Morrow County Public Works	$76,404.00
20010881	John Day R	Fish passage improvements: 1 push-up dam removed, replaced with pump station	1	2001	Grant SWCD	$74,641.00
20040938	Mountain Cr	Instream habitat enhancement: anchored structures	0.32 m	2004	ODFW	$3,000.00
20020840	John Day R	Irrigation systems for improved water conservation	81 ac	2002	Wasco County SWCD	$20,122.00
20040931	John Day R	Fish passage	1	2004	Grant SWCD	$90,321.00
20040927	John Day R	Fish passage	2	2004	Grant SWCD	$35,026.00
20040926	Badger Cr	Fish passage	4	2004	Grant SWCD	$43,025.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
20040822	John Day R	Riparian fencing	1.25 ac	1998	ODFW	$6,250.00
20040923	West Branch Bridge Cr	Fish passage – push-up dam, irrigation dam	1 dam, 67 ac	2004	Wheeler SWCD	$104,021.00
20040839	Alder Cr	Riparian fencing	0.26 m	2001	ODFW	$710.00
20010884	John Day R	Fish passage improvements: 1 push-up dam removed, replaced with pump station	1	2001	Grant SWCD	$115,803.00
20020599	Gauge Cr	Upland vegetation management: juniper control, grass seeding	49 ac	2002	Wheeler SWCD	$11,686.00
20020598	West Branch Bridge Cr	Livestock exclusion, upland vegetation management: juniper control, brush removal, reseeding	3600 ft cross fence, 11.5 ac veg. mang, 49 ac juniper, 8 ac brush	2002	Wheeler SWCD	$9,988.00
20020597	West Branch Bridge Cr	Fish passage improvements: 1 culvert replaced with open bottom arch culvert	1	2002	Wheeler SWCD	$24,145.00
20020596	Pine Cr	Instream habitat enhancement: anchored structures, 'V' structures; fish passage improvements: 1 culvert removed and not replaced, 1 irrigation ditch removed	21 anchored structures, 3 v structures	2002	Wheeler SWCD	$69,000.00
20010885	John Day R	Fish passage improvements: 1 push-up dam removed, replaced with permanent diversion structure	1	2001	Grant SWCD	$52,204.00
20010886	John Day R	Fish passage improvements: 1 push-up dam removed, replaced with permanent diversion structure	1	2001	Grant SWCD	$33,740.00
20010887	John Day R	Fish passage improvements: 1 push-up dam removed, replaced with permanent diversion structure	1	2001	Grant SWCD	$29,970.00
20040924	Mountain Cr	Riparian planting	0.5 m	2004	Wheeler SWCD	$3,950.00
20040842	Cottonwood Cr	Riparian fencing	0.25 m	1998	ODFW	$2,500.00
20040819	John Day R	Riparian fencing	0.67 m	1998	ODFW	$3,330.00
20040820	Dry Fork Thirtymile Cr	Riparian fencing	0.02 m	1998	ODFW	$2,800.00
20040729	Jackknife, Watershed	Upland erosion control	60 ac	2004	Sherman SWCD	$6,451.00
20050661	Lost Valley Cr	Road	2 culverts	2005	Wheeler SWCD	$3,751.00
20020785		Off-channel livestock watering	1	2002	Sherman SWCD	$6,212.00
20040827	John Day R	Riparian fencing	1.3 m	1998	ODFW	$2,324.00
20010910	West Branch Bridge Cr	Riparian fencing; off-channel livestock watering, cross fencing	0.75 m rip fence, 1,320 ft. up. fence	2001	Wheeler SWCD	$9,468.00
20010909	Johnson Cr	Riparian fencing; off-channel livestock watering	0.75 m	2001	Wheeler SWCD	$15,351.00
20040829	John Day R	Riparian fencing	0.83 m	1998	ODFW	$4,166.00
20050659		Riparian fencing, off-channel, WASCOB	2 m fenced, 5 off-channel sites, 6 control basins	2003	Sherman SWCD	$106,385.00
20040828	Lake Cr	Riparian fencing	0.12 m	1998	ODFW	$1,750.00
20010903	John Day R	Riparian fencing	0.68 m	2001	ODFW	$3,400.00
20040841	Johnny Cr	Riparian fencing	0.5 m	1998	ODFW	$5,000.00
20010898	John Day R	Riparian fencing	0.4 m	2000	ODFW	$2,230.00
20010888	John Day R	Fish passage improvements: 1 push-	1	2001	Grant SWCD	$64,844.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
		up dam removed, replaced with pump station				
20001125	Rock Cr	Upland erosion control: sediment control basins	4 control basins	2000	Gilliam SWCD	$4,316.00
20001126	Sixmile Canyon & Hay Cr	Upland erosion control	617 ac	2000	Gilliam SWCD	$39,611.00
20001127	John Day R	Riparian fencing; off-channel livestock watering	1.5 m fence, 9 sites	2000	Wheeler SWCD	$29,463.00
990908	Pine Hollow	Off-channel livestock watering, grazing management: cross-fencing, erosion control: sediment basins	9,702 ft fenced, 980 ac WASCOB, 420 ac rip plants, 1 off-channel site	1999	Sherman SWCD	$65,618.00
990937	John Day R	Riparian tree planting, riparian fencing; off-channel livestock watering, irrigation systems for improved water conservation	5 m fenced, 6 ac planted, 3 off-channel sites, 46 ac treated	1999	Wheeler SWCD	$57,128.00
20010889	John Day R	Fish passage improvements: 1 push-up dam removed, replaced with pump station	1	2001	Grant SWCD	$99,950.00
1115	John Day R	Riparian fencing	1 mile	1997	ODFW	$7,000.00
1116	John Day R	Riparian fencing	1 mile	1996	ODFW	$7,000.00
20030841	Lake Cr	Riparian tree planting, riparian fencing	4 m	2003	ODFW	$43,000.00
20030838	Mountain Cr	Instream habitat enhancement: anchored structures	25 structures	2003	ODFW	$3,500.00
20030835	Thirtymile Cr	Upland off-channel watering site	1	2003	Gilliam SWCD	$5,194.00
20030833	Hay Cr	Upland	1 sed. Basin, 1 off-channel site	2003	Gilliam SWCD	$4,266.00
20040831	John Day R	Riparian fencing	0.8 m	1998	ODFW	$5,600.00
1117	John Day R	Riparian fencing	1.25 miles	1997	ODFW	$8,750.00
20030925		WASCOB	50 ac	2003	Sherman SWCD	$4,045.00
1175	Pine Hollow Watershed	Off-channel livestock watering, cross fencing, riparian pasture, erosion control: WASCOB, juniper control	5 ac juniper, 2 sed. Control basins, 4,000 ft terrace, 65 ac planted	1997	Sherman SWCD	$27,200.00
20050694		Upland terracing	7,741 ft	2005	Sherman SWCD	$6,667.00
980496	Pine Hollow & tribs	Off-channel livestock watering, cross fencing, erosion control: terraces & WASCOB	6 sed. Basins, 1 off-channel site, 5,296 ft terrace, 65 ac planted	1998	Sherman & Wasco SWCD	$53,558.00
20030947	Muddy Cr	Fish passage	1 dam	2003	Wasco County SWCD	$55,069.00
20030948	Service Cr	Upland erosion control	65 ac erosion manag. 330 ac fenced, 40 ac juniper	2003	Wheeler SWCD	$19,057.00
20030960		Off-channel watering sites	5	2004	Sherman SWCD	$3,671.00
20040728		Upland sed. Control basins	600 ac	2004	Sherman SWCD	$2,385.00
20030858		Upland sed. Control basins	6	2003	Sherman SWCD	$2,600.00
20050772	John Day R	Upland fence, off-channel watering site	l site	2001	Wheeler SWCD	$14,280.00
20050770	Muleshoe Cr	Riparian fencing, planting	0.5 m fenced, 1	2004	Wheeler SWCD	$10,935.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
			m planted			
20050769	Alder Cr	Upland juniper treatment	360 ac	2003	Wheeler SWCD	$33,684.00
20050768	West Branch Bridge, Bridge, Gable, Nelson, Keyes, Bear, Alder, Pine crks	Upland irrigation, water measuring device	?	2003	Wheeler SWCD	$9,014.00
20050767	Mountain Cr	Riparian planting	0.19 m	2003	Wheeler SWCD	$2,500.00
20050766	Kahler Cr, Corncob Cr	Instream log berm, riparian fencing/planting, juniper	0.78 m fenced, 0.53 m planted, 1 structure, 15 ac juniper treated	2004	Wheeler SWCD	$8,715.00
20030846	Mountain Cr	Instream large wood placement	51 logs	2003	ODFW	$3,200.00
20030859		Off-channel watering site	1 site	2003	Sherman SWCD	$14,566.00
20030847		Upland terrace	35 ac	2003	Sherman SWCD	$1,525.00
20030857		Upland erosion control	6 ac	2003	Sherman SWCD	$3,765.00
20030856		Upland WASCOB	2 sites	2003	Sherman SWCD	$5,876.00
20030854		Upland range	300 ac	2003	Sherman SWCD	$4,481.00
20030853		Upland range	412 ac	2003	Sherman SWCD	$8,400.00
20030851		Upland brush management	135 ac	2003	Sherman SWCD	$8,520.00
20030850		Off-channel watering site	1	2003	Sherman SWCD	$14,037.00
20030832	Lamberson Canyon	Off-channel watering site	1	2003	Gilliam County SWCD	$3,765.00
20030860	Cottonwood Cr	Off-channel watering site	5	2003	Wheeler SWCD	$8,125.00
20050674	West Branch Bridge Cr	Upland juniper, noxious weeds, off-channel watering site	15 ac, 1 site	2005	Wheeler SWCD	$5,641.00
20030834	Stackhouse Canyon	Off-channel watering site	1	2003	Gilliam SWCD	$6,050.00
20020853	John Day R	off-channel livestock watering	1	2002	Gilliam SWCD	$4,562.00
20040712	Holmes Cr	Upland irrigation	25 ac	2005	Monument SWCD	$4,209.00
20020852	John Day R	off-channel livestock watering	1	2002	Gilliam SWCD	$6,725.00
20020851	Rock Cr	irrigation systems for improved water conservation	42 ac	2002	Gilliam SWCD	$12,953.00
20040717	Rood Canyon, area of	Off-channel watering site	1	2004	Morrow SWCD	$12,726.00
20040721		Upland erosion control, WASCOB	75 ac	2004	Sherman SWCD	$2,499.00
20040723		Upland erosion control, WASCOB	1	2004	Sherman SWCD	$5,794.00
20040727		Upland brush management	600 ac	2004	Sherman SWCD	$3,051.00
20040664	Thirty Mile Cr	Off-channel watering site	5	2004	Gilliam SWCD	$7,561.00
981090	John Day R	fish passage improvements: push-up dam removed, replaced with pump	1 structure	1998	Grant SWCD	$109,017.00
	Rock Cr	instream structure removal	1 mile	2000	USFS Ochoco NF	$4,500.00
	Rock Cr	Cutbank (channel morphology) Restoration-instream structure placement	2 miles	2001	USFS Ochoco NF	$11,000.00
	Wheeler Cr	fish passage improvement	3 miles	1997	USFS Umatilla NF	$2,500.00
	Alder Cr	fish passage improvement	2 miles	1997	USFS Umatilla NF	$1,500.00
	Davis Cr	fish passage improvement	1 mile	1997	USFS Umatilla NF	$2,000.00
	Corncob Cr	fish passage improvement	1 mile	1997	USFS Umatilla NF	$1,500.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
	Wheeler Cr	Riparian planting	36 acres	1998	USFS Umatilla NF	$6,300.00
	Wheeler Cr	Riparian planting	14 acres	1999	USFS Umatilla NF	$2,450.00
	Henry Cr - electric	riparian corridor and pasture fencing	0.25	1998	USFS Umatilla NF	$300.00
	Henry Cr - electric	riparian corridor and pasture fencing	0.75	2001	USFS Umatilla NF	$750.00
	EF Bologna Creek	riparian corridor and pasture fencing	2	1997	USFS Umatilla NF	$16,000.00
	Rock Creek	Instream structure removal	1 mi	2000	USFS Ochoco NF	$4,500.00
	Deep Creek	Riparian fencing	5 miles	2000	BLM	$10,000.00
	John Day	Ag field rehabilitation. Control weeds, plant riparian shrubs and cottonwoods	300 ac 2 miles	2000	BLM	$12,000.00
	Bridge Creek	Spring developments provide alternative water sources for cattle	3 springs	2000	BLM	$9,000.00
	Lower mainstem John Day	Wild and Scenic River Management Plan changed season of use for grazing allotments to protect riparian conditions	Tumwater Falls to Service Creek	2001	BLM	Unknown
	Esau Canyon	Pasture development and riparian fencing	11 riparian miles	2003	BLM	$44,000.00
	Cordwood Canyon	Riparian fencing	0.3 mile	2003	BLM	$10,500.00
	Bear Creek	Willow Spring riparian fencing (trib to Bear Creek, then Bridge Creek)	2.7 riparian miles	2003	BLM	$10,000.00
	Lower mainstem John Day	Green Fence #2 riparian fencing	3 miles	2006	BLM	$14,000.00
	Lower mainstem John Day	Stanley ag. Field/John Day River riparian fencing	1 mile	2006	BLM	$8,000.00
Upper Mainstem John Day Population						
20001163	John Day R	fish passage improvements: 1 push-up dam permanently removed	1	2000	Grant SWCD	$60,386.00
981098	John Day R	irrigation systems for improved water conservation	55 acres treated, 2,800 ft pipe	1995	Grant SWCD	$46,778.00
20010882	John Day R	irrigation systems for improved water conservation	161 ac	2001	Grant SWCD	$67,930.00
20001161	John Day R	fish passage improvements: 1 push-up dam permanently removed	1	1999	Grant SWCD	$258,063.00
990719	Canyon Cr	boulder placement; riparian fencing, watergaps	2 water gaps, 0.45 fencing	1995	ODFW	$32,155.00
981097	John Day R	irrigation systems for improved water conservation	37 ac treated, 4,780 ft pipe	1995	Grant SWCD	$94,320.00
20001162	John Day R	fish passage improvements: 1 push-up dam permanently removed	1	2000	Grant SWCD	$60,258.00
20040935	Standard Creek Diversion	Fish passage improvements, push-up dam	1	2004	Grant SWCD	$22,351.00
20020752	Indian Cr	fish passage improvements: 1 push-up dam permanently removed and replaced with 1 permanent lay-flat stachion diversion structure	1	2002	Grant SWCD	$20,072.00
20020586	Indian Cr	riparian fencing	0.6 m	2002	ODFW	$6,286.00
20020751	Indian Cr	fish passage improvements: 1 push-up dam permanently removed and	1	2002	Grant SWCD	$20,072.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
		replaced with 1 permanent lay-flat stachion diversion structure				
20040934	Dixie Cr	Fish passage, push-up dam	1	2004	Grant SWCD	$13,502.00
20001164	John Day R	irrigation systems for improved water conservation	66 ac	2000	Grant SWCD	$50,836.00
20001165	Indian Cr	fish passage improvements: 2 push-up dams permanently removed	2	2000	Grant SWCD	$30,973.00
20020587	John Day R	irrigation systems for improved water conservation	300 ac	2002	Grant SWCD	$60,982.00
20040830	John Day R	Riparian planting	0.15 m	2002	ODFW	$760.00
20020588	John Day R	fish passage improvements: 1 push-up dam permanently removed and replaced with permanent diversion structure	1	2002	Grant SWCD	$24,830.00
20020589	John Day R	fish passage improvements: 1 push-up dam permanently removed and replaced with 1 permanent lay-flat stachion diversion structure	1	2002	Grant SWCD	$21,675.00
20020590	John Day R	fish passage improvements: 1 push-up dam permanently removed and replaced with 1 permanent lay-flat stachion diversion structure	1	2002	Grant SWCD	$24,703.00
20020591	John Day R	fish passage improvements: 1 push-up dam permanently removed and replaced with 1 permanent lay-flat stachion diversion structure	1	2002	Grant SWCD	$23,110.00
20020592	John Day R	fish passage improvements: 1 push-up dam permanently removed and replaced with 1 permanent diversion structure	1	2002	Grant SWCD	$31,918.00
20050771	John Day R	Upland irrigation water measuring devises		2002	Grant SWCD	$5,013.00
20040929	John Day R	Fish passage push-up dam	1	2004	Grant SWCD	$58,844.00
1114	Canyon Cr	instream habitat enhancement: boulder placement; riparian tree planting	40 boulders, other not reported	1996	ODFW	$900.00
20040933	John Day R	Upland irrigation improvement	50 ac	2003	Grant SWCD	$24,961.00
20020792	Indian Cr	fish passage improvements: 1 push-up dam removed and replaced with permanent lay-flat stachion diversion structure	1	2002	Grant SWCD	$19,057.00
20020791	Indian Cr	fish passage improvements: 1 push-up dam removed and replaced with 4.7 permanent lay-flat station diversion structure	1	2002	Grant SWCD	$19,746.00
20020581	Beech Cr	Riparian fencing	4.7 m	2002	ODFW	$16,402.00
20040928	John Day R	Fish passage push-up dam	2	2004	Grant SWCD	$19,056.00
20040930	Canyon Cr	Fish passage, push-up dam	1	2004	Grant SWCD	$15,090.00
981099	Widows Cr	riparian fencing; fish passage improvements: push-up dam removed, replaced with screened inlet structures	2.1 miles	1995	Grant SWCD	$228,570.00
20040932	John Day R	Fish passage, push-up dams	2	2004	Grant SWCD	$44,664.00
20050673	Grouse Cr	Upland juniper, noxious weeds, plantings	530 ac juniper, 280 ac weeds, 305 ac plant	2005	Grant SWCD	$55,361.00
981085	Indian Cr	riparian fencing	2.68 miles	1998	ODFW	$29,858.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
20001157	Grub Cr	riparian fencing	1.6 m	2000	ODFW	$20,656.00
20040823	Widows Cr	riparian fencing	0.25 m	1998	ODFW	$3,500.00
20010890	John Day R	irrigation systems for improved water conservation	66 ac	2001	Grant SWCD	$40,530.00
1122	Widows Cr/John Day R	riparian fencing	3.45 miles	1996	ODFW	$24,150.00
981092	John Day R	fish passage improvements: push-up dam removed, replaced with infiltration gallery	1 structure	1997	Grant SWCD	$61,498.00
20040669	Blue Mountain Ditch, area of	Upland juniper	50 ac	2004	Grant SWCD	$4,601.00
20030939	Deardorf Cr	invasive species removal	?	2003	Grant Weed Control	$1,708.00
20040668	Blue Mtn. Ditch, area of	invasive species removal	75 ac	2004	Grant SWCD	$8,091.00
1120	Canyon Cr	boulder placement; riparian fencing	1 mile, 20 boulders	1996	ODFW	$17,000.00
981084	Indian Cr	fish passage improvements: push-up dam removed, replaced with infiltration gallery	1	1998	Grant SWCD	$17,060.00
20040825	John Day R	riparian fencing	0.6 m	1998	ODFW	$3,030.00
20040812	Laycock Cr	riparian fencing	0.75 m	2003	ODFW	$7,500.00
20040666	McClellan Cr, area of	Upland juniper treatment	150.8 ac	2005	Grant SWCD	$14,556.00
20040665	Laycock Cr, area of	Upland juniper treatment	86.8 ac	2004	Grant SWCD	$7,144.00
20040808	Laycock Cr	riparian fencing	0.5 m	2003	ODFW	$6,000.00
981086	John Day R	riparian fencing; off-channel livestock watering	4 miles, 1 site	1998	ODFW	$46,427.00
20030732	Dads Cr & Dixie Cr	riparian fencing	2.25 m	2003	Grant SWCD	$11,112.00
20030731		Upland treatment	80 ac	2003	Grant SWCD	$5,027.00
981089	John Day R	irrigation systems for improved water conservation	35 ac	1999	Grant SWCD	$69,741.00
981091	John Day R	fish passage improvements: push-up dam removed, replaced with pump	1 pump station, replaced 1,980 ft pipe	1997	Grant SWCD	$136,777.00
20010902	Indian Cr	riparian tree planting, riparian fencing	0.3 m fenced, 4 ac planted	2000	ODFW	$2,400.00
20040837	Dry Cr	Riparian fencing	2 m	1998	ODFW	$11,400.00
20050664		Upland juniper removal	135 ac	2005	Grant SWCD	$12,400.00
20020585	Grub Cr	riparian fencing	0.5 m	2002	ODFW	$5,943.00
20030843	Canyon Cr	riparian fencing	0.5 m	2003	ODFW	$11,500.00
20030842	Canyon Cr/Berry Cr	riparian fencing	1.4 m	2003	ODFW	$18,176.00
981096	John Day R	riparian fencing; fish passage improvements: push-up dam removed, replaced with pump station	0.43 miles, 1 pump station	1996	Grant SWCD	$94,372.00
20030840	John Day R	riparian fencing	0.7 m	2003	ODFW	$15,000.00
20030839	Canyon Cr	riparian fencing	0.25 m	2003	ODFW	$10,000.00
20010901	West Fork Grub Cr	riparian fencing; off-channel livestock watering	1.1 m fencing, 3 sites	2000	ODFW	$23,164.00
20001160	John Day R	fish passage improvements: 1 push-up dam permanently removed	1	1999	Grant SWCD	$61,922.00
20030837	Indian Cr	instream habitat enhancement: anchored structures; riparian fencing	27 structures, 0.5 m fence	2003	ODFW	$13,000.00
20030836	McClellan Cr	Upland juniper treatment	94 ac	2003	Grant SWCD	$7,820.00
20010905	Beech Cr	riparian fencing	1 m	2001	ODFW	$7,910.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
981095	John Day R	irrigation systems for improved water conservation	82 ac, 3 pump stations	1996	Grant SWCD	$103,367.00
20020753	Indian Cr	fish passage improvements: 1 push-up dam permanently removed and replaced with 1 permanent lay-flat stachion diversion structure	1 structure	2002	Grant SWCD	$20,072.00
981094	John Day R	fish passage improvements: push-up dam removed, replaced with permanent structure	1 structure	1996	Grant SWCD	$34,186.00
990723	Indian Cr	boulder placement; riparian fencing, watergaps	86 boulders, 0.3 m fence	1999	ODFW	$8,690.00
981093	John Day R	cross fencing, irrigation systems for improved water conservation; fish passage improvements: push-up dam removed, replaced with infiltration gallery	1 structure	1998	Grant SWCD	$221,457.00
20020583	Canyon Cr	riparian fence maintenance		2002	ODFW	$1,190.00
	Little Pine Creek	Culvert replacement for fish passage	1 culvert	2005	BLM	$25,000.00
	Cottonwood Creek	Riparian fence	1 mile	2006	BLM	$17,000.00
	Little Pine Creek	Re-route valley bottom road; obliterate and re-contour old roadbed	1 mile	2006	BLM	$98,000.00
Middle Fork John Day Population						
20010891	Camp Cr	fish passage improvements: 1 push-up dam removed, replaced with permanent diversion structure	1	2001	Grant SWCD	$32,975.00
20001167	South Fork Long Cr	fish passage improvements: 1 push-up dam permanently removed	1	1999	Grant SWCD	$18,297.00
20001128	Middle Fork John Day R	instream habitat enhancement: off-channel habitat; riparian tree planting; wetland habitat improvements	1 side-channel, 3 ac wetland, 0.006 ac riparian plants	2000	The Nature Conservancy	$12,734.00
20040840	Granite Cr	Riparian fencing	0.8 m	2001	ODFW	$8,750.00
991049	Big Cr, Hawkins Cr, Big Boulder Cr, & Middle Fork John Day R	instream water right transfer/lease		2000	Oregon Water Trust	$136,998.00
20010892	Camp Cr	fish passage improvements: 1 push-up dam removed, replaced with permanent diversion structure	1	2001	Grant SWCD	$35,378.00
990718	Middle Fork John Day R	riparian fencing, watergaps	1.3 m	1996	ODFW	$78,270.00
981087	Middle Fork John Day R	fish passage improvements: push-up dam removed, replaced with pipeline	800 ft of pipe, headgates	1998	Grant SWCD	$21,364.00
1123	Middle Fork John Day R	streambank stabilization; riparian fencing	1.3 miles fenced, 0.5 m stabilized	1996	ODFW	$30,480.00
1121	Middle Fork John Day R	riparian fencing	3.75 miles	1997	ODFW	$26,250.00
1119	Camp Cr	riparian fencing	0.5 miles	1997	ODFW	$7,230.00
990722	Camp Cr	riparian fencing, watergaps	0.5 m fenced, 3 gaps	1997	ODFW	$32,735.00
20010893	Middle Fork John Day R	riparian fencing	5 m	2001	ODFW	$26,250.00
20010894	Paul Cr	riparian fencing	1 m	1999	ODFW	$21,000.00
20020843	Pass Cr	riparian fencing; off-channel livestock watering	0.25 m	2002	North Fork John Day Watershed Council	$26,345.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
20040818	Middle Fork John Day R	Riparian fencing	2 m	1996	ODFW	$14,000.00
20020593	Middle Fork John Day R	fish passage improvements: 1 push-up dam permanently removed and replaced with 1 permanent lay-flat station diversion structure	1	2002	Grant SWCD	$31,430.00
20020594	Middle Fork John Day R	fish passage improvements: 1 push-up dam permanently removed and replaced with 1 permanent lay-flat stachion diversion structure	1	2002	Grant SWCD	$30,066.00
20040936	Camp Cr	Fish passage	1	2003	Grant SWCD	$12,511.00
	Galena area streams	Summit Fire Recovery and Fish Habitat Rehabilitation-instream structures and large wood placement	24 miles	1999	USFS Malheur NF	
	Galena area streams	Summit Fire Recovery and Fish Habitat Rehabilitation-log landing rehabilitation	8 acres	1999	USFS Malheur NF	
	Galena area streams	Summit Fire Recovery and Fish Habitat Rehabilitation-meadow restoration (seeding, planting, water table restoration)	20 acres	1999	USFS Malheur NF	
	Galena area streams	Summit Fire Recovery and Fish Habitat Rehabilitation-road decommissioning	43 miles	1999	USFS Malheur NF	
	Galena area streams	Summit Fire Recovery and Fish Habitat Rehabilitation-riparian planting and caging	20 miles	1999	USFS Malheur NF	
	Galena area streams	Summit Fire Recovery and Fish Habitat Rehabilitation-instream structures and large wood placement	6 miles	2000	USFS Malheur NF	
	Galena area streams	Summit Fire Recovery and Fish Habitat Rehabilitation-instream structures and large wood placement	12 miles	2001	USFS Malheur NF	$16,100.00
	SE Galena area multiple streams	Summit fire/SE Galena hardwood diversity planting and protection	6 miles	2002	USFS Malheur NF	$57,375.00
	Vinegar Creek	riparian planting	5 miles	2002	USFS Malheur NF	$4,730.00
	Long Creek and MF John Day River	Flood Meadows riparian planting and protection, spring exclosure, streambank protection through large wood placement	1/2 mile each	2003	USFS Malheur NF	$9,900.00
	Long Creek, Coxie Creek, Camp Creek, Lick Creek, West Fork Lick Creek	Riparian Planting, caging, riparian corridor and pasture fencing	3.5 miles	2004	USFS Malheur NF	$96,950.00
	Camp Creek	riparian planting and protection	1 mile	2005	USFS Malheur NF	$9,345.00
	Long Creek and Camp Creek	riparian planting and caging	Long Creek (1 mile), Camp Creek (4 miles)	2006	USFS Malheur NF	$11,343.00
	Little Indian Creek	Riparian corridor fencing	.7 miles	1997	Umatilla NF	$10,800.00
North Fork John Day Population						
990477	Middle Fork Wilkins Cr	peak flow passage improvements,	1	1999	Pioneer Resources, LLC	$150.00
990478	Scaffold Cr	road relocation	3	1999	Pioneer Resources, LLC	$200.00
990479	Wilkins Cr	peak flow passage improvements	6	1998	Pioneer Resources, LLC	$11,000.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
990480	Snake Cr & Camas Cr	peak flow passage improvements, surface drainage improvements	12 structures, 140 stations	1998	Pioneer Resources, LLC	$44,048.00
990481	Fivemile Cr	peak flow passage improvements, surface drainage improvements	1 culvert, 1 structure	1999	Pioneer Resources, LLC	$13,000.00
990482	Wilkins Cr	Voluntary Riparian Tree Retention	?	1999	Pioneer Resources, LLC	$0.00
990717	Camas Cr	instream large wood placement; riparian fencing, watergaps; off-channel livestock watering	2.1 m fenced, 49.7 ac	1995	ODFW	$106,732.00
20040937	Cottonwood Cr	Riparian fencing	3 m	2005	ODFW	$43,000.00
20040714	North Fork John Day R	Off-channel watering site	1	2005	Monument SWCD	$3,385.00
20011133	Camas Cr	riparian tree planting, riparian fencing	1 m	2001	Oregon Parks & Recreation Dept.	$20,973.00
20040709	North Fork John Day R	Riparian fencing	0.5 ac	2003	Monument SWCD	$6,007.00
20011089	North Fork John Day R, trib of	upland erosion control	10 ac	2001	North Fork John Day Watershed Council	$3,350.00
20011017	Porter Cr	fish passage improvements: 1 culvert retrofitted	1 culvert	2000	ODOT	$0.00
20040786	Porter Cr, Johnson Cr, Harrington Cr, & tribs of	Upland fencing, off-channel watering site, road	Bridge, 6 off-channel sites, 2 ac fenced	2005	North Fork John Day Watershed Council	$64,348.00
20040824	North Fork John Day R	Riparian fencing	1.5 m	1998	ODFW	$7,500.00
20010907	North Fork John Day R	fish passage improvements: 1 push-up dam removed, replaced with permanent pumping station	1	2000	North Fork John Day Watershed Council	$35,000.00
990720	Fox Cr	riparian fencing, watergaps; off-channel livestock watering	1 m fenced, 2 gaps, 2 off-channel sites	1995	ODFW	$42,185.00
980965	North Fork John Day R	riparian fencing	0.5 miles, 4.2 ac	1998	North Fork John Day Watershed Council	$3,100.00
20030845	Granite Cr	dredge tail leveling	0.6 m	2003	ODFW	$50,000.00
20030844	Granite Cr	dredge tail leveling	0.35 m	2003	ODFW	$40,000.00
1118	Fox Cr	riparian fencing	0.5 m	1996	ODFW	$7,000.00
1406	Pine Cr	riparian tree planting	0.25 m, 1.2 ac	1997	North Fork John Day Watershed Council	$350.00
1407	North Fork John Day R	riparian tree planting	0.25 m	1996	North Fork John Day Watershed Council	$150.00
1408	Cottonwood Cr	riparian tree planting	0.13 m	1997	North Fork John Day Watershed Council	$200.00
1409	North Fork John Day R	bank stabilization	0.5 m	1997	North Fork John Day Watershed Council	$7,800.00
980008	North Fork John Day R	fish passage improvements: push-up dam removed, replaced with permanent pumping station	1	1998	North Fork John Day Watershed Council	$21,770.00
20040711	Board Cr	Upland erosion control	120 ac	2004	Monument SWCD	$9,734.00
20030943	Portugese Canyon	Upland juniper	150 ac	2003	Monument SWCD	$6,790.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
20040713	Pine Cr	Upland juniper	60 ac	2005	Monument SWCD	$5,945.00
980966	North Fork John Day R	riparian fencing	0.125	1998	North Fork John Day Watershed Council	$1,000.00
980967	North Fork John Day R	instream habitat enhancement: weirs	4 structures	1998	North Fork John Day Watershed Council	$8,900.00
980968	North Fork John Day R	fish passage improvements: push-up dam removed, replaced with permanent pumping station	1 dam	1998	North Fork John Day Watershed Council	$21,770.00
20030944	Kingsely Cr	Riparian and upland	0.5 m rip fence, 40 ac upland fenced, 19 ac treated	2003	Monument SWCD	$8,586.00
20030945	Upper Wilson Cr	riparian fencing	2.08 m	2003	North Fork John Day Watershed Council	$15,600.00
990721	Fox Cr	anchored structures; riparian fencing, watergaps	0.3 m fenced, 2 water gaps	1995	ODFW	$9,628.00
20040710	Wall Cr	Upland erosion, off-channel watering site	37 ac, 1	2004	Monument SWCD	$10,466.00
20010906	North Fork John Day R	fish passage improvements: 1 push-up dam removed, replaced with permanent pumping station	1	2000	North Fork John Day Watershed Council	$32,000.00
20030942	Alkali Cr	Off-channel watering sites	4	2003	Monument SWCD	$9,818.00
20040836	North Fork John Day R	Riparian fencing	0.25 m	1998	ODFW	$860.00
20001158	Granite Cr	riparian tree planting, riparian habitat enhancement: dredge pile leveling, floodplain restoration	1.8 m fenced, 12 ac planted	2000	ODFW	$179,754.00
20050658	Snipe Cr	Riparian fencing	0.25 m	2005	Umatilla SWCD	$5,248.00
20010895	Fox Cr	riparian fencing; off-channel livestock watering	1.1 m, 1 site	1999	ODFW	$10,000.00
20010896	North Fork John Day R	riparian fencing; off-channel livestock watering	0.5 m, 1 site	1999	ODFW	$3,000.00
20010899	North Fork John Day R	riparian fencing	1m	2000	ODFW	$5,000.00
20040940	Cottonwood Cr	Riparian fencing	0.8 m	2004	Grant SWCD	$7,788.00
20040939	Cottonwood Cr	riparian fencing	0.26 m	2005	ODFW	$70,000.00
20020584	Granite Cr	dredge pile leveling		2002	ODFW	$52,614.00
	Fox Cr	Watershed Improvement-Riparian Planting	4 miles of stream	2002	USFS Malheur NF	$10,020.00
	Auger Creek	Ingram Meadows structure repair, riparian planting and riparian fencing	6 miles	2000	USFS Ochoco NF	$55,425.00
	Granite and Clear Creeks	floodplain dredge tailings redistribution	3.3 miles	2000	USFS Umatilla NF	$100,000.00
	SF Desolation Creek	riparian conifer planting for fire recovery-Summit Fire	1 mile	2000	USFS Umatilla NF	$14,000.00
	Granite and Clear Creeks	floodplain dredge tailings redistribution and riparian planting	3 miles	2001	USFS Umatilla NF	$134,500.00
	Clear Cr	floodplain dredge tailings redistribution	1 mile	2002	USFS Umatilla NF	$56,600.00
	Clear Cr	riparian planting and tubing	2 miles	2003	USFS Umatilla NF	$13,500.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
	NF Cable Cr	riparian planting-Tower fire recovery	1 mile	2003	USFS Umatilla NF	$600.00
	NF Cable Cr	riparian planting-Tower fire recovery	2 miles	2004	USFS Umatilla NF	$3,520.00
	NF Cable Cr	riparian planting-Tower fire recovery	1 mile	2005	USFS Umatilla NF	$13,900.00
	Lightning Cr	fish passage improvement	1 mile	2006	USFS Umatilla NF	$83,000.00
	Lightning Cr	riparian planting-Tower fire recovery	3 miles	2006	USFS Umatilla NF	$8,400.00
	Clear Cr	floodplain dredge tailings redistribution	.4 miles	2006	USFS Umatilla NF	$256,300.00
	Smith Cr	Riparian corridor fencing	.4 miles	2000	USFS Umatilla NF	$6,320.00
	Smith Cr	Riparian corridor fencing	.6 miles	1999	USFS Umatilla NF	$9,920.00
	Smith Cr	Riparian corridor fencing	.5 miles	1998	USFS Umatilla NF	$7,600.00
	Park Cr	Riparian corridor fencing	.3 miles	1997	USFS Umatilla NF	$2,080.00
	Camp Cr	Riparian corridor fencing	5.4 miles	1999	USFS Umatilla NF	$43,200.00
	Dry Camas Cr	Riparian corridor fencing	1 mile	1997	USFS Umatilla NF	$16,000.00
	Bear Wallow	Riparian corridor fencing	1 mile	1997	USFS Umatilla NF	$16,000.00
	Owens Cr	Riparian corridor fencing	.5 miles	2000	USFS Umatilla NF	$8,000.00
	Texas Bar Cr	Riparian corridor fencing	1.3 miles	1997	USFS Umatilla NF	$10,200.00
	Lane Cr	Riparian corridor fencing	3.5 miles	2001	USFS Umatilla NF	$28,000.00
	Kelsay Cr	Riparian corridor fencing	.6 miles	2003	USFS Umatilla NF	$9,600.00
	W.F. Meadowbrook Cr	Riparian corridor fencing	.5 miles	2002	USFS Umatilla NF	$8,640.00
	Smith Cr	Riparian corridor fencing	.6 miles	2002	USFS Umatilla NF	$8,960.00
	S. F. Big Wall	fish passage improvement	3 miles	1995	USFS Umatilla NF	$1,000.00
	Keating Cr	fish passage improvement	5 miles	1995	USFS Umatilla NF	$2,000.00
	E. F. Keating Creek	Channel restoration	.1 miles	1996	USFS \Umatilla NF	$4,500.00
	Ditch Creek	Riparian planting	4 miles	1998	USFS Umatilla NF	$4,000.00
	Wilson Creek	Riparian planting	5 miles	1997	USFS Umatilla NF	$3,000.00
	Indian Creek	large wood placement	4 miles	1997	USFS Umatilla NF	$8,600.00
	SF Big Wall Creek	fish passage improvement	4 miles	1998	USFS Umatilla NF	$2,000.00
	Oriental Creek	Oriental basin road obliteration	5.5 miles	1999	USFS Umatilla NF	$16,500.00
	Texas Bar Creek	Texas Bar basin road obliteration	4.2 miles	1999	USFS Umatilla NF	$12,600.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
	Wilson Creek	riparian corridor and pasture fencing	6.5	1996	USFS Umatilla NF	$52,000.00
	Bull Wilson Creek	riparian corridor and pasture fencing	3	2003	USFS Umatilla NF	$48,000.00
	Wall Creek	riparian corridor and pasture fencing	4.5	2003	USFS Umatilla NF	$36,000.00
	Colvin Creek - electric	riparian corridor and pasture fencing	1	1998	USFS Umatilla NF	$800.00
	Skookum Creek	riparian corridor and pasture fencing	2	1999	USFS Umatilla NF	$28,000.00
	Skookum Creek	riparian corridor and pasture fencing	4.5	2002	USFS Umatilla NF	$36,000.00
	Little Wall Creek	riparian corridor and pasture fencing	2	2004	USFS Umatilla NF	$28,000.00
	Bacon Creek	riparian corridor and pasture fencing	2.75	1997	USFS Umatilla NF	$22,000.00
	Little Wall Creek - electric	riparian corridor and pasture fencing	1.5	1998	USFS Umatilla NF	$1,500.00
	Three Trough Creek	riparian corridor and pasture fencing	1	1998	USFS Umatilla NF	$750.00
	Indian Creek	riparian corridor and pasture fencing	0.5	1996	USFS Umatilla NF	$4,000.00
	Indian Creek	riparian corridor and pasture fencing	2	1998	USFS Umatilla NF	$16,000.00
	Indian Creek	riparian corridor and pasture fencing	5.8	2004	USFS Umatilla NF	$46,400.00
	SF Big Wall Creek	riparian corridor and pasture fencing	3	1999-2000	USFS Umatilla NF	$42,000.00
	Dark Canyon	riparian corridor and pasture fencing	1.5	1999	USFS Umatilla NF	$12,000.00
	NFJD River multiple streams	Riparian Reforestation - conifers	22 acres	1995	USFS Umatilla NF	$11,000.00
	NFJD River multiple streams	Riparian Reforestation - conifers	21 acres	1996	USFS Umatilla NF	$10,500.00
	NFJD River multiple streams	Riparian Reforestation - conifers	23 acres	1997	USFS Umatilla NF	$11,500.00
	NFJD River multiple streams	Riparian Reforestation - conifers	60 acres	1998	USFS Umatilla NF	$30,000.00
	NFJD River multiple streams	Riparian Reforestation - conifers and hardwoods	54 acres	1999	USFS Umatilla NF	$32,400.00
	NFJD River multiple streams	Riparian Reforestation - conifers and hardwoods	93 acres	2000	USFS Umatilla NF	$55,800.00
	NFJD River multiple streams	Aspen Restoration	10 acres	1995	USFS Umatilla NF	$50,000.00
	NFJD River multiple streams	Aspen Restoration	20 acres	1996	USFS Umatilla NF	$100,000.00
	NFJD River multiple streams	Aspen Restoration	10 acres	1997	USFS Umatilla NF	$55,000.00
	NFJD River multiple streams	Aspen Restoration	12 acres	1998	USFS Umatilla NF	$66,000.00
	NFJD River multiple streams	Aspen Restoration	10 acres	1999	USFS Umatilla NF	$60,000.00
	NFJD River multiple streams	Aspen Restoration	10 acres	2000	USFS Umatilla NF	$60,000.00
	N. Fk. John Day	Buckaroo Flats riparian fencing	1 mile	2006	BLM	$11,000.00
	N. Fk. John Day	Wild and Scenic River Management	Camas Creek	2001	BLM	Unknown

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
		Plan changed season of use for grazing allotments to protect riparian conditions	to headwaters			
South Fork John Day Population						
20040814	South Fork John Day R	riparian fencing	0.33 m	1997	ODFW	$3,300.00
981088	South Fork John Day R	weirs, deflectors, streambank stabilization; off-channel livestock watering, stream crossings for cattle	3 crossings, 2 off-channel sites, 15 deflectors, 8 weirs	1999	Grant SWCD	$122,838.00
20040667	Rosebud Cr	riparian fencing, off channel watering, upland fencing	16 m rip fence, 2 sites, 10,032 ft upland fence	2004	Grant SWCD	$34,044.00
20040835	South Fork John Day R	riparian fencing	6.1 m	2001	ODFW	$1,250.00
20001166	South Fork John Day R	fish passage improvements: 1 push-up dam permanently removed	1	1999	Grant SWCD	$29,620.00
20050672		Upland vegetation management	3,711 ac weeds, 2,943 ac juniper	2005	Grant SWCD	$411,072.00
20050660	Bear Cr	Fish passage	1 culvert	2005	Grant SWCD	$19,337.00
20040817	South Fork John Day R	riparian fencing	0.33 m	1997	ODFW	$3,332.00
20010900	South Fork Murderers Cr	riparian fencing	1m	1999	ODFW	$10,000.00
20020595	South Fork John Day R	fish passage improvements: 1 push-up dam permanently removed and replaced with 1 permanent lay-flat stachion diversion structure	1	2000	Grant SWCD	$36,169.00
20010904	South Fork John Day R	riparian fencing	1m	2001	ODFW	$5,657.00
20001159	South Fork John Day R	bank stabilization with juniper riprap; riparian tree planting; fish passage improvements: 1 fish ladder installed, 1 push-up dam permanently removed, 1 fish screen installed on irrigation diversions	0.66 m juniper riprap, 1 dam, 3.5 ac planted	2000	Grant SWCD	$114,944.00
1174	South Fork John Day R	riparian tree planting	5 m, 24 ac	1997	Upper South Fork John Day Watershed Council	$6,082.00
20040832	South Fork John Day R	riparian fencing	0.5 m	1998	ODFW	$2,800.00
	Murderers Cr	Road Reconstruction and resurfacing (included 8 culvert upgrades and streambank bioengineering)	3.1 miles of stream	2001	USFS Malheur NF	$92,779.00
	NF Cable Creek	riparian planting-Tower fire recovery	1 mile	2003	Umatilla NF	$600.00
		riparian planting-Tower fire recovery	2 miles	2004	Umatilla NF	$3,520.00
		riparian planting-Tower fire recovery	1 mile	2005	Umatilla NF	$13,900.00
	Lightning	fish passage improvement	1 mile	2006	Umatilla NF	$83,000.00
		riparian planting-Tower fire recovery	3 miles	2006	Umatilla NF	$8,400.00
	Clear Creek	floodplain dredge tailings redistribution	.4 miles	2006	Umatilla NF	$256,300.00
	S. Fk. John Day	South Fork road repair to reduce erosion	.75 mile in two segments	2005	BLM	$144,000.00
	Indian Creek	Riparian fence	3 miles	2000	BLM	$6,000.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
	Soda Creek	Riparian fence	2 miles	2006	BLM	$8,000.00
	S. Fk. John Day	Wild and Scenic River Management Plan changed season of use for grazing allotments to protect riparian conditions	Smokey Ck. to Malheur NF boundary	2001	BLM	Unknown
Umatilla River Population						
20030716	Iskuulpa Cr (Squaw Cr)	Instream, riparian, road, upland (grazing, fencing, off-channel watering)	66 structures, 151 logs, 0.3 m rip planting, 25 off-channel sites, 20,000 ac exclusive, 11,612 ac rotation	2003	Confederated Tribes of the Umatilla Indian Reservation	$462,094.00
20030901	Little Butter Cr	Off-channel watering site	2 sites	2003	Morrow SWCD	$19,502.00
20050604	Meacham Cr	Upland vegetation management	3 ac	2004	Umatilla SWCD	$1,433.00
20050603	South Patawa	Upland vegetation management	45 ac	2005	Umatilla SWCD	$16,011.00
20030899		Off-channel	1 site	2003	Morrow SWCD	$10,861.00
20020641	Sandhollow Cr	off-channel livestock watering	2 sites	2002	Morrow SWCD	$4,946.00
20030742		Upland irrigation improvement	31 ac	2003	Hermiston Irrigation District	$6,170.00
20030903		Upland sprinklers	41 ac	2003	Morrow SWCD	$72,210.00
20030905	Stewart Cr	Fish passage	2 culverts	2003	ODOT	$300,000.00
20001200	Butter Cr	riparian fencing; off-channel livestock watering	0.63 m fenced, 1 site	1999	Umatilla SWCD	$9,823.00
20050602	Butter Cr	Upland vegetation management	22 ac	2004	Umatilla SWCD	$7,853.00
20001168	Little Butter Cr	instream habitat enhancement: anchored structures	0.25 m	1999	Morrow County Public Works	$37,785.00
20050606	Camas Cr	Upland vegetation management	6 ac	2003	Umatilla SWCD	$2,273.00
20020633	Butter Cr	riparian fencing; off-channel livestock watering	3.64 m, 20 sites	2002	Umatilla County SWCD	$122,069.00
20050718		Off-channel watering sites	3	2005	Morrow SWCD	$5,921.00
20050719		Off-channel watering site	1	2005	Morrow SWCD	$7,350.00
20030906	Stanfield Canal	Upland fenced, improved	20 ac	2003	Umatilla SWCD	$9,765.00
20030967	Webb Slough	Riparian fenced, off-channel	0.45 m, 2 sites	2003	Umatilla SWCD	$34,886.00
990730	Butter Cr	bank stabilization	0.06 m	1999	Umatilla SWCD	$6,535.00
20050617	Birch Cr, Bear Cr, West Birch Cr	Upland vegetation management	72 ac	2005	Umatilla SWCD	$36,822.00
20050616	Upper Butter Cr		107 ac	2005	Umatilla SWCD	$24,211.00
20050615	Stage Gulch		20 ac	2005	Umatilla SWCD	$218,917.00
990733		erosion control: grass seeding	23,650 ac treated	1999	Umatilla SWCD	$216,785.00
990732	Butter Cr	livestock exclusion, livestock grazing management plan	5,808 ft fence	1999	Umatilla SWCD	$5,016.00
990731	Butter Cr	bank stabilization	0.01 m	1999	Umatilla SWCD	$4,544.00
990729	Westgate Canyon Cr	weirs, cross berm creation; riparian tree planting	10 weirs, 1.7 m riparian planting, 1 m treated	1999	ODFW	$57,878.00
990728	Birch Cr	anchored structures, weirs, deflectors, channel alteration, cross berm creation; riparian tree planting, riparian fencing	105 anchors, 1 weir, 17 deflectors, 0.66 m fenced, 1,675 ft channel, 2.77m	1999	ODFW	$208,329.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
			riparian plant			
990727	East Birch Cr	anchored structures, weirs, deflectors, off-channel habitat (pond created), channel alteration, streambank stabilization, cross berm creation; riparian tree planting, riparian fencing	105 anchors, 10 weir, 39 deflectors, 1 pond, 12 ac treated, 1 m fenced, 7.5 ac riparian plant	1999	ODFW	$219,832.00
990726	Umatilla R	anchored structures, deflectors, bank stabilization; riparian tree planting, bio-engineering	52 anchors, 10 deflectors, 0.07 m stabilized, 0.38 m riparian plant, 2 ac treated	1998	ODFW	$122,144.00
20040735	Butter Cr	Upland fencing, off-channel watering site	7,497 m, 12 sites	2004	Umatilla SWCD	$112,507.00
20020709	Umatilla R	off-channel livestock watering	1	2003	Morrow SWCD	$11,071.00
20050607	McKay Cr	Upland vegetation management	22 ac	2005	Umatilla SWCD	$1,863.00
20050611	South Patawa	Upland vegetation management	3 ac	2005	Umatilla SWCD	$2,033.00
20040734	Butter Cr	Riparian fence, upland fence, of-channel watering site	0.19 m riparian, 21,650 ft upland, 12 sites	2004	Umatilla SWCD	$46,990.00
20050608	Twomile Cr	Upland vegetation management	2 ac	2003	Umatilla SWCD	$1,284.00
20050609	Rail Cr	Upland vegetation management	59 ac	2003	Umatilla SWCD	$16,773.00
20050610	Butcher Cr	Upland vegetation management	60 ac	2003	Umatilla SWCD	$15,531.00
	Little McKay	Fish habitat restoration	2 mi	2000-2003	USFS Ochoco NF	$200,000.00
		Culverts replaced for flow and fish passage	4	2005-2006	USFS Ochoco NF	$320,000.00
	McKay Creek	RHCA vegetation restoration along dispersed camping areas	4 mi	2005-2006	USFS Ochoco NF	$30,000.00
Walla Walla River Population (Oregon)						
20030800	Richartz Irrigation Ditch	Upland vegetation management	918 ac	2003	Walla Walla Basin Watershed Council	$370,205.00
20011007	Walla Walla R	Riparian tree planting	1 m, 15 ac	2001	Walla Walla Basin Watershed Council	$0.00
20050711	Walla Walla R	Upland irrigation	205 ac	2005	Walla Walla Basin Watershed Council	$1,723,311.00
20011006	Walla Walla R	fish passage improvements: 1 fish ladder installed	1	2001	Walla Walla Basin Watershed Council	$5,264,000.00
1127	Couse Cr	instream habitat enhancement: anchored log structures, deflectors; riparian planting & fencing; upland weed control	0.4 m fenced, 10.7 ac treated, 4 deflectors, 3 anchors	1997	Walla Walla Basin Watershed Council	$17,540.00
20030795	Walla Walla R	Upland	80 ac	2003	Walla Walla Basin Watershed Council	$3,848.00
20030796	Walla Walla R	Fish passage push-up dam, irrigation diversion, upland	1 dam, 1 diversion, 446	2002	Walla Walla Basin	$810,789.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
			ac upland		Watershed Council	
20011005	Walla Walla R	Instream water rights; irrigation systems for improved water conservation: sprinkler irrigation, 1 pond for storage, piping of delivery ditch	90 ac improved	2001	Walla Walla Basin Watershed Council	$68,007.00
20030798	South Fork Walla Walla	Upland	24 ac	2003	Walla Walla Basin Watershed Council	$50,966.00
20050618	Big Rayborn Canyon	Upland vegetation management	14 ac	2005	Umatilla SWCD	$5,816.00
991007	Cottonwood Cr & Little Meadows Cr	Surface drainage improvements, fence construction, rolling dip construction	8 culverts, 5 structures, 45 structures, 180 stations	1999	Walla Walla Basin Watershed Council	$143,028.00
20050614	Pine Cr	Upland vegetation management	21 ac	2005	Umatilla SWCD	$6,747.00
20030801	Powell Ditch	Upland vegetation management	17 ac	2003	Walla Walla River Irrigation District	$8,069.00
20040807	Hodgson, Rayborn & Dry Creek Canyons	Upland erosion control	4 ponds	2004	Walla Walla Basin Watershed Council	$54,287.00
20011004	North Fork Walla Walla R, South Fork Walla Walla R	Instream water rights; irrigation systems for improved water conservation; fish passage improvements: 3 push-up dams removed, replaced with 1 headgate, 1 consolidated w/other ditch, 1abandoned, 5 fish screens installed	572 ac	2001	Walla Walla Basin Watershed Council	$58,818.00
20050671	Rayborn Canyon	Upland vegetation management	7 ac	2005	Umatilla SWCD	$5,408.00
20030797	Walla Walla R	Fish passage, push-up dam, instream, upland	1 dam 1 ac	2003	Walla Walla Basin Watershed Council	$9,610.00
20050600	Rayborn Canyon	Upland vegetation management	12 ac	2004	Umatilla SWCD	$5,795.00
20030974	Ford Branch, Little Walla Walla R	Upland irrigation	18 ac	2003	Davis Orchards	$10,248.00
20050612	Couse Cr	Upland vegetation management	29 ac	2004	Umatilla SWCD	$10,553.00
20030794	Ford Branch	Upland		2003	Lefore Fruit Farms, Inc.	$7,207.00
20050601	Hay Cr	Upland vegetation management	31 ac	2004	Umatilla SWCD	$11,873.00
20050713	Little Walla Walla R	Upland irrigation improvement	9.7 ac	2005	Walla Walla Basin Watershed Council	$12,674.00
20040733	Spring Cr	Upland fence	10 ac	2004	Umatilla SWCD	$5,489.00
20001194	various	peak flow passage improvements, surface drainage improvements, road vacated, road closure, road grass seeded	2 structures, 4 corss-drains, 80 stations	2000	ODF	$57,294.00
20050709	North & South Forks of Walla Walla R	Upland vegetation management	140 ac	2005	Walla Walla Basin Watershed Council	$10,584.00
20020831	Walla Walla R	irrigation systems for improved water conservation	Water storage reservoir	2002	Walla Walla Basin	$19,260.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
					Watershed Council	
20050605	Pine Cr	Upland vegetation management	31 ac	2004	Umatilla SWCD	$9,374.00
20020632	Huffman Irrigation Ditch	irrigation systems for improved water conservation	475 ac	2002	Walla Walla Basin Watershed Council	$137,966.00
991048	Couse Cr	instream water rights transfers/leases		1997	Oregon Water Trust	$21,318.00
	S. Fk. Walla Walla	Moved campsites and traffic away from river and bridge replacement	0.5 miles	1998	BLM	$250,000.00
	N. Fk. Walla Walla	Riparian exclosure fence	0.5 miles	2005	BLM	$5,000.00
	SF Walla Walla	Push-up dam to be converted to pump	1	2003	OWEB	$4,000.00
	SF Walla Walla	Push-up dam conversion to rock weir	1	2003	CRITFC, OWEB	$16,000.00
	SF Walla Walla	Diversion and push-up dam not utilized/easement pending	1	2000	OWEB	$4,000.00
	NF Walla Walla	Diversion modified to eliminate need for push-up dam	1	2001	OWEB	$700.00
	NF Walla Walla	Eliminated push-up dam by consolidating to NF-8	1	2001	OWEB	$5,100.00
	NF Walla Walla	Push-up dam conversion to rock weir	1	2003	CRITFC OWEB	$12,000.00 $2,000.00
	Couse Cr	Instream lease of water (pump inactive)		1998	OWEB OR Water Trust	$36,780.00 $39,125.00
	Mainstem: Milton-Freewater to headwaters	Lockable headgate and water-measuring device	16 sites	2002	OWEB	$32,000.00
	Mainstem: Milton-Freewater to state line	Little Walla Walla push-up dam replaced with dam and fishway	1	2000	BPA	
	Smith Ditch	Ditch users have been consolidated to other sources		2002	OWEB OWEB pending Landowners	$15,000.00 $2,700.00 $15,000.00
	Nursery pump	Push-up diversion dam eliminated through consolidation to Eastside Diversion	1	2002	OWEB	$11,500.00
	Nursery Bridge Fishway	Fishway installed to allow passage past grade control structure	1	2001	BPA/COE	~$5,000.00
	Mainstem: Milton-Freewater to state line RM 42.5-44	Ditch piping, farm efficiency upgrades	1.5 miles	2000-2003	Landowners BPA OWEB WW River ID Hudson Bay ID OR Water Trust	$234,000.00 $478,000.00 $533,000.00 $46,000.00 $249,000.00
	Mainstem Walla Walla R., Mill Cr, NF WW R., SF WW R.	Ditch diversion, fish screen placement	29 diversions		ODFW, OWEB, BPA	
	Nursery Bridge	Fish screen placement		2000	ODFW Mitchell Act/ BPA	$80,000.00
	NF Walla Walla R., SF Walla Walla R.	Fish screen placement	5 sites	2001	OWEB	$175,000.00
		Fish screen placement (includes portables on the Smith ditch)	19 sites		ODFW Mitchell Act	$198,374.00
	Mill Cr (city screen)	Fish screen placement	1	2001	OWEB City of Walla Walla	$75,000.00 $135,000.00

Habitat Restoration Projects in Oregon Mid-Columbia steelhead population areas from 1995 through 2005 (OWEB 2006)						
OWEB Project Number	Stream Name	Project Description	Quantity	Year	Project Leader	Total Cost
					BPA	$210,000.00
	Walla Walla	Marie Dorian Dam removal	1	1997	CTUIR	
	Walla Walla	Little Walla Walla passage/screens	1	2000	CTUIR	$1,000,000
	Mill Creek	City of Walla Walla Intake Screens	1	2001	ODFW	$420,000.00
	North Fork, South Fork, mainstem Walla Walla	gravity ditch diversions screened	22	2000	ODFW	$246,058.00
	Walla Walla River	Eastside Ditch Screen	1	2001	ODFW	$80,000.00
	Walla Walla River	Riparian Easement	1500 feet	2003	CTUIR	
	South Fk Walla Walla River	Riparian Easement	3200 feet	2003	CTUIR	
	Walla Walla Subbasin	Upland Restoration	7737 acres	1998-2003	NRCS	
	Walla Walla River	Annual in-stream water lease	7.9 cfs	2003-2005	OR Water Trust	
	Couse Creek	Upland restoration and riparian fence	1.2 miles	2000	CTUIR	
	Walla Walla River	river flow restored in summer	25 cfs	2001-2005	USFWS	
	Walla Walla River	Riparian Easement	1900 feet	2001	CTUIR	
	Walla Walla Subbasin	CRP	18225	1998-2003	NRCS	
	Walla Walla Subbasin	CCRP	247	1998-2003	NRCS	
	South Fork Walla Walla River	Area of Critical Environmental Concern – protected management	1280 acres along 2.376 stream miles	1995-2005	BLM	
	South Fork Walla Walla River	Protected management, no roads, no logging	13708 acres	1995-2005	USFS	
	Mill Creek	Protected management, no roads, no logging in municipal watershed	5000 acres	1995-2005	USFS	
	Walla Walla Subbasin	Direct seeding sediment reduction on steep slope wheat farms	2812 acres	1998-2003	NRCS	
	Couse Creek	Riparian fence	1.3 miles	1997	CTUIR	
	Pine Creek	Riparian fence	1.5 miles	1999	SWCD	
	Dry Creek	Riparian Fence	.3 miles	1998	WWBWC	

APPENDIX D

Hydropower Configuration and Operational Improvements Implemented in Recent Years that Provide Survival Benefits to Oregon's Mid-C Steelhead Populations

and

Estuary Improvements Implemented in Recent Years that Provide Survival Benefits to Oregon's Mid-C Steelhead Populations

Hydropower Configuration and Operational Improvements Implemented in Recent Years that Provide Survival Benefits to Oregon's Mid-C Steelhead Populations:

- Bonneville Powerhouse I (PH1) minimum-gap turbine runner (MGR) installations
- Bonneville PH1 juvenile bypass system (JBS) screen removal
- Bonneville PH2 corner collector installation
- Bonneville PH2 fish guidance efficiency (FGE) improvements
- Bonneville PH2 operation as first priority
- Bonneville spill operation improvements including five additional flow deflectors
- The Dalles spill wall construction
- The Dalles spill pattern improvements
- The Dalles sluiceway operation improvements
- The Dalles adult collection channel improvements
- John Day spill operation improvements
- John Day South Fish Ladder improvements
- McNary spill operation improvements
- McNary end spillbay deflectors and hoists
- McNary full flow juvenile passive integrated transponder (PIT)-tag detections
- McNary juvenile transport facility bypass piping improvements
- McNary spare extended-length submerged base screen
- McNary improved juvenile bypass dewatering screens
- McNary adult PIT-tag detection in fish ladders
- McNary overhauling auxiliary water supply (AWS) pumps
- McNary upgrading of adult fish ladders tilting weir controls

Estuary Improvements Implemented in Recent Years that Provide Survival Benefits to Oregon's Mid-C Steelhead Populations:

- Replaced three culverts with full-spanning bridges
- Provided approximately 10 miles of improved tidal channel connectivity by installing a tide gate retrofit
- Acquired approximately 473 acres of off-channel and riparian habitats
- Restored and created 90 acres of marsh and tidal sloughs and approximately 100 acres of riparian forests
- Protected approximately 55 acres of high quality riparian and floodplain habitat
- Restored and preserved approximately 154 acres of off-channel habitat
- Protected 80 acres of high-value off-channel forested wetland habitat
- Restored approximately 96 acres of tidal wetlands habitat by replacing undersized culvert that limited fish access
- Conserved 155 acres of forested riparian and upland habitat
- Provided partial tidal channel reconnection by tide gate retrofit (acreage unknown at this time)
- Provided integrated pest management (purple loosestrife)
- Reconnected and restored 183 acres of historical floodplain by dike removal
- Restored 25 acres of historical floodplain by breaching a dike

APPENDIX E

U.S. Forest Service
Bureau of Land Management

Forest Service and Bureau of Land Management Programs in Support of Mid-Columbia Steelhead Recovery Sufficiency Assessment

Forest Service and Bureau of Land Management Programs in Support of Mid-Columbia Steelhead Recovery Sufficiency Assessment

May, 2007

Executive Summary

The Forest Service (FS) and Bureau of Land Management (BLM) have in place a *Management and Conservation Framework* that is comprised of programs that contribute to recovery of ESA-listed salmon and steelhead on federal lands, these include:

1. A diverse body of environmental laws and regulations
2. Agency policies
3. Land Management Plans with associated aquatic strategies, and
4. Guidance and procedures for project design, implementation, and monitoring

Collectively, this existing *Management and Conservation Framework* represents the "baseline" that governs land management, contributing to both short and long-term recovery goals for ESA-listed salmon and steelhead on federal lands. While elements of the framework may be revised or amended over time, the interwoven nature of statutes, regulations and policies, as well as interagency and public processes, maintains the integrity and overall effectiveness of the framework in providing meaningful contributions to salmon and steelhead recovery.

The foundation of the Management and Conservation Framework are two aquatic strategies known as (PACFISH and the Northwest Forest Plan – Aquatic Conservation Strategy (NWFP-ACS). PACFISH was incorporated into FS and BLM Land Management Plans in 1995 and the NWFP ACS amended Forest Service plans on the east slope of the Cascade mountain range in 1994. These aquatic strategies provide for the long-term protection and appropriate management of physical or biological features essential to recovery of ESA-listed salmon and steelhead on federal lands.

Forest Service and BLM Aquatic & Riparian Habitat Management and Conservation Framework

Introduction

The Forest Service (FS) and Bureau of Land Management (BLM) have in place a *Management and Conservation Framework* that is comprised of programs that contribute to recovery of ESA-listed steelhead on federal lands. These include:

1. A diverse body of environmental laws and regulations; for example, the Clean Water and Endangered Species Acts;
2. Agency policies
3. Land Management Plans with associated aquatic strategies, and
4. Guidance and procedures for project design, implementation, and monitoring

Collectively, this existing *Management and Conservation Framework* represents the "baseline" that governs land management, contributing to both short and long-term recovery goals for ESA-listed steelhead on federal lands. While elements of the framework may be revised or amended over time (e.g., Congress may pass new statutes, agencies may revise plans, etc.), the interwoven nature of statutes, regulations, and policies – as well as interagency and public processes – maintains the integrity and overall effectiveness of the framework in providing meaningful contributions to salmon and steelhead recovery.

The following describes the primary building blocks in the *Management and Conservation Framework* the Forest Service (FS) and Bureau of Land Management (BLM) apply to federally-managed lands within the Pacific Northwest (States of Idaho, Oregon, and Washington) that contribute to salmon and steelhead recovery goals and objectives, and guide recovery actions:

Land Management Plans

FS and BLM *Land Management Plans* contribute to recovery by providing assurances that public lands are managed in accordance with Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 *et seq.*)/(FLPMA), the National Forest Management Act/(NFMA) of 1986, and other applicable laws, regulations and policy. These legal and policy requirements ensure the federal land managing agencies make informed decisions and provide for the responsible management of public land resources, including ESA-listed species.

Both FS and BLM *Land Management Plans* describe broad, multiple-use guidance for managing public lands and mineral estates. Plan decisions are made at a broad scale and guide site-specific project design and approval. *Land Management Plans* highlight goals and objectives for resource management and establish management guidance needed to achieve them. Plans also identify what public and commercial uses are appropriate and where they should occur. Land *Management Plans* contain protective management direction, in some cases even stronger than PACFISH or the NWFP-ACS. Applicable to specific large blocks of land, these additional protections include; Congressionally designated Wilderness, Wild and Scenic Rivers and municipal watersheds. In addition, some types of management areas also receive strong watershed-scale protections based on land use decisions contained in land management plans. Examples include; allocations and management direction for non-motorized dispersed recreation areas, and Scenic Areas. All *Land Management Plans* are developed with public involvement, and impacts of a plan are analyzed in an appropriate NEPA document. Plans also contain a monitoring component to provide continuous feedback on the efficacy of direction in meeting {plan} objectives.

Within the range of Columbia and Snake River basins, the FS and BLM rely on these two aquatic strategies, PACFISH and the NW Forest Plan – ACS, to ensure that actions on federal lands prevent further degradation and begin to restore high quality in-stream and riparian habitat conditions in support recovery of ESA-listed salmon and steelhead. Current FS and BLM *Land Management Plans* west of the Cascades in Oregon and Washington were amended by the NWFS EIS Record of Decision (ROD) in 1994, amended in 2003. East of the Cascades (eastern OR/WA, ID) were amended by a PACFISH Decision Notice in 1995

PACFISH and the NWFP-ACS are described individually in more detail below:

PACFISH

(Aquatic Strategy for Managing National Forest System and Bureau of Land Management Anadromous Fish Producing Watersheds in Eastern Oregon, Washington, Idaho, and portions of northern California)

In February, 1995, Forest Service (FS) and Bureau of Land Management (BLM) administrative units with anadromous fish, outside the range of the northern spotted owl covered by the Northwest Forest Plan – Aquatic Conservation Strategy (NWFP-ACS) in Oregon, modified their *Land Management Plans* through amendment by PACFISH. PACFISH was developed as an ecosystem-based, interim strategy designed to arrest the degradation of habitat and begin restoration of in-stream and riparian habitats on lands administered by the FS and BLM in eastern Oregon and Washington, Idaho, and portions of northern California. The intent of the strategy was to allow for 'passive' restoration of the ecological health and productivity of watersheds that contain present or potential anadromous fish habitat through the application of riparian standards and guidelines to both proposed and ongoing actions. PACFISH was to remain in place until longer term aquatic conservation strategies, similar to the NWFP-ACS were completed through *Land Management Plan* amendment or revisions (PACFISH Environmental Assessment, 1994). Those revisions have not yet occurred, and PACFISH still applies wherever NWFP-ACS does not already apply.

PACFISH contains the following components that are applied to FS and BLM management actions to maintain and restore ecological processes that support high quality habitat for salmon and steelhead:

- Riparian Goals – *establishes an expectation of the characteristics of healthy, functioning watershed, riparian areas, and associated fish habitats;*
- Riparian Management Objectives (RMOs)- quantitative *RMOs for stream channel, riparian and watershed conditions were developed to provide the criteria against which attainment or progress toward attainment of the riparian goals are measured. RMOs provide measurable targets toward which managers are aiming as they conduct resource management activities across the landscape. The objectives are time specific to reflect the ecological capabilities of specific ecosystems;*

- Delineation of streamside areas (Riparian Habitat Conservation Areas, aka "RHCA"s) that are important to maintenance of high quality aquatic habitat and where special management considerations are applied - *PACFISH requires that proposed actions within RHCAs do not prevent or retard attainment of RMOs. RHCAs include traditional riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems by (1) influencing the delivery of coarse sediment, organic matter, and woody debris to streams, (2) providing root strength for channel stability, (3) shading the stream, and (4) protecting water quality;. RHCA widths vary depending upon the aquatic and riparian resources to be protected in each stream reach, based on stream and riparian characteristics.*
- Standards and/or guidelines *to ensure to the extent legally possible, that projects do not prevent or retard attainment of riparian goals and management objectives*;
- Designation of *Key* or *Priority* watersheds - *areas where additional management emphasis and/or watershed analysis is required to ensure that salmon and steelhead habitat is maintained or provided priority for restoration*;
- Watershed analyses - *to provide sufficient context for designing actions that support maintenance or restoration of aquatic habitats needed for recovery of ESA-listed salmon and steelhead* ;
- Watershed restoration efforts focused through watershed analysis;
- Monitoring program to evaluate project implementation (compliance) and effectiveness of PACFISH as a strategy for protecting and improving aquatic habitat conditions on federal lands.
  http://www.fs.fed.us/rm/boise/research/techtrans/projects/pacfish_home.shtml

PACFISH, combined with underlying Land Management Plans and *BLM* Rangeland Health Standards, and complemented by consultation programs conducted for compliance with the Endangered Species Act, provides the program guidance needed to protect and conserve steelhead and their habitat on federal lands. The protective guidance provided by these programs is applied on every FS and BLM project during project development and implementation. They have been determined to be sufficient in terms of their intended purpose of protecting habitat for ESA-listed salmon and steelhead to the extent permitted by law, thereby promoting recovery of the species and their habitats.

PACFISH provides a framework for minimizing adverse effects from land management activities on aquatic resources through the assessment of proposed or ongoing management actions, within RHCAs, with Riparian Goals and Riparian Management Objectives (RMOs). Standards and Guidelines are applied to actions within Riparian Habitat Conservation Areas (RHCAs) to ensure that they do not prevent or retard attainment of high quality aquatic habitat (RMOs). The use of Watershed Analysis and special considerations provided in *KEY* watersheds (priority populations) provide another level of management consideration that increases certainty of outcomes for protection and meeting of both short and long-term recovery goals.

Preliminary results from broad-scale aquatic habitat status and trend monitoring of FS and BLM lands within the interior Columbia River basin since 2001 indicates conditions have improved over the past 5 years, continuing the habitat recovery presumed to have begun in 1995 as a result of the protections PACFISH instituted. Implementation and Effectiveness Monitoring will both continue to evaluate the overall long-term effectiveness of PACFISH policy and program directives at preventing further degradation of habitat for native anadromous and resident salmonids, and its effectiveness at restoring near-natural rates of habitat and species recovery on actively managed FS and BLM lands, particularly within streamside riparian areas on streams affected by ongoing livestock grazing.

Northwest Forest Plan's Aquatic Conservation Strategy and Protective Land Allocations In Oregon and Washington

The Northwest Forest Plan ACS (NWFP-ACS) was designed to incorporate all elements of an aquatic and riparian ecosystem necessary to maintain its natural disturbance regime. The NWFP-ACS applies to all FS and BLM lands within western WA, OR, and the east face of the Cascades in WA.

Aquatic ecosystem elements embedded in the NWFP-ACS include; maintenance of hydrologic function, high water quality, adequate amounts of coarse woody debris, complex stream channels that provide a diversity of aquatic habitat types, and riparian areas with suitable microclimate and vegetation. These elements directly or indirectly correspond to each of the physical and biological attributes of 'Primary Constituent Elements' identified as characterizing salmon and steelhead designated critical habitat: water quality and quantity; substrates; shade; large wood; cover; conditions suitable for forage production; channel form and connectivity with floodplains; and, unobstructed migration corridors. Since being amended to FS *Land Management Plans* in the eastern Cascades in 1994, the NWFP-ACS has created a connected system of aquatic and riparian habitats throughout the plan area that are assumed to be reversing the trend of aquatic and riparian habitat degradation and begun the long recovery process for these habitats over the past 12 years.

Most primary program components of the NWFP-ACS are similar to those found in PACFISH. NWFP-ACS components include:

- Aquatic Goals and Objectives - *each project must maintain or restore the physical and biological processes required by riparian dependent-resources at the watershed scale or broader to comply with the ACS*
- Riparian Reserves - *portions of watersheds where riparian-dependent resources receive primary emphasis. The extensive Riparian Reserves within the Northwest Forest Plan area protect the stream and adjacent riparian areas critical to maintaining a highly functioning aquatic ecosystem,*
- Standards and Guidelines – *Standards and Guidelines prohibit and regulate activities in Riparian Reserves that retard or prevent attainment of the ACS aquatic/riparian objectives. Use of these provides assurances that a project cannot have a negative impact in the long- term on riparian-dependent resources or ecological processes in the Riparian Reserves at the watershed scale.*
- Key Watershed network -*serves as refugia for anadromous salmonids,*
- Watershed analyses - *to provide sufficient context for designing actions that support maintenance or restoration of aquatic habitats needed for recovery of ESA-listed salmon and steelhead* ;

- Watershed Restoration Strategy-*a formal restoration strategy based on watershed analysis.*
- Monitoring-*a formal long-term broad-scale monitoring program*
- Adaptive Management-*ongoing adjustments in management based on monitoring and other new information as it becomes available.*

Riparian Reserves
The NWFP-ACS provides the foundation for the conservation and recovery of anadromous fish species on federally-managed lands through use of Riparian Reserves. Riparian Reserves are portions of watersheds where riparian-dependent resources receive primary emphasis. In conjunction with the Key Watershed network, these areas serve as refugia for ESA-listed and non-listed anadromous fish.

Land Allocations
The NWFP-ACS, with additional protective land allocations, collectively provides an extensive network of Riparian Reserves and watersheds contributing to the protection and restoration of aquatic ecosystems on federally-managed lands.

Large proportions of federal lands within the NWFP area in Oregon are in some form of *Reserve* or *Special Management* status. *Reserve* or *Special Management* status lands are those where land management actions are largely prohibited or significantly shaped by application of protective Standards and Guidelines (S&Gs) for land management activities. These specially-managed lands are located both within and outside Key Watersheds. Federal lands outside of Key Watersheds are also protected under other land allocations including; Riparian Reserves, Congressional Reserves such as Wild and Scenic River corridors, Wilderness and/or Municipal Watersheds; spotted owl Late-Successional Reserves (LSRs) and Areas Withdrawn from active management (Forest Service) through Forest Plans.

NWFP-ACS Standards and Guidelines are also required to be applied within LSRs, providing increased protection for all stream types. As LSRs have late-successional characteristics, and are overlain with Riparian Reserves, they serve as core areas of high quality stream habitat, fish refugia, and centers from which degraded aquatic systems can be recolonized once they are restored. Streams within these reserves may also be particularly important for endemic or locally distributed fish species and stocks. Collectively, these protective upland land allocations (non-Riparian Reserve; not located in Key Watersheds) comprise 1,331,636 acres or 17 percent of federally-managed lands within the area of designated critical habitat for anadromous fish in Oregon and Washington.

Watershed Analysis and Watershed Restoration
Watershed analysis, a requirement of the NWFP-ACS, provides an understanding of aquatic habitat conditions and processes. This informs land management decisions regarding the timing, location, and magnitude of activities on the landscape to protect and/or restore the physical and biological features essential to the conservation of anadromous fish. Watershed analysis also provides information on priorities for watershed restoration. The FS has made significant investments in watershed restoration in the NWFP area since its inception in 1994. Activities have emphasized; restoration of fish passage, reductions in the delivery of fine sediments to

stream channels, placement of large wood debris in stream channels, riparian plantings and thinning to accelerate large wood recruitment/increase shade/improve nutrient cycling, and have included control of noxious weeds, and obliteration or high-level maintenance of as risks to meeting aquatic habitat objectives

Monitoring

The NWFP-ACS also contains a long-term monitoring component to evaluate progress towards goals for protection and management of physical and biological features essential to long-term conservation of ESA-listed salmon and steelhead. In the NWFP ACS, monitoring is considered an essential component of management as the information it provides helps to evaluate the overall success of the applied strategies and allows for needed adjustments. Four types of monitoring are conducted by the FS:

- *Implementation monitoring* - to determine if activities (i.e., timber sales, silvicultural projects, watershed restoration, etc.) were implemented as planned and whether or not they meet NWFP-ACS Standards and Guidelines.
- *Effectiveness monitoring* - evaluate if NWFP-ACS Standards and Guidelines are meeting the strategy's goals and objectives. www.reo.gov/monitoring/watershed.
- *Validation monitoring* is primarily research-oriented and directed at testing underlying assumptions upon which management strategies are based. http://www.reo.gov/monitoring/10yr-report/documents/synthesis-reports/all.pdf., http://ocid.nacse.org/nbii/density/pubs.html, http://www.fs.fed.us/pnw/publications/index.shtml
- *Local* - In addition, many of the local FS and BLM administrative units conduct annual monitoring (implementation, effectiveness) to address local management issues.

Adaptive Management

Adaptive Management is described in the Northwest Forest Plan (USDA and USDI 1994a) as a continuing process of action-based planning, monitoring, researching, evaluating and adjusting with the objective of improving the implementation and achieving the goals of the standards and guidelines. Using this process, new information is evaluated and then serves as the basis for decisions on needed adjustments to management. Adjustments may also result in the refinement of standards and guidelines, land-use allocations, or amendments to FS and BLM Land Management Plans.

Collectively, these NWFP-ACS program components emphasize aquatic habitat management for protection and recovery ESA-listed anadromous salmonid ESUs on NFS and BLM lands.

APPENDIX F

State of Oregon Programmatic Review

Statewide Habitat Programs Implemented by Oregon State Agencies to Address Limiting Factors and Threats to the Recovery of Listed Anadromous Salmon and Steelhead

Statewide Habitat Programs Implemented by Oregon State Agencies to Address Limiting Factors and Threats to the Recovery of Listed Anadromous Salmon and Steelhead

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Executive Summary

Natural resource agencies within the State of Oregon conducted an internal review of their habitat-based programs to assess sufficiency in addressing threats, and associated limiting factors, to the recovery of listed anadromous salmonids in Oregon. This assessment is a component of Oregon's recovery planning effort, specifically in guiding development of basin actions for specific populations. The process builds on the foundation of the Oregon Plan for Salmon and Watersheds wherein the collective and coordinated actions of natural resource agencies synergistically care for Oregon's watersheds and salmon.

Sufficiency of statewide programs was based on technical, institutional, budgetary, implementation, and documentation criteria, and categorized according to certainty, or lack thereof, of sufficiency in addressing limiting factors. Program jurisdiction on federal, state, and private forests, agricultural lands, and urban/rural residential lands was also identified. Factors limiting to salmonid viability were characterized as habitat access, food web dynamics, physical habitat quality and quantity, water quality, and water quantity and flow timing. Eight management strategies were identified for addressing limiting factors and threats related to freshwater habitat conditions.

(*Note: final sufficiency analysis is ongoing and incomplete*).

Key constraints to program effectiveness included inadequate outreach and education, monitoring, technical assistance, prioritization, and program oversight, all of which are a result of inadequate funding and staff resources. Monitoring of program actions on the ground was identified as being crucial to providing rigor and necessary documentation of program effectiveness and sufficiency.

Introduction

Oregon is in the process of developing recovery plans for salmon and steelhead populations in the state that are listed as threatened or endangered under the U.S. Endangered Species Act (ESA). One step in the development of these recovery plans is consideration of the ability of existing regulatory, management, or incentive-based programs to address the habitat factors that have historically limited, or are currently limiting, the salmon and steelhead populations in Oregon. This document provides information about limiting factors and critical "bottlenecks", and evaluates the likely influence the agency programs will have on addressing limiting factors and bottlenecks for improving habitat and population trends.

While completion of this document is not a federal ESA requirement, its contents will be included in recovery plans being developed across the state, and will serve as a resource for the planning teams tasked with developing specific action plans for each of the salmon and steelhead recovery planning domains in Oregon.

State regulatory and management mechanisms are important tools to preventing the continued decline of habitats and promoting their protection and restoration to create healthy watersheds for fish. Thus, in evaluating the various regulatory programs, the process considers the degree to which practices that were historically adverse have been stopped, the impact of the current standard to improve conditions over time, and the adequacy of companion non-regulatory programs to timely restore desired conditions. This process will also serve as a baseline from which improvement can be measured toward reducing threats that initially contributed to a listing decision. The listing (and delisting) decision includes as one criteria (among several) the "inadequacy of existing regulatory mechanisms" that threaten the continued existence of a species.

This process builds on the regulatory, incentive-based and management foundation established prior to and for the Oregon Plan for Salmon and Watersheds, wherein the collective and coordinated actions of natural resource agencies work to synergistically care for Oregon's watersheds and salmon. While agency programs in large part were not intended to achieve habitat conditions that foster recovery, they *were* intended to improve watershed conditions in general for salmon.

Conceptual Framework

Limiting factors are the physical, biological, or chemical conditions and associated ecological processes and interactions (e.g., population size, habitat connectivity, water quality, water quantity, streambank sloughing etc.) experienced by the fish that may influence viable salmonid population (VSP) parameters (i.e. abundance, productivity, spatial structure, and diversity). There are five broad categories of habitat limiting factors:

Water quantity/hydrograph –Magnitude and timing of flows.

Water quality – Water characteristics including temperature, dissolved oxygen, suspended sediment, pH, toxics, etc.

Food Web – The complex of interrelated food chains that ultimately feed salmon and steelhead.

Physical habitat quality/quantity – The amount and characteristics of physical habitat such as amount of large wood in the stream channel, occurrence of deep pools, and silt free spawning gravel.

Habitat access – Impaired access to spawning and/or rearing habitat.

As illustrated in Figure 1, many interrelations exist between the limiting factor categories. For example, a water quantity/hydrograph limitation can influence habitat access (dewatered stream channels), water quality (less dilution of pollutants), physical habitat quality (changing macro and micro habitat conditions), and food web (altering nutrient retention rates).

Threats are the human actions (e.g., fishing, operation of hatcheries, operation of the hydro system, road building, riparian habitat degradation, channel straightening, etc.) or natural occurrences (e.g., flood, drought, volcano, tsunami, etc.) that *cause or contribute-to* limiting factors and site-specific "bottlenecks".

Management strategies describe how recovery goals will be achieved by stating the general approaches that set the path from current conditions to the desired future state. Management strategies guide the creation of *management actions*, which are specific activities or behaviors intended to address the bottleneck to help achieve one or more recovery goals.

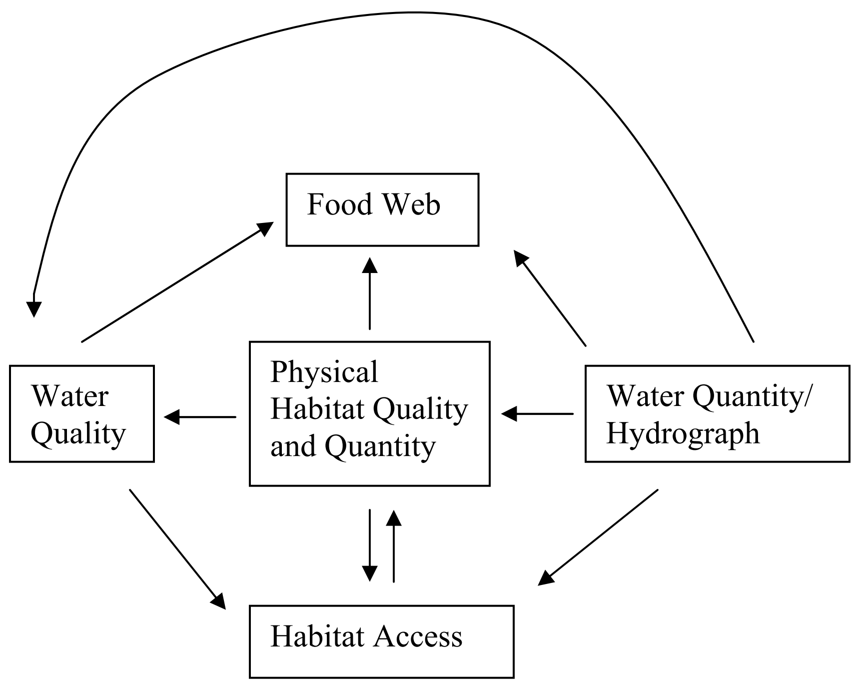


Figure 1. Interrelation between limiting factor categories.

Recovery planners have identified eight management strategies that are needed to address limiting factors (or bottlenecks) and threats related to freshwater habitat conditions. Table 1 shows these management strategies and the limiting factor categories they address as well as examples of threats that can lead to the limiting factor becoming a concern.

Although the management strategies provide a useful general approach and framework for recovery efforts, they do not necessarily provide the detail needed to assess if specific key limiting factors are adequately addressed by existing management programs. This review focuses on the adequacy of State of Oregon programs to impact the following specific key limiting factors common to all recovery planning domains in Oregon:

- Excessive fine sediment in spawning gravel
- Low habitat complexity
- High water temperature
- Impaired passage
- Inadequate stream flows or altered timing of flows
- Agricultural and forestry chemicals
- Animal waste
- Human, urban, or industrial waste

Table 1. Relationship between limiting factors, specific threats and management strategies addressed by statewide programs.

Management Strategies	Limiting Factors Addressed	Examples of Threats Addressed
1 - Protect and conserve ecological processes that support the viability of populations and their life history strategies throughout their life cycle.	All habitat limiting factors	See individual limiting factors.
2 – Restore and maintain floodplain connectivity and function	Habitat access, Food web, & Physical habitat quality	Stream straightening, channelization and diking, wetland draining and filling, dams that limit sediment movement
3 - Restore riparian condition and LWD recruitment, and maintain conditions adequate to support natural stream function and processes	Water Quality, Food web, & Physical habitat quality	Riparian habitat use and degradation, introduction of non-native plants that alter riparian function.
		Urban, residential or commercial development
		Stream cleaning and splash damming.
		Fine sediment from roads and other upland disturbances.
4 – Restore and maintain passage and connectivity to habitats blocked or impaired by artificial barriers	Habitat access	Dams, culberts, tidegates, road crossings, and hatchery weirs.
5 - Restore stream flows and natural hydrograph to provide sufficient flow during critical periods.	Water quantity/hydrograph & Habitat Access	Municipal and irrigation water withdrawals
		Urban, residential or commercial development
		Hydropower and flood control dams
		Riparian habitat use and degradation, introduction of non-native plants that alter riparian and upland functions.
6 - Restore and maintain channel structure and complexity.	Physical habitat quality & Food web	Riparian use and degradation, and introduction of non-native plants that alter riparian and upland functions.
		Stream cleaning, splash damming, straightening, channelization, and diking.
7 - Improve degraded water quality and maintain unimpaired water quality	Water quality	Municipal and irrigation water withdrawals
		Hydropower and flood control dams
		Agricultural, municipal, and industrial effluent and toxins.
		Fine sediment from roads, agricultural practices, development.
		Riparian habitat use and degradation, introduction of non-native plants that alter riparian and upland functions.
8 - Restore degraded upland processes to limit potential adverse impacts of uncharacteristic erosion and runoff, and maintain healthy upland processes.	Water & Physical habitat quality	Fine sediment from roads, agricultural practices, development.
		Urban, residential, or commercial development
		Riparian habitat use and degradation, introduction of non-native plants that alter upland functions.

Program Review Process

Program managers from each natural resource agency were asked to provide information on statewide programs currently implemented by their agencies that address the key limiting factors described earlier. Four categories of information regarding these programs were requested:

1) A general description of the program, including documentation of the program's guidance, jurisdiction, and implementation timeline. Appendix Table 1 lists this information for each program evaluated.
2) A list of the management strategies addressed by the program and the land use for which the program is intended. Appendix Table 2 lists this information for each program evaluated.
3) An evaluation of the program ("sufficiency") in the context of the key limiting factors (*ongoing)*, the rationale for the sufficiency characterization, recommendations for modification to the program to improve its sufficiency, and constraints on the program that may hamper its ability to fully address the key limiting factor. Varying levels of documentation is also provided that supports or addresses "sufficient" or "likely to be sufficient" assessments. Table 2 shows the criteria used to assess the programs. Appendices Tables 3-10 show this information by key limiting factor for each program.
4) A list of references that provide more detailed information about the program (see Appendix 11).

Table 2. Criteria used to determine sufficiency of programs to address key habitat limiting factors to the recovery of Oregon salmon and steelhead populations.

Sufficiency Designation	Criteria for Designation
Yes	Adequate technical, institutional, and budgetary capacity to implement the program, has a clear timeline for implementation, and documentation that the program can significantly reduce the limiting factor/threat within the program's jurisdictional area.
Likely	Adequate technical, institutional, and budgetary capacity to implement the program, has a clear timeline for implementation, and documentation that the program can significantly reduce the limiting factor/threat within the programs jurisdictional area, but it is a relatively new program with limited documentation on program effectiveness.
Uncertain	Adequate technical, institutional, and budgetary capacity to implement the program within its jurisdictional area, but the program lacks an adequate monitoring program, or has no clear timeline for implementation.
No	Inadequate technical, institutional, or budgetary capacity to implement the program within its jurisdictional area.

Program managers were asked to focus their efforts on "programs" that implement conservation, protection, or restoration actions. Programs whose sole function is monitoring the status and/or trend in natural resources are not included in this review.

Results

A total of 36 programs within nine natural resource agencies were evaluated (Table 3; Appendix Tables 1, 3-10). ODEQ had the most programs (7) addressing the most limiting factors (6), while ODLCD and ODOT had the fewest programs (1) addressing from 1-3 limiting factors.

Note: Sufficiency analysis is ongoing, therefore final results are not adequately complete for presentation in this report. Refer to Appendices for descriptive analysis of programs.

Agencies identified the need for adequate and dependable funding and increased staff resources to improve program sufficiency, especially those programs characterized as uncertain or insufficient. These limitations hamper or preclude sufficient outreach and education to landowners, effectiveness and compliance monitoring, technical assistance, program development, implementation, and oversight, and necessary inventories. Monitoring of program action effectiveness is crucial to understanding and acknowledging program sufficiency, and to adjusting program elements for improved adequacy. Trend monitoring is especially important to delineating progress or problems over time.

Jurisdictional limitations, overly broad statutory directives, increasing costs, and reliance on other state and local authorities for implementation constrain effectiveness of some programs. In addition, coordination and collaboration, both internally among state agencies and externally with federal land managers and private land owners, remains an important need to more fully address landscape issues. Some voluntary programs also conflict with landowner values and priorities, necessitating highly favorable incentives to overcome these social hurdles to effect positive change.

Conclusions and Recommendations

This review was conducted prior to specific benchmarks being established for recovery goals or an analysis of the predicted benefits of specific actions currently undertaken by each program, and programs combined. Nonetheless, using the detailed information provided in the Appendices on program objectives, jurisdiction, guidance, timelines, modifications and constraints should provide useful information for individual planning teams for each recovery domain as they formulate specific action plans for each ESA-listed salmon and steelhead population. This information will likely be helpful in the future as the state strives to improve its effectiveness in addressing habitat limiting factors.

Note: Sufficiency analysis of programs is incomplete.

Monitoring is especially critical to improving accountability, increasing knowledge of action effectiveness, and strengthening rigor in future assessments. An appropriate evaluation of a program's sufficiency requires field monitoring and documentation to assess whether program implementation on the ground is having the desired effect in addressing threats and limiting factors. For many programs, monitoring is absent or limited, tempering the ability to adequately evaluate its effectiveness. A number of program evaluations were based on the sufficiency and soundness of the infrastructure or process for implementing the program or an accounting of activities. To adequately assess action effectiveness and program sufficiency, actual monitoring and measurement of habitat conditions and trends must take place.

Continued emphasis on agency collaboration and coordination will strengthen the Oregon Plan foundation to better meet recovery needs now and into the future. The integrated workings and commitments of multitude agencies are needed to provide greater and more durable benefits to Oregon's salmon, watersheds, and citizens. Unfortunately, the relative contribution of these programs, in the context of overall importance to the landscape, was not assessed. Also not assessed was the cumulative and synergistic contribution of various programs to achieve overall habitat protection goals. This is an important consideration as no one program was intended to address any one limiting factor completely. *It is possible that individual programs by themselves are not adequate to address specific threats and limiting factors for meeting recovery goals, but the combined suite of available state agency programs in aggregate may create an adequate overall program for the state regarding a specific limiting factor.*

The collective efforts of state habitat programs has made comparative progress in improving trends over the past ten or more years, due in part to the Oregon Plan. The services these programs provide to the public and the regulatory oversight afforded are essential to maintaining a balance in protecting Oregon's natural resources within the context of resource use and development. However, improving landscape function to achieve recovery will require a concerted and conscious effort by many, including Oregon's natural resource agencies. Future funding packages to support and bolster programs to facilitate effectiveness would enhance this state's efforts toward recovery.

Appendix Table 1. Description of statewide programs currently implemented by the State of Oregon that support habitat management strategies in tributaries.

Agency	Program	Description	Guidance	Jurisdiction	Timeline
ODA	Agricultural Water Quality Management (SB 1010)	In 1993 the legislature established the Agricultural Water Quality Management Act. In 1995, the legislature supplemented the Act with ORS 561.191. This statute reinforces ODA's responsibility for and jurisdiction over agricultural practices and water pollution associated with activities on agricultural and rural lands. Administrative rules adopted to guide Program administration are found in OAR Chapter 603, Divisions 90 and 95. Regulatory actions address violations when they arise. Monitoring tools include DEQ ambient monitoring sites, local monitoring programs such as Rogue Valley Council of Government's Bear Creek monitoring and ODA Riparian Conditional Analysis for agricultural lands.	Ag Water Quality Mgmt Act	All agricultural practices and water pollution associated with activities on agricultural and rural lands, excluding federal or tribal trust lands.	Affected by rate of riparian vegetation development where needed. Development timeline will vary from 5 to 50 years depending on present site condition and site potential.
ODA	Confined Animal Feeding Operation (CAFO)	Confined Animal Feeding Operation (CAFO) program protects water quality by preventing animal wastes from discharging into waters of the state. ODA's CAFO program provides a means for the state to meet the requirements of the federal Clean Water Act. Operators know what is expected of them and are visited by ODA inspectors on an annual basis to insure compliance.	ORS 468B0.50 and 468B.0125	All permitted and non-permitted Confined Animal Feeding Operations.	In place, regulation ongoing
ODA	Pesticides	The ODA Pesticide Division regulates pesticide applicators, labeling, and regulates misuse.	Oregon State Pesticide Control Act, ORS 634, and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)	All pesticide use throughout the state (commercial and private)	In place, regulation is ongoing
ODA	Soil and Water Conservation Districts	SWCDs identify and address natural resource concerns within their respective boundaries and work w/ local, state, federal and private interests to deliver conservation services.	Oregon's 45 SWCDs are organized under ORS Chapter 568 and are governed by an elected board of directors who serve without pay.	All lands within district boundaries	Program is in place, outreach and technical support is ongoing
ODA	Weed Control and Invasive Species	The Noxious Weed Control Program provides leadership and technical expertise for weed control programs throughout the state. ODA also tracks invasive exotic plants, insects and animals through a number of detection programs including reporting from citizens and other agencies.	The Oregon Invasive Species Council, which was created by the legislature, was initiated in 2002 with functions identified by ORS 561.685.	Non-regulatory program – weed control statewide (Federal, State, Public and Private lands)	Program is in place, outreach and implementation are ongoing
ODEQ	401 Dredge & Fill Certifications	Section 401 of the federal Clean Water Act requires that an applicant for a federal permit, to conduct an activity that may result in a discharge to waters of the State, must provide the permitting agency with a State water quality certification. A water quality certification is the mechanism by which the State evaluates whether an activity will meet water quality standards. Certifications may be denied, approved or approved with conditions, which if met, will ensure that water quality standards are met.	Federal Clean Water Act; ORS 468B.035 & .047; OAR 340-048	All waters of the State	In-place and on-going

Appendix Table 1 (continued). Description of statewide programs currently implemented by the State of Oregon that support habitat management strategies in tributaries.

Agency	Program	Description	Guidance	Jurisdiction	Timeline
ODEQ	401 Hydroelectric Recertification	Section 401 of the federal Clean Water Act requires that an applicant for a federal permit, to conduct an activity that may result in a discharge to waters of the State, must provide the permitting agency with a State water quality certification. A water quality certification is the mechanism by which the State evaluates whether an activity will meet water quality standards. Certifications may be denied, approved or approved with conditions, which if met, will ensure that water quality standards are met.	Federal Clean Water Act; ORS 468B.035 & 040 - .047; OAR 340-048	All waters of of the State	In-place and on-going
ODEQ	Environmental Clean Ups	DEQ's Environmental Cleanup Program protects human health and the environment by identifying, investigating, and remediating sites contaminated with hazardous substances. The Cleanup Programs objective is to guide all sites to No-Further-Action (NFA) determinations as quickly and inexpensively as possible. DEQ has issued over 1,000 NFAs since 1994, some of which include institutional or engineering controls to manage site risks.	Various Federal Laws; ORS465; OAR 340-122	All waters of of the State	In-place and on-going
ODEQ	Non-Point Source Program	DEQ requires Designated Management Agencies to develop Non Point Source Implementation Plan for sub basins that have TMDLs. Additionally, DEQ works in cooperation with other state, federal and local agencies to enhance their programs to address elements of non point source pollution and administers grants and loans to implement on-the-ground projects.	Federal Clean Water Act; ORS 468B.035	All waters of of the State	In-place and on-going
ODEQ	Point Source Permits	DEQ issues water quality permits to protect surface and ground waters of the state. These permits regulate sewage and industrial wastewater discharges from industrial and municipal sources.	Federal Clean Water Act; ORS 468B.035, 030 & 050; OAR 340-045.	All waters of of the State	In-place and on-going
ODEQ	Storm Water Permits	DEQ issues water quality permits to protect surface and ground waters of the state. Stormwater permits are required for and regulate storm water discharges to surface waters from: Construction activities (that disturb greater than 1 acre); industrial activities (subject to federal permitting requirements determined by SIC codes listed in the federal regulations); and municipalities (covered under Phase 1 (populations over 100,000) and Phase 2 (populations over 50,000) permitting requirements).	Federal Clean Water Act; ORS 468B.035, 030 & 050; OAR 340-045.	All waters of of the State	In-place and on-going

Appendix Table 1 (continued). Description of statewide programs currently implemented by the State of Oregon that support habitat management strategies in tributaries.

Agency	Program	Description	Guidance	Jurisdiction	Timeline
ODEQ	Water Quality Standards	DEQ develops numeric and narrative water quality standards to protect for the most sensitive beneficial uses of the waters of the state – typically for protection of fish and other aquatic life and human health. As required under the Clean Water Act, these standards are to be reviewed every three years to insure that they are scientifically up-to-date.	Federal Clean Water Act; ORS 468B.035 & 048; OAR 340-041-0001 to 340-041-0350	All waters of of the State	In-place and on-going
ODF	Fire Program	The Fire Program of the Oregon Department of Forestry provides effective protection from fire for forest resources including water and watersheds, fisheries, wildlife, soil productivity and soil stability. National Fire Plan activities target fuel reduction and stand management that contribute to stands that are more fire resilient and benefit all forest resources. The Fire Program also educates forest landowners and forest homeowners about the value off fire hazard and risk reduction measures and takes positive action to minimize threats.	ORS Chapter 527, 526	Private forestlands, BLM land on Westside.	Program is active & ongoing.

Appendix Table 1 (continued). Description of statewide programs currently implemented by the State of Oregon that support habitat management strategies in tributaries.

Agency	Program	Description	Guidance	Jurisdiction	Timeline
ODF	Oregon Forest Practices Act	The FPA encourages economically efficient forest practices that ensure the continuous growing and harvesting of forest tree species and the maintenance of forestland for such purposes as the leading use on privately owned land consistent with sound management of soil, air, water, fish and wildlife resources. The FPA regulates road construction and road maintenance. Road construction must allow the migration of adult and juvenile fish upstream and downstream during conditions when fish movement in that stream normally occurs. For roads constructed after 1994, the forest practices act requires fish passage to be maintained. For all other roads the FPA encourages this standard. For roads constructed prior to 1994, other statutes apply that are outside the jurisdiction of the Department of Forestry. The water protection rules protect, maintain and, where appropriate, improve the functions and values of streams, lakes, wetlands, and riparian management areas. These functions and values include water quality, hydrologic functions, the growing and harvesting of trees, and fish and wildlife resources. Temperature is primarily addressed in the water protection rules that include general vegetation retention prescriptions for streams, lakes and wetlands. Requirements for vegetation along fish bearing streams varies by stream size and geographic region, however along all fish bearing streams, trees within 20 feet, vegetation within 10 feet, and trees leaning over the channel are required to be retained. Retention requirements beyond this vary. With regards to habitat complexity and off-channel habitat availability, the FPA regulates slash treatment, reforestation, chemical applications, road construction, harvesting, and hauling. Statutes and administrative rules vary for each practice, Each is designed to protect function and value of these resources. Requirements vary by stream size and geographic region, however along all fish bearing streams, trees within 20 feet, vegetation within 10 feet, and trees leaning over the channel are required to be retained. Retention requirements beyond this vary. These rules take a precautionary, passive approach by protecting the existing condition. They allow restoration activities only with site specific, written plans. With regards to fine sediment, the forest practices act regulates slash treatment, road construction, harvesting, and hauling. Rules vary for each practice. Each set of rules is designed to prevent or minimize sediment or debris delivery to waters of the state and to meet clean water standards. In addition to regulations for each specific practice, riparian buffers along fish bearing streams add an additional area of filtration between operation activities and waters of the state. A staff of field foresters works with landowners and operators to assist, educate, and enforce the rules. A statewide monitoring program assesses compliance with the rules and rule effectiveness at achieving objectives.	ORS Chapter 527, OAR Chapter 629	Operations on or pertaining to non-federal forestlands regardless of zoning or taxation, with the exception of where local governments (cities) have taken on responsibility of administering regulations within Urban Growth Boundaries that provide protection of forestland resources. Jurisdiction includes limited federal lands such as lands owned by Army Corp of Engineers, Bureau of Reclamation, and US Fish and Wildlife. USDA Forest Service and BLM lands are regulated through designation of those two agencies as the designated management agency under agreement with ODEQ. Operation means any commercial activity relating to the establishment, management or harvest of forest tree species. There are certain exceptions regarding Christmas trees, trees grown as intensive agriculture crops, trees grown to mitigate the effects of agricultural practices, and where approved land use conversions have commenced. See OAR 629-600-0100 (47).	Program is active & ongoing. Recent changes include wet weather hauling rules, road drainage, and measures around certain streams. Monitoring of small and medium fish bearing streams is under way. Board of Forestry work plan indicates evaluation of small non-fish bearing streams for temperature in 2008.

Appendix Table 1 (continued). Description of statewide programs currently implemented by the State of Oregon that support habitat management strategies in tributaries.					
Agency	Program	Description	Guidance	Jurisdiction	Timeline
ODF	Private forestry component of the Oregon Plan for Salmon and Watersheds	Forest Landowners contribute to the Oregon Plan by complying with Oregon's Forest Practices Act and by accomplishing additional projects that contribute to Oregon Plan goals. Regarding fish passage, forest landowners close or rehabilitate legacy roads and update functioning roads to meet current standards, Oregon Plan measures on forestland are currently being updated to include recommendations from the work of the forest practices advisory committee and the DEQ sufficiency analysis. With regards to temperature, forest landowners manage riparian areas, leave additional conifers along streams, increase RMAs for non-fish bearing streams, and place leave trees to benefit Oregon Plan objectives. Oregon Plan measures on forestland are currently being updated to include recommendations from the work of the forest practices advisory committee and the DEQ sufficiency analysis. With regards to fine sediments, forest landowners voluntarily rehabilitate legacy roads to reduce the threat of fine sediment. This includes adding water bars, removing culverts, and pulling back perched soils on roads built prior to adoption of the FPA. Oregon Plan measures on private forestland are currently being updated to include recommendations from the work of the forest practices advisory committee and the DEQ sufficiency analysis. Regarding habitat complexity and off channel habitat availability, forest landowners place wood in streams, manage riparian areas, restore conifers in riparian management areas, and participate in habitat restoration activities. Oregon Plan measures on forestland are currently being updated to include recommendations from the work of the forest practices advisory committee and the DEQ sufficiency analysis.	ORS Chapter 521 and OAR 629-605-0103	Voluntary	Ongoing, updated voluntary measures planned for 2007.

Appendix Table 1 (continued). Description of statewide programs currently implemented by the State of Oregon that support habitat management strategies in tributaries.

Agency	Program	Description	Guidance	Jurisdiction	Timeline
ODF	State Forest Program	The State Forest Program implements actions related to roads to minimize effects upon fish passage. First, roads are built and maintained according to the standards of the Forest Roads Manual. Additionally, stream crossings are surveyed at the watershed scale to identify locations of potential effects to fish passage. (This is usually conducted through the watershed analysis process.) Based on these surveys, actions are taken to improve fish passage, where necessary. Finally, ODF conducts monitoring to ensure that actions are applied properly and to evaluate the effectiveness of these actions. The State Forest Program applies management standards for aquatic and riparian areas that include wide riparian buffers on fish bearing streams. These same standards apply to large and medium perennial streams without fish. Small perennial streams without fish also have tree retention requirements. ODF also applies additional risk-reduction strategies in Salmon Anchor Habitats (until 2011).. Finally, monitoring is conducted. ODF evaluates the effectiveness of its riparian strategies through its adaptive management program. The State Forest Program applies management standards for aquatic and riparian areas which are designed to increase the development of riparian large wood to restore aquatic habitats. These include a wider riparian management zone than specified under the FPA, with additional tree retention. Where appropriate, the FMP promotes the use of alternative vegetation treatments to accelerate the development of large wood. Active restoration is also applied to improve habitat complexity. Restoration projects include wood placement and re-routing of roads away from streams. Priority areas for restoration are generally identified through the watershed analysis process. Finally, monitoring is conducted. ODFW conducts monitoring to evaluate the effectiveness of restoration projects, while ODF evaluates the effectiveness of its riparian strategies through an adaptive management process. The State Forest Program implements actions related to roads and timber harvest to minimize the ability of sediment to reach streams. First, roads are built and maintained according to the standards of the Forest Roads Manual. Additionally, roads are surveyed at the watershed scale to identify locations of potential effects to streams. (This is usually conducted through the watershed analysis process.) Based on these surveys, actions are taken to reduce hydrologic connectivity, potential for road failure, and other potential sediment impacts. Timber harvest, likewise, is conducted to minimize sediment contributions to streams. The wide buffers specified by the Forest Management Plan prevent disturbance in the near stream area that might otherwise result in sediment delivery to streams. Finally, ODF conducts monitoring to ensure that actions are applied properly and to evaluate the effectiveness of these actions.	ORS Chapter 527, 521, OAR 629-640-0100 & -0200 through -0440, Northwest Oregon State Forests Management Plan, Forest Roads Manual, ODFW rules/statutes, OWEB guidance on fish passage	State Forest Land	

Appendix Table 1 (continued). Description of statewide programs currently implemented by the State of Oregon that support habitat management strategies in tributaries.

Agency	Program	Description	Guidance	Jurisdiction	Timeline
ODFW	Conservation Strategy for Oregon	Previously called the Comprehensive Wildlife Conservation Strategy, the Conservation Strategy for Oregon provides a non-regulatory, statewide approach to species and habitat conservation. It synthesizes existing plans, scientific data, and local knowledge into a broad vision and conceptual framework for long-term conservation of Oregon's native fish, wildlife and habitats. Conservation of instream and upland habitats will promote watershed health.	USFWS and Association of Fish and Wildlife Agencies guided the development and review process for the Strategy. For guidance on the implementation, see the Oregon Conservation Strategy document: http://www.dfw.state.or.us/conservationstrategy/	The Conservation Strategy for Oregon is meant to apply to all lands, rivers, streams, and estuaries in Oregon.	Internal review by January 2008; varying levels of external review to occur at 5 – and 10 – year intervals.
ODFW	Fish Passage Program	The owner or operator of an artificial obstruction located in waters in which native migratory fish are currently or were historically present must address fish passage requirements by gaining approval from ODFW prior to certain trigger events. Trigger events include installation, major replacement, a fundamental change in permit status (e.g., new water right, renewed hydroelectric license), or abandonment of the artificial obstruction. In addition, ODFW is working toward identification of the highest priority passage sites, at which passage can be addressed.	Laws regarding fish passage may be found in ORS 509.580 through 910 and in OAR 635, Division 412.	Artificial obstructions located in Oregon waters in which native migratory fish are currently or were historically present	ongoing
ODFW	Fish Screening and Passage Grant Program	Oregon water users may be eligible for an ODFW cost-share incentive program and state tax credit designed to promote the installation of ODFW approved fish screening or fish passage devices. Fish screens prevent fish from entering water diversions. Fishways provide fish passage to allow migration. ODFW works with owners who apply for funding, as well as actively seeks projects at which to provide fish screening and passage.	Laws regarding passage, screening, and cost share can be found in ORS 315.138, 496.085, 496.141, 496.303, 497.124, 498.301 through 346, 509.580 through 910, 537.141, 540.525, and in OAR 635, Division 412.	Oregon water users including independent agriculture users, private domestic users, municipal water suppliers, irrigation districts and commercial industries.	On-going

Appendix Table 1 (continued). Description of statewide programs currently implemented by the State of Oregon that support habitat management strategies in tributaries.					
Agency	Program	Description	Guidance	Jurisdiction	Timeline
ODFW	Lands Resources Program	The Wildlife Division Land Resources Program helps guide land-use activities in Oregon that affect fish and wildlife habitats. The program offers tax incentives, grants and technical assistance to private and public landowners, businesses and governments to promote conservation of fish and wildlife habitats, and to ensure environmental protection standards are met. Programs goals promote healthy riparian and wetland corridors - decreasing bank erosion and filtering run-off.	OAR's for Landowner Incentive Program (LIP), Access and Habitat Program, Bird Stamp Program, and Riparian Lands Tax Incentive Program) can be found at http://arcweb.sos.state.or.us/rules/OARS_600/OAR_635/635_tofc.html	All owners of private and public land in Oregon interested in conserving fish and wildlife habitats.	Ongoing
ODFW	Restoration and Enhancement Program	ODFW oversees a comprehensive program to assist in enhancing natural fish production, improve hatchery programs, and provide additional public access to fishing waters. To achieve these goals, the R and E Program provides funding that directly benefits fish by addressing items such as fish passage, habitat restoration, public education, research and monitoring.	OAR's 635-009-0200 through -0240; Stat. Auth.: ORS 512	All streams, rivers, lakes, and estuaries in Oregon.	Ongoing.
ODFW	Salmon Trout Enhancement Program	The Salmon and Trout Enhancement Program (STEP) recognizes that volunteers play an important role in the restoration of salmon, steelhead and trout. STEP (1) educates the public about Oregon's salmon and trout resources and the habitats they depend on, (2) inventories and monitors fish populations and their habitat, (3) enhances, restores and protects habitat for native stocks of salmon, steelhead, and trout, and (4) produces fish to supplement natural fish production, augment fisheries, or, in the case of the classroom egg incubation program, provide educational opportunities. Habitat monitoring and enhancement function under STEP, could be used to address this limiting factor.	OAR's 635-009-0090 through -0150; Stat. Auth.: ORS 496	All Oregonians that are eager to contribute time, muscle, money, and perseverance to the restoration of salmon, steelhead and trout in Oregon.	Ongoing.
ODFW	Watershed Council Liaison	The ODFW Watershed Council Liaison position provides technical support to watershed councils involved in assessing watershed conditions and conducting restoration projects designed to address watershed needs. Among those projects are actions that specifically address fish passage barriers, iparian enhancement, habitat complexity, and fine sediments in streams.	Oregon Aquatic Habitat Restoration Guidelines.	All watershed councils in Oregon.	Not identified.
ODLCD	Statewide Comprehensive Land use Planning	Oregon's statewide comprehensive land use program requires cities and counties to plan for and manage land use in compliance with 19 statewide planning goals. Local land use plans and ordinances must identify and protect natural resources and identify and plan for hazard areas. The statewide land use program provides a framework for local governments to adopt land use plans and ordinances and approve development that are salmon-friendly.	(ORS 197,)RS 195, ORS 215, ORS 227)	City and county land use plans and ordinances.	Implementation is on-going. Plans and ordinances are updated according to local needs and as a result of legislation.

Appendix Table 1 (continued). Description of statewide programs currently implemented by the State of Oregon that support habitat management strategies in tributaries.					
Agency	Program	Description	Guidance	Jurisdiction	Timeline
ODOT	Salmon-Fish Passage Program	Oregon Department of Transportation's (ODOT) Salmon-Fish Passage Program originated in 1997 through the Oregon Plan for Salmon and Watersheds (Oregon Plan). This program, initiated by Governor Kitzhaber and authorized by the Oregon Transportation Commission (OTC), defined ODOT's Oregon Plan contributions. The OTC invested $12 million Immediate Opportunity Funds prior to the 2000-2003 State Transportation Improvement Plan (STIP) to replace and retrofit high priority fish passage culverts owned and managed by ODOT. ODOT's Salmon-Fish Passage program funding levels continue to be approved by the OTC (FY 2008 through FY 2011 are $ 3.7, $ 3.9, $4.1, and $4.2 million respectively). ODOT's Salmon-Fish Passage Program has invested approximately $30 million into culvert improvements and provided access to nearly 370 miles of stream habitat once blocked to native migratory fish. These capital investment improvements, at culverts identified by Oregon Department of Fish and Wildlife (ODFW) as high priority fish passage locations, are critical elements of ODOT's Oregon Plan contributions. These projects promote the recovery and sustainability of threatened and endangered native migratory fish in Oregon. The goal of this program is to continue to support the Oregon Plan and to repair (replace or retrofit) priority fish passage culverts in the most aggressive, cost effective, and efficient means as practicable with limited program funds.	ORS 509-580 through 910, OAR Chapter 635-412-0010 through OAR 635-412-0040, Executive Order (EO) 99-01, and ODOT's Mission Statement	ODOT's Salmon-Fish Passage Program addresses fish passage needs at priority hydraulic facilities located within ODOT rights of way. These rights of way bisect multiple jurisdictions and land use.	ODOT's program is ongoing and presently funded through FY 2011. Funding requests through FY 2013 are complete and it is expected that the ODOT Salmon-Fish Passage Program will continue to be funded.
ODSL	Voluntary Restoration Initiative	Under DSL's new Voluntary Restoration Initiative, two Wetland Restoration Specialists are working with landowners and organizations interested in restoring wetlands. Primary objectives are to provide technical assistance on restoration site assessment, permitting and monitoring, facilitate restoration of historical wetland types (emphasis on rare and at-risk habitats), and accurately track/report quality/ quantity of projects	ORS Chapter 196.600-692; OAR 141-085-0240 -0257 and 0610-1660	Wetlands that meet the three wetland indicators described in the Corps of Engineers' 1987 Wetland Manual.	Initiative began in March 2006 and is scheduled as a 3-year program.
ODSL	Removal-Fill Program	Oregon's Removal-Fill Law requires people who plan to remove or fill material in waters of the state to obtain a permit from the Department of State Lands. Proposed permanent impacts to instream and off-channel habitat, as well as to wetlands, are required to be offset with compensatory mitigation actions such as riparian planting, large wood placement, or wetland restoration. All permits issued by DSL include conditions that require protection of fish habitat and water quality, including in-water timing restrictions, turbidity monitoring and sediment and erosion control requirements, and riparian vegetation removal restrictions and revegetation requirements. By offering streamlined General Authorizations for projects with minimal impacts (i.e. bioengineering methods and planting instead of riprap), the permit process encourages applicants to design projects with minimized impacts to water resources. The Department recently implemented a pilot program for an expedited permitting process for fish habitat enhancement activities including placement of large woody debris and boulders.	ORS Chapter 196.795 - 990 and ORS Chapter 390.835; OAR 141-085-0005 - 0165.	Waterways to the ordinary high water mark and wetlands that meet the three wetland indicators described in the Corps of Engineers' 1987 Wetlands Manual.	Program is ongoing

Appendix Table 1 (continued). Description of statewide programs currently implemented by the State of Oregon that support habitat management strategies in tributaries.

Agency	Program	Description	Guidance	Jurisdiction	Timeline
OWEB	CREP Program	OWEB is the state cost share partner for the Conservation Reserve Enhancement Program (CREP) that pays for riparian restoration and provides a 10-15 year conservation rental for maintenance of the plantings. The program has enrolled nearly 2,000 miles of stream since 1999.	ORS 541.351 - 541.420 and OAR 695-001-0000 through 695-050-0050	Agricultural lands	Ongoing
OWEB	Grant Program	OWEB's grant program supports voluntary efforts by Oregonians seeking to maintain and restore native fish and healthy watersheds. OWEB funds projects that restore, maintain, and enhance the state's watersheds, supports the capacity of local watershed-based citizen groups to carry out a variety of restoration projects, promotes citizen understanding of watershed needs and restoration ideas, provides technical skills to citizens working to restore urban and rural watersheds, and monitors the effectiveness of investments in watershed restoration. OWEB regular grants are awarded every 6 months for restoration and protection of ecological resources. Grant applications are reviewed by a regional multidisciplinary team to develop recommendations and prioritization of grant applications for OWEB consideration. The review teams evaluate whether the grant applications address limiting factors and the technical soundness of the proposals.	ORS 541.351 - 541.420 and OAR 695-001-0000 through 695-050-0050	All lands	Ongoing
OWRD	Administration of Water Rights	Surface waters in many areas of the state are fully allocated during critical flow periods for fish. However, there are several aspects of the review process for new water right applications that are protective of fish and fish habitat. All new groundwater permits are evaluated to determine the potential to cause substantial interference with surface flows. Surface water availability is modeled monthly and includes existing instream water rights. Applications to appropriate surface waters are evaluated at the 80% exceedance level. Permits are subject to public interest review standards that include interagency consultation on potential impacts of further appropriation to fish and fish habitat. All new water right applications are subject to review through an interagency review and consultation process. Permits, if approved, may be conditioned to address impacts on listed species identified through the consultation process.	OAR 690-009, 033, 051, 310	With few exceptions, all surface and ground waters of the state	Program is in place and ongoing
OWRD	Enclosed Livestock Water Delivery Systems	Livestock owners with legal access to use surface waters are exempt from the requirement to obtain a permit or certificate to divert water to a trough or tank through an enclosed water delivery system meeting minimum requirements. OWRD Watermasters provide technical support to interested landowners.	ORS 537.141	Water rights appurtenant to agricultural lands.	In place and ongoing

Appendix Table 1 (continued). Description of statewide programs currently implemented by the State of Oregon that support habitat management strategies in tributaries.

Agency	Program	Description	Guidance	Jurisdiction	Timeline
OWRD	Flow Restoration Programs	ODFW and OWRD have identified priority watersheds where flow restoration will produce the most benefit for listed species. OWRD staff work with water rights holders to restore streamflows through voluntary flow restoration measures. Voluntary measures include instream leases, instream transfers, allocations of water conserved through improved efficiencies, and changes to existing rights including consolidation or transfers of points of diversion. In certain circumstances, reclaimed water from certain municipal, industrial and confined animal feeding operations may provide an effective alternative to new diversions of surface water or ground water.	OAR 690-018, 077, 380	All interested water right holders	Program is in place, outreach, administration and technical assistance are ongoing
OWRD	Lease/Transfer Water Rights Associated with CREP Program	Perfected water rights appurtenant to lands enrolled under the CREP program are not subject to forfeiture for non-use during the enrollment period. OWRD encourages CREP participants to voluntarily lease or temporarily transfer associated water rights instream while enrolled in CREP. Associated water rights leased or transferred instream can be protected instream to benefit minimum flows and listed species.	ORS 537.348, 540.610 (Revised), OAR 690-077, 380	Water rights appurtenant to agricultural lands enrolled in CREP.	Program is in place, outreach, administration and technical assistance are ongoing
OWRD	Water Distribution and Regulation	Distribution and regulation of water use for the protection of senior water rights, including instream rights, is a priority for OWRD. Staff regularly monitor streamflow, particularly on those streams with established instream rights, and work to eliminate illegal use through compliance and enforcement of Oregon water law.	OAR 690-250, 077, ORS 540.045	With few exceptions, all surface and ground waters of the state	Program is in place. Distribution and regulation are ongoing.
OWRD	Water Supply and Conservation Planning	OWRD Staff work with water rights holders to address water supply through the development of water management and conservation plans. The development of these plans for new and extended municipal rights and through voluntary participation of irrigation districts must identify conservation measures that will be pursued. Municipal plans must also include five year benchmarks for implementation of conservation activities.	OAR 690-086 (Guidance is also available through the League of Oregon Cities)	Municipal and Agricultural water right holders interested in preparing, or required to prepare, water management and conservation plans.	In place and ongoing.
OWRD	Water Use Measurement Strategy	Federal and state agencies, cities, counties, schools, irrigation districts and other special districts are required to report water use on an annual basis. Since 1990, many new permits have required water meters to be installed and annual reports to be submitted to the state. In addition, the Water Resource Commission considered water use measurement in 2000 and adopted a strategy for improving water measurement statewide. The strategy includes a program to inventory and complete field assessments of significant points of diversion and to look for opportunities to increase measurement at those diversions by ensuring compliance and promoting voluntary measurement via cost-share programs. Significant diversions are characterized as those required to measure through a water right condition, or those diversions without a measurement condition that are greater than 5 cfs, or greater than 10% of the lowest monthly 50% exceedance flow as defined in the water availability model, and greater than 0.25 cfs.	OAR 690-085, ORS 537.099 and the Water Resource Commission's Strategy for Statewide Water Measurement	With few exceptions, all surface and ground waters of the state	Ongoing with partial implementation

Appendix 2. Strategies and land uses addressed by statewide management programs. A checked box indicates that the program addresses components of the management strategy or has jurisdiction over a land use. See Table 1 for a description of management strategy codes. Land use codes are: FF = Federal Forest; SF = State Forest; PF = Private Forest; Ag = Agriculture; UR = Urban/Rural residential;

Agency	Program	Management Strategy								Land use				
		1	2	3	4	5	6	7	8	FF	SF	PF	Ag	UR
ODA	Agricultural Water Quality Management (SB 1010)	√		√		√		√	√				√	
ODA	Confined Animal Feeding Operation (CAFO)							√	√				√	
ODA	Pesticides							√		√	√	√	√	√
ODA	Soil and Water Conservation Districts	√	√	√		√	√	√	√	√	√	√	√	√
ODA	Weed Control and Invasive Species	√		√		√		√	√	√	√	√	√	√
ODEQ	401 Dredge & Fill Certifications							√		√	√	√	√	√
ODEQ	401 Hydroelectric Recertification							√		√	√	√	√	√
ODEQ	Environmental Clean Ups							√		√	√	√	√	√
ODEQ	Non-Point Source Program					√		√		√	√	√	√	√
ODEQ	Point Source Permits							√						√
ODEQ	Storm Water Permits			√		√		√	√					√
ODEQ	TMDLs							√		√	√	√	√	√
ODEQ	Water Quality Standards							√		√	√	√	√	√
ODF	Fire Program	√	√	√	√	√		√	√	√		√		
ODF	Oregon Forest Practices Act	√	√	√	√	√	√	√	√		√	√	√	√

Appendix 2 (continued).

Agency	Program	Management Strategy								Land use				
		1	2	3	4	5	6	7	8	FF	SF	PF	Ag	UR
ODF	State Forest Program	√	√	√	√	√	√	√	√		√			
ODFW	Conservation Strategy for Oregon	√	√	√	√	√	√	√		√	√	√	√	√
ODFW	Fish Passage Program				√					√	√	√	√	√
ODFW	Fish Screening and Passage Grant Program				√							√	√	√
ODFW	Lands Resources Program	√	√	√	√	√	√	√		√	√	√	√	√
ODFW	Restoration and Enhancement Program	√	√	√	√	√	√	√		√	√	√	√	√
ODFW	Salmon Trout Enhancement Program	√	√	√	√	√	√	√		√	√	√	√	√
ODFW	Watershed Council Liaison	√	√	√	√	√	√	√		√	√	√	√	√
ODLCD	Statewide Comprehensive Land use Planning		√		√		√		√	√	√	√	√	√
ODOT	Salmon-Fish Passage Program				√					√	√	√	√	√
ODSL	Removal-Fill Program	√	√		√		√	√		√	√	√	√	√
ODSL	Voluntary Restoration Initiative	√	√				√			√	√	√	√	√
OWEB	CREP Program	√	√	√			√	√	√				√	
OWEB	Grant Program	√	√	√	√	√	√	√	√	√	√	√	√	√
OWRD	Administration of Water Rights				√	√				√	√	√	√	√
OWRD	Enclosed Livestock Water Delivery Systems			√									√	
OWRD	Flow Restoration Programs					√				√	√	√	√	√

Appendix 2 (continued).

Agency	Program	Management Strategy 1	2	3	4	5	6	7	8	Land use FF	SF	PF	Ag	UR
OWRD	Lease/Transfer Water Rights Associated with CREP Program					√			√				√	
OWRD	Water Distribution and Regulation					√				√	√	√	√	√
OWRD	Water Supply and Conservation Planning					√							√	√
OWRD	Water Use Measurement Strategy					√				√	√	√	√	√

Appendix Table 3. Program sufficiencies to address fine sediment impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODA	Agricultural Water Quality Management (SB 1010)		Basin plans and rules are reviewed biennially to determine whether the plan is sufficient to meet and address water quality standards, and modified as necessary to meet deficiencies and new requirements or information. Reviews include review of compliance actions, outreach activities, projects, and monitoring results. ODA focuses efforts and resources on areas of highest priority and program is enforced. "Compliance" is based on inspections prompted by "notification" of inappropriate occurrences; increasing complaints and notifications reflect an increased public awareness and greater number of basin rules in place. Water quality monitoring is conducted by DEQ at permanent sites. Aerial photography at 4-5 yr intervals documents riparian condition trends.	Biennial reviews will determine if modifications are needed. Given more resources (funding) implementation of on-the-ground actions, including monitoring, would be accelerated. More monitoring would provide improved documentation of program adequacy. Resources are needed for site capability assessment through GIS.	Landowner cooperation, capacity for outreach, changing land ownerships and new landowners knowledge of agricultural issues, perception that this is only a complaint driven process, technical assistance, adequate monitoring at meaningful scales
ODA	Soil and Water Conservation Districts		Strong local infrastructure, provides strong local involvement and action. Districts focus efforts and resources on areas of highest priority. An accounting of outreach activities and conservation planning and practices reported by SWCDs on an annual basis is available from ODA.	None at this time. Given more resources (funding) implementation of on-the-ground actions would be accelerated.	Stable and adequate levels of resources (Funding)
ODA	Weed Control and Invasive Species		Weed and invasive species negatively affect desired riparian condition and function. ODA focuses efforts and resources on areas of highest priority. This is a voluntary program and not under regulatory control	None at this time. Given more resources (funding) implementation of on-the-ground actions would be accelerated.	Adequate technical support, capacity for outreach, perception that this is not doable because it is an ongoing challenge
ODEQ	401 Dredge & Fill Certifications		Limited monitoring for compliance and lack of cumulative impacts tracking.	A greater number of specific types of projects will be monitored for compliance in the future. This will help in evaluating adequacy of portions of the program but additional monitoring and evaluation is needed.	The state review is primarily fee based. Fees need to be periodically adjusted to cover the cost of the program.
ODEQ	Non-Point Source Program		The program relies on existing state and local authorities to address non point sources of pollution. Programs to address nonpoint sources, especially in urban and agricultural areas, are relatively recent and additional time and trend monitoring is needed to document results. Additionally, while a schedule for implementation is to be identified, timing of implementation is often dependent on adequate future funding which often is not guaranteed or certain.	Adequate monitoring program needed; see other programs listed in this document for modifications needed as it relies on other existing state and local authorities for implementation. See other programs listed in this document for Modifications Needed,	See other programs listed in this document for constraints as it relies on other existing state and local authorities for implementation.
ODEQ	Storm Water Permits		Stormwater permitting program is: - a relatively recent program where programs, practices and technology are evolving (e.g. phase 2 permits are being developed by 2007) and therefore there has been limited time to monitor the effectiveness of this program; - In the case of municipal storm water, permits require implementation of best management practices to the maximum extent practicable which may not restore upland processes or may not water quality standards in some areas.	Additional staff for technical assistance and program oversight. Additional Staffing.	Number of staff is always a limitation. Funding is a blend of federal, state and fee support. Additional funding has recently been provided based on a Blue Ribbon Committee Report which recommended changes to fee structures and additional general funds.

Appendix Table 3 (continued). Program sufficiencies to address fine sediment impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODEQ	TMDLs		TMDLs target bringing waters back into compliance with water quality standards. Oregon entered into a Consent Decree and Memorandum of Agreement with USEPA in 2000 under which it committed to substantially complete TMDLs statewide by 2010 (based on number of waters listed on the 1998 303(d) list). Uncertainty is based on the fact that sedimentation is likely to underlisted and therefore only a few sedimentation TMDLs have been developed in Oregon. Additionally, DEQ has not had much experience in addressing sedimentation under the TMDL program.	The Department is currently working on updating the turbidity standard and has identified that the sedimentation standard needs to be addressed in future triennial standards reviews. The Department is also re-examining its 303(d) listing criteria based on the current narrative standard. Subsequent sedimentation TMDLs will address these concerns. Additional Staffing.	Staffing resources.
ODEQ	Water Quality Standards		A growing backlog of standards need to be updated. At current staffing levels, DEQ cannot update standards on a three year cycle nor undertake complex standard development that would be needed to adequately address complex issues such as sedimentation and turbidity. Without updates, DEQ would rely on current standards or those promulgated by the USEPA. In the case of addressing sedimentation, DEQ relies on use of its current narrative standard.	Additional staffing for this program (DEQ had a preliminary budget request in for the 2007 Legislature, but did receive the Governor's approval).	Number of staff

Appendix Table 3 (continued). Program sufficiencies to address fine sediment impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODF	Fire Program		Resources are needed to assist forest landowners to reduce fuels that place forested watersheds at risk. Infrastructure is also needed to support resource enhancement opportunities through biomass conversion projects.	More coordinated efforts by all of Oregon's agencies and landowners to work collaboratively with federal partners to increase the contribution for recovery from federal forests.	Federal and private forest 'checker-board' ownership can place private forestlands at risk for uncharacteristic wildfire when either forest is not managed. There is a need for both ODF and ODF&W, and all landowners to play a role in the management of federal forests located in Oregon. A collaborative relationship between state natural resource agencies and federal forest management agencies may restore the health, diversity, and resilience of federal forests by increasing the information shared and by providing a variety of perspectives on site-specific and landscape level determinations. Wildfire-prone areas are identified in a community wildfire protection plans identifying priority areas for hazardous fuel removal from federal lands.

Appendix Table 3 (continued). Program sufficiencies to address fine sediment impacts.					
Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODF	Oregon Forest Practices Act		Current practices under the Act have reduced sediment inputs and will sustain a trend of reducing fine sediment inputs over time. Past activities that have unnecessarily contributed fine sediments have been abandoned or modified. Modifications to practices have been designed to address the key mechanisms for delivery of fine sediment from forest operations. Legacy issues are addressed over time through the regulatory process when culverts are replaced or roads become part of an active operation. Legacy issues are also addressed in an expedited manner through voluntary measures. Documentation Links: Final Oregon Coastal Coho Assessment: http://nrimp.dfw.state.or.us/OregonPlan Sufficiency Analysis: A Statewide Evaluation of Forest Practices Act Effectiveness in Protecting Water Quality, ODF and DEQ 2002. Pages 6, 7 (Wet Weather road use rules subsequently adopted.) Pgs. 6-7, 32-35, 59-61, C3-8. http://egov.oregon.gov/ODF/PRIVATE_FORESTS/docs/fp/AllSAv1031.pdf ODF BMP Compliance study 2002 pages 19-25 http://egov.oregon.gov/ODF/PRIVATE_FORESTS/docs/fp/BMPfinalTR15.pdf Additional monitoring: o Road Hazard Inventory (pdf) o FPMP Technical Report #17 (pdf) - Wet Season Road Use Monitoring Project: Final Report, June 2003 o FPMP Technical Report #8 (pdf), Evaluation of the Effectiveness of Forest Road BMPs to Minimize Stream Sediment Impacts - Final FY 96 Report to the Oregon DEQ o FPMP Technical Report #9 (pdf), Forest Roads, Drainage, and Sediment Delivery in the Kilchis River Watershed, June 1997 o FPMP Technical Report #10 (pdf), Forest Road Sediment and Drainage Monitoring Project Report for Private and State Lands in Western Oregon, February 1998 o Storm Impacts & Landslides of 1996 : http://egov.oregon.gov/ODF/PRIVATE_FORESTS/landslides.shtml	Additional resources for monitoring and program implementation would increase the certainty that the current rules are efficient and effective at delivering desired outcomes. The Board of Forestry has adopted an indicator to address road related risks. The metrics for the indicator are: 1) Percent of road system disconnected from the stream network; 2) Percent of stream crossings on fish streams providing passage; 3) Land area in non-forest condition due to roads (road subgrade plus cutslope). The desired trend is an increasing proportion of sampled Oregon forest roads are determined to pose a low risk to soil and water resources. Additional resources and interagency coordination are needed to implement this indicator.	Resources and collaboration remain constraining. Current resource needs include the resources necessary to implement Forestry Program for Oregon indicator monitoring for roads and fish passage and the resources necessary to conduct more Private Forests Program compliance and effectiveness monitoring.

Appendix Table 3 (continued). Program sufficiencies to address fine sediment impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODF	Private forestry component of the Oregon Plan for Salmon and Watersheds		The trend for fine sediment regimes is clearly improving. Past practices that contributed fine sediments have been abandoned or modified. Existing rules regulate practices on current operations. Voluntary investments mitigate legacy sediment problems. The Oregon Plan is designed to address known sources of sediment not addressed as active operations under the Forest Practices Act. The contribution of sediment from these sources is unknown as is the total amount of work that would be needed to address these sources. Considering this uncertainty, adequacy of the program is deemed likely. Reporting and communication indicate that many landowners actively participate in the Oregon Plan and road work on roads built prior to the adoption of the Oregon forest practices act has become routine maintenance for many landowners. OWEB Watershed Restoration Inventory data indicates that landowners are actively participating in the Oregon Plan. Documentation Oregon Watershed Enhancement Board Watershed Restoration Inventory	More resources to inventory roads, especially on small, non-industrial private lands, would increase our understanding of legacy roads, fine sediment and the links to listed species	As always, more resources would increase project accomplishment, education, coordination, and monitoring.
ODF	State Forest Program		The program is built on a sound theoretical basis. Similar practices to those employed by ODF have been proven to reduce sediment production, transport, and delivery in other studies. While this gives reason to believe that the FMP standards are effective, the degree of effectiveness has not yet been established because monitoring is not yet complete. Documentation Because program standards meet or exceed those under the FPA, the documentation listed to support the sufficiency of the FPA will also support the sufficiency of the State Forests Program. Future monitoring reports produced by the State Forests Program will likely document any additional benefits produced by FMP strategies.	The need for modification to the current program is uncertain, pending the results of monitoring.	Staffing and funding are the major constraints to sediment reduction projects. While new roads are built according to current standards, and road maintenance is ongoing, improvements to existing roads are scheduled as time and funding allows.
ODFW	Conservation Strategy for Oregon		The Oregon Conservation Strategy is a new voluntary program. As such, monitoring and evaluation will be necessary to determine the effectiveness of the program.	None at this time. The role of this new program as it pertains specfically to listed salmon and steelhead is still being defined.	Voluntary measures – no assurance that it will be implemented
ODFW	Lands Resources Program		Uncertain of funding status or participation by public and private entities (i.e. Riparian Lands Tax Incentive Program).	Need further promotion of existing programs by I and E, Wildlife Division, and District staff.	Funding and staff time.

Appendix Table 3 (continued). Program sufficiencies to address fine sediment impacts.					
Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODFW	Restoration and Enhancement Program		Funding for this program is through a surcharge imposed on all sport fishing licenses and commercial salmon fishing licenses and poundage fees. As such, funding is a subject to annual variations in fish abundance, harvest rates, and license sales.	None. The Program will evaluate their ability to shift resources to priorities that emerge from recovery planning. Further changes in program scope and focus would require legislative action.	Broad legal mandates of the program limit the ability of the program to focus solely on the needs of recovery planning, variable funding due to funding mechanism.
ODFW	Salmon Trout Enhancement Program		Current staffing and the broad scope of the program limits the capacity of the program to address any single program element.	Additional funding, additional FTE.	Funding.
ODFW	Watershed Council Liaison		Currently there are only two watershed council liaison positions in ODFW, both in the North Coast Watershed District. There are no positions for other regions of Oregon.	New positions.	Funding.
ODLCD	Statewide Comprehensive Land Use Planning		The land use actions taken by local governments can supplement and support other specific restoration activities but are not sufficient in themselves to achieve restoration. Local land use actions will likely not remediate legacy conditions or significantly alter current practices, but will affect future development.	None. The statewide land use program is not intended to be sufficient to recover salmon.	Technical and planning assistance to local governments would be highly beneficial in enlisting local planning efforts in salmon recovery.
ODSL	Removal-Fill Program		DSL's removal-fill permits include conditions designed to protect water quality, including turbidity monitoring and sediment and erosion control rquirements. Not enough projects are monitored for compliance.	A greater number of projects need to be monitored for compliance. Additional, permanent compliance staff are needed.	The half-time Compliance Monitoring Specialist position is funded for three years and is subject to reauthorization each year of the three year period. The status of the position is uncertain after that time.
OWEB	CREP Program		Limitation on recruiting private landowners for voluntary water quality restoration projects. Limitation to water quality restoration opportunities due to existing infrastructure. The limitation of CREP technical assistance has been demonstrated to be the single most important factor linked to enrollment.	Increased capital and non-capital funds	Funding
OWEB	Grant Program		There is a limitation on local capacity to provide the landowner outreach, project design and facilitate implementation to address agricultural management, forest management and urban runoff that affects sediment delivery to streams.	Increased funds available to support local conservation capacity in watershed councils and soil and water conservation districts. A direct conversation with the industrial forest landowners about identifying ways to further address forest road runoff.	Funding and focus for effort by land use category (forest, urban and agriculture).

Appendix Table 3 (continued). Program sufficiencies to address fine sediment impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
OWRD	Enclosed Livestock Water Delivery Systems		When combined with riparian fencing programs, opportunities to protect and restore riparian communities, including filtering of fine sediments, while providing livestock watering capabilities are increased. There is currently no monitoring program in place to evaluate program effectiveness.	No modifications to program design are proposed. The program would benefit from expanded outreach and education.	The program is reliant on landowner interest. Construction and subsequent maintenance of fencing and off-channel watering devices require adequate financial resources.

Appendix Table 4. Program sufficiencies to address habitat complexity impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODA	Soil and Water Conservation Districts		Strong local infrastructure, provides strong local involvement and action. Districts focus efforts and resources on areas of highest priority. However, addressing this limiting factor requires a reduction in productive land which is not a priority for landowners. There is no monitoring to demonstrate effectiveness.	None at this time. Given more resources (funding) implementation of on-the-ground actions would be accelerated. Incentives are needed to foster landowner buy-in.	Stable and adequate levels of resources (Funding). Conflict with landowner values and priorities.
ODF	Fire Program		Resources are needed to assist forest landowners to reduce fuels that place forested watersheds at risk. Infrastructure is also needed to support resource enhancement opportunities through biomass conversion projects.	More coordinated efforts by all of Oregon's agencies and landowners to work collaboratively with federal partners to increase the contribution for recovery from federal forests.	Federal and private forest 'checker-board' ownership can place private forestlands at risk for uncharacteristic wildfire when either forest is not managed. There is a need for both ODF and ODF&W, and all landowners to play a role in the management of federal forests located in Oregon. A collaborative relationship between state natural resource agencies and federal forest management agencies may restore the health, diversity, and resilience of federal forests by increasing the information shared and by providing a variety of perspectives on site-specific and landscape level determinations. Wildfire-prone areas are identified in a community wildfire protection plans identifying priority areas for hazardous fuel removal from federal lands.

Appendix Table 4. Program sufficiencies to address habitat complexity impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODF	Oregon Forest Practices Act		The trend should be improving for in-stream habitat complexity and off channel availability. Vegetation retention along streams was not required until FPA rules were first established in 1972. Vegetation retention standards were revised in 1983, 1987, 1994, and 2006. Under the current Forest Practices Act, riparian areas are designed to provide the vegetation necessary for riparian functions including shade, large wood, and nutrients. A monitoring program is in place and an adaptive management process incorporates information. Rules are modified as necessary to meet the goals for riparian function and water quality. The existing vegetation in these riparian management areas will mature and provide these functions; however this will take many decades to occur. In the short term, landowners make voluntary contributions to habitat complexity through the Oregon Plan. Documentation Links Final Oregon Coastal Coho Assessment: http://nrimp.dfw.state.or.us/OregonPlan Sufficiency Analysis: A Statewide Evaluation of Forest Practices Act Effectiveness in Protecting Water Quality, ODF and DEQ 2002. http://egov.oregon.gov/ODF/PRIVATE_FORESTS/docs/fp/AllSAv1031.pdf Harvest Effects on Riparian Function & Structure o FPMP Technical Report #12 (pdf) - Harvest Effects on Riparian Function and Structure , July 2001 o Executive Summary (pdf)	Evaluation of the vegetation retention requirements along western Oregon small and medium fish-bearing streams is underway. If modifications are needed, methods to accomplish these modifications through regulatory and non-regulatory means will be considered.	Lack of production functions for fish populations and habitat conditions is a major constraint. Lack of incentives and technical assistance to provide forest landowners more site-specific options is also a major constraint.

Appendix Table 4 (continued). Program sufficiencies to address habitat complexity impacts					
Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODF	Private forestry component of the Oregon Plan for Salmon and Watersheds		The protection and voluntary measures should result in improving trends for in-stream habitat complexity and off channel availability. Under the Forest Practices Act, riparian areas are designed to provide the vegetation necessary for riparian functions including shade, large wood, and nutrients.. A monitoring program is in place, and an adaptive management process incorporates information. Rules are modified as necessary to meet the goals for riparian function. The existing vegetation in these riparian management areas will mature and provide these functions; however this will take many decades to occur. In the short term, landowners make voluntary contributions to improve habitat complexity through the Oregon Plan. Through the voluntary measures, the temporal and spatial opportunities for improvements are greatly accelerated. Forest landowners are contributing directly to the habitat complexity and off-channel availability by actively placing large wood during the course of forest operations. While not yet fully systematic, the proportion of operations conducting restoration as part of the operation should increase over time. Prioritization concepts, such as high aquatic potential are being developed. Documentation Links Oregon Watershed Enhancement Board Watershed Restoration Inventory OAR 629-640-0105: Placing Large Wood Key Pieces in Type F Streams to Improve Fish Habitat: This rule streamlines the process for placing large wood when conducted during a forest operation under the FPA. It is anticipated that this new rule will facilitate increased voluntary placement of large wood. This assessment is based on more than just monitoring. Every "call" is based on monitoring, rules, policies, incentives, education, and guidance.	More information about the needs and priorities would assist landowners in efficiently spending limited resources. Monitoring of effectiveness could be improved	Sufficient incentives are necessary to increase the scope of non-regulatory measures to match the needs. More stewardship foresters and habitat biologists are necessary to support the commitment landowners have willingly made. This would strengthen the educational component and complement the technical assistance from ODF, ODF&W, and OSU Extension foresters.

Appendix Table 4 (continued). Program sufficiencies to address habitat complexity impacts

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODF	State Forest Program		The program is built on a sound theoretical basis. Similar practices to those employed by ODF have been proven to improve fish habitats and populations in other studies. While this gives reason to believe that the FMP standards are effective, the degree of effectiveness has not yet been established because monitoring is not yet complete. Documentation Because program standards meet or exceed those under the FPA, the documentation listed to support the sufficiency of the FPA will also support the sufficiency of the State Forests Program. Future monitoring reports produced by the State Forests Program will likely document any additional benefits produced by FMP strategies.	The need for modification to the current program is uncertain, pending the results of monitoring.	Staffing and funding are the major constraints to habitat restoration projects. Projects are generally conducted opportunistically in connection with timber sales. Additional projects could be conducted with increased staffing and funding.
ODFW	Conservation Strategy for Oregon		The Oregon Conservation Strategy is a new voluntary program. As such, monitoring and evaluation will be necessary to determine the effectiveness of the program.	None at this time. The role of this new program as it pertains specifically to listed salmon and steelhead is still being defined.	Voluntary measures – no assurance that it will be implemented
ODFW	Lands Resources Program		Uncertain of funding status or participation by public and private entities (i.e. Riparian Lands Tax Incentive Program).	Need further promotion of existing programs by I and E, Wildlife Division, and District staff.	Funding and staff time.
ODFW	Restoration and Enhancement Program		Funding for this program is through a surcharge imposed on all sport fishing licenses and commercial salmon fishing licenses and poundage fees. As such, funding is a subject to annual variations in fish abundance, harvest rates, and license sales.	None. The Program will evaluate their ability to shift resources to priorities that emerge from recovery planning. Further changes in program scope and focus would require legislative action.	Broad legal mandates of the program limit the ability of the program to focus solely on the needs of recovery planning, variable funding due to funding mechanism.
ODFW	Salmon Trout Enhancement Program		Current staffing and the broad scope of the program limits the capacity of the program to address any single program element.	Additional funding, additional FTE.	Funding.
ODFW	Watershed Council Liaison		Currently there are only two watershed council liaison positions in ODFW, both in the North Coast Watershed District. There are no positions for other regions of Oregon.	New positions.	Funding.
ODLCD	Statewide Comprehensive Land Use Planning		The land use actions taken by local governments can supplement and support other specific restoration activities but are not sufficient in themselves to achieve restoration. Local land use actions will likely not remediate legacy conditions or significantly alter current practices, but will affect future development.	None. The statewide land use program is not intended to be sufficient to recover salmon.	Technical and planning assistance to local governments would be highly beneficial in enlisting local planning efforts in salmon recovery.

Appendix Table 4 (continued). Program sufficiencies to address habitat complexity impacts

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODSL	Removal-Fill Program		DSL's removal-fill permitting process encourages protection and restoration of instream and off channel habitat and wetlands. At current staffing levels, DSL does not always have the resources to do the outreach necessary to encourage landowners to protect and restore water resources.	Additional funding would increase the effectiveness of the program.	The fact that DSL does not have jurisdiction over the removal of large wood hinders our ability to protect instream and off- channel habitat.
ODSL	Voluntary Restoration Initiative		The Initiative provides direct technical assistance to landowners and organizations involved in restoring wetlands that provide off channel habitat. Because the Initiative is only funded for three years, its impact will be too limited to significantly address the threat of off channel habitat loss. The Initiative is too new to document program effectiveness.	Converting this three-year program to a permanent program would increase effectiveness. The Initiative is too new to determine what program modifications might be needed.	The Initiative is funded for three years and is subject to reauthorization each year of the three-year period. The status of the program is uncertain after that time.
OWEB	CREP Program		Limitation on recruiting private landowners for voluntary water quality restoration projects. Limitation to water quality restoration opportunities due to existing infrastructure. The limitation of CREP technical assistance has been demonstrated to be the single most important factor linked to enrollment.	Increased capital and non-capital funds	Funding
OWEB	Grant Program		Limitation on technical assistance to design floodplain restoration and stream complexity projects that can provide benefits through the range of natural flow conditions. Limitation on recruiting private landowners for voluntary floodplain restoration project implementation and protection and restoration of side-channel habitat. Limitation to floodplain and side-channel restoration and protection opportunities due to existing infrastructure.	Increased funding for technical assistance for project design and outreach to engage landowners. Effectiveness monitoring of large wood placement projects to answer questions about the stability and movement of large wood through Oregon streams.	Funding

Appendix Table 5. Program sufficiencies to address water temperature impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODA	Agricultural Water Quality Management (SB 1010)		Basin plans and rules are reviewed biennially to determine whether the plan is sufficient to meet and address water quality standards, and modified as necessary to meet deficiencies and new requirements or information. Reviews include review of compliance actions, outreach activities, projects, and monitoring results. ODA focuses efforts and resources on areas of highest priority and program is enforced. "Compliance" is based on inspections prompted by "notification" of inappropriate occurrences; increasing complaints and notifications reflect an increased public awareness and greater number of basin rules in place. Water quality monitoring is conducted by DEQ at permanent sites. Aerial photography at 4-5 yr intervals documents riparian condition trends.	Biennial reviews will determine if modifications are needed. Given more resources (funding) implementation of on-the-ground actions, including monitoring, would be accelerated. More monitoring would provide improved documentation of program adequacy.	Landowner cooperation, capacity for outreach, changing land ownerships and new landowners knowledge of agricultural issues, perception that this is only a complaint driven process, technical assistance, adequate monitoring at meaningful scales
ODA	Soil and Water Conservation Districts		Strong local infrastructure, provides strong local involvement and action. Districts focus efforts and resources on areas of highest priority. An accounting of outreach activities and conservation planning and practices reported by SWCDs on an annual basis is available from ODA.	None at this time. Given more resources (funding) implementation of on-the-ground actions would be accelerated. Additional measurement of program effectiveness is needed through documentation of habitat improvement.	Stable and adequate levels of resources (Funding)
ODEQ	401 Hydroelectric Recertification		Certifications are based on review that the proposed project will meet water quality standards. Given that most major hydroelectric projects are going through relicensing and that some actions will be based on further monitoring and adaptive management strategies (monitoring and adaptive management needs are specified for each project), additional data will be collected in the future to document program effectiveness. Documentation will be developed as part of the TMDL implementation process.	Additional Funding and Staff	the state review is primarily fee based. Fees need to be periodically adjusted to cover the cost of the program
ODEQ	Non-Point Source Program		The program relies on existing state and local authorities to address non point sources of pollution. Programs to address nonpoint sources, especially in urban and agricultural areas, are relatively recent and additional time and trend monitoring is needed to document results. Additionally, while a schedule for implementation is to be identified, timing of implementation is often dependent on adequate future funding which often is not guaranteed or certain.	Adequate monitoring program needed; see other programs listed in this document for modifications needed as it relies on other existing state and local authorities for implementation. See other programs listed in this document for Modifications Needed.	See other programs listed in this document for constraints as it relies on other existing state and local authorities for implementation.

Appendix Table 5. Program sufficiencies to address water temperature impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODEQ	Point Source Permits		Permits are written to meet water quality standards, sources not in compliance have to come into compliance within the permit cycle (typically, 5 years). Compliance monitoring is required. Permits are reviewed and updated on at least 5-year basis or as needed, based on new requirements. Additionally, the TMDL program can require additional treatment to meet water quality based conditions. The CWA has a citizen lawsuit provision which is an effective oversight provision for permitting. Studies are required as part of the permit process, including mixing zones surveys. Additional data and reports are available through ODEQ.	None	Number of staff is always a limitation. Funding is a blend of federal, state and fee support. Additional funding has recently been provided based on a Blue Ribbon Committee Report which recommended changes to fee structures and additional general funds.

Appendix Table 5. (continued). Program sufficiencies to address water temperature impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODEQ	TMDLs		TMDLs target bringing waters back into compliance with water quality standards. Oregon entered into a Consent Decree and Memorandum of Agreement with USEPA in 2000 under which it committed to substantially complete TMDLs statewide by 2010 (based on number of waters listed on the 1998 303(d) list). Most of the subbasins in Oregon are listed for temperature with TMDLs developed to address temperature issues for the entire subbasin. Therefore, most of the state should have TMDLs for temperature in the coming years. Implementation follows the TMDLs although there are many programs already in place in much of Oregon. Given that this program is fairly new and it will take years to decades to address degraded riparian conditions, there is limited documentation on the effectiveness of TMDL-related programs to address temperature. TMDL processes will be a condition of 401 hydroelectric certifications	Additional Staffing.	Staffing resources.
ODEQ	Water Quality Standards		Temperature Standards were recently updated (December 2003) and approved by the U.S. Environmental Protection Agency (March 2004). The numeric and narrative criteria, when achieved, should protect fish and other aquatic life in all life stages. Given that the criteria were adopted recently, programs that target achieving these criteria have been recently modified or developed, therefore field documentation of the effectiveness of the standard to protect fish is limited. Documentation will be developed as part of the TMDL process.	Additional staffing for this program (DEQ had a preliminary budget request in for the 2007 Legislature, but did receive the Governor's approval).	Number of staff

Appendix Table 5. (continued). Program sufficiencies to address water temperature impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODF	Fire Program		Resources are needed to assist forest landowners to reduce fuels that place forested watersheds at risk. Infrastructure is also needed to support resource enhancement opportunities through biomass conversion projects.	More coordinated efforts by all of Oregon's agencies and landowners to work collaboratively with federal partners to increase the contribution for recovery from federal forests.	Federal and private forest 'checker-board' ownership can place private forestlands at risk for uncharacteristic wildfire when either forest is not managed. There is a need for both ODF and ODF&W, and all landowners to play a role in the management of federal forests located in Oregon. A collaborative relationship between state natural resource agencies and federal forest management agencies may restore the health, diversity, and resilience of federal forests by increasing the information shared and by providing a variety of perspectives on site-specific and landscape level determinations. Wildfire-prone areas are identified in a community wildfire protection plans identifying priority areas for hazardous fuel removal from federal lands.

Appendix Table 5. (continued). Program sufficiencies to address water temperature impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODF	Oregon Forest Practices Act		Shade levels for streams on forestlands are consistently measured at high levels. A sufficiency analysis established that on a landscape level and for most streams the water quality standards are being met by the current rules. Areas of concern that were identified were limited and increments of temperature change that might result from the areas of concern are not of the magnitude to result in adverse stress or mortality. The relationships among temperature, sunlight, and fish productivity in some streams is being evaluated in several large research projects including an ODF riparian function study, the Hinkle Creek watershed study, and the Trask River watershed study. An adaptive management process will incorporate monitoring and research results into the Forest Practices Act. Documentation Links Final Oregon Coastal Coho Assessment: http://nrimp.dfw.state.or.us/OregonPlan Sufficiency Analysis: A Statewide Evaluation of Forest Practices Act Effectiveness in Protecting Water Quality, ODF and DEQ 2002. http://egov.oregon.gov/ODF/PRIVATE_FORESTS/docs/fp/AllSAv1031.pdf Stream Temperature Monitoring o FPMP Technical Report #2 (pdf), Cooperative Stream Temperature Monitoring: Project Completion Report For 1994 - 1995 (Small Type N Streams), Sept. 1999 o FPMP Technical Report #3 (pdf), Effectiveness of Riparian Management Areas and Hardwood Conversions in Maintaining Stream Temperature, March 1997 Shade Quality Study o FPMP Technical Report #13 (pdf) - Shade Conditions Over Forested Streams in the Blue Mtn and Coast Range Georegions of Oregon, August 2001 o Executive Summary (pdf)	Research and monitoring is currently under way to determine the linkages am	Funding for existing and planned research and monitoring projects is critical to understanding water temperature, riparian conditions, and stress and mortality of salmon and steelhead. These studies span multiple years of data collection and take a long-term commitment of funding and resources to provide feedback to inform policy decisions.

Appendix Table 5. (continued). Program sufficiencies to address water temperature impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODF	Private forestry component of the Oregon Plan for Salmon and Watersheds		The trend for water temperature is improving. Oregon Plan measures contribute to developing healthy riparian stand conditions that are presumed necessary for salmonids and water temperature, The Oregon Plan is designed to decrease the time to get to healthy conditions through active management. Where landowners choose not to participate in the Oregon Plan, standard Oregon Forest Practices RMA protections apply that develop healthy riparian conditions through passive management. Documentation Oregon Watershed Enhancement Board Watershed Restoration Inventory	Modifications should keep pace with best available science.	Funding for existing and planned monitoring projects is critical to understanding water temperature, riparian conditions, and stress and mortality of salmon and steelhead. These studies span multiple years of data collection and take a long term commitment of funding and resources to provide feedback to inform policy decisions. More resources would increase project accomplishment, education, and coordination.
ODF	State Forest Program		The program is built on a sound theoretical basis: The FMP provides for shade along fish-bearing streams. While this gives reason to believe that the FMP standards are effective, the degree of effectiveness has not yet been established because monitoring is not yet complete. Documentation Because program standards meet or exceed those under the FPA, the documentation listed to support the sufficiency of the FPA will also support the sufficiency of the State Forests Program. Future monitoring reports produced by the State Forests Program will likely document any additional benefits produced by FMP strategies.	The need for modification to the current program is uncertain, pending the results of monitoring.	None identified.
ODFW	Conservation Strategy for Oregon		The Oregon Conservation Strategy is a new voluntary program. As such, monitoring and evaluation will be necessary to determine the effectiveness of the program.	None at this time. The role of this new program as it pertains specfically to listed salmon and steelhead is still being defined.	Voluntary measures – no assurance that it will be implemented.
ODFW	Lands Resources Program		Uncertain of funding status or participation by public and private entities (i.e. Riparian Lands Tax Incentive Program).	Need further promotion of existing programs by I and E, Wildlife Division, and District staff.	Funding and staff time.
ODFW	Restoration and Enhancement Program		Funding for this program is through a surcharge imposed on all sport fishing licenses and commercial salmon fishing licenses and poundage fees. As such, funding is a subject to annual variations in fish abundance, harvest rates, and license sales.	None. The Program will evaluate their ability to shift resources to priorities that emerge from recovery planning. Further changes in program scope and focus would require legislative action.	Broad legal mandates of the program limit the ability of the program to focus solely on the needs of recovery planning, variable funding due to funding mechanism.
ODFW	Salmon Trout Enhancement Program		Current staffing and the broad scope of the program limits the capacity of the program to address any single program element.	Additional funding, additional FTE.	Funding.

Appendix Table 5. (continued). Program sufficiencies to address water temperature impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODFW	Watershed Council Liaison		Currently there are only two watershed council liaison positions in ODFW, both in the North Coast Watershed District. There are no positions for other regions of Oregon.	New positions.	Funding.
ODSL	Removal-Fill Program		DSL's removal-fill permits include conditions designed to protect water quality, including riparian vegetation removal restrictions and revegetation requirements. Not enough projects are monitored for compliance.	Modifications Needed: A greater number of projects need to be monitored for compliance. Additional, permanent compliance staff are needed.	The half-time Compliance Monitoring Specialist position is funded for three years and is subject to reauthorization each year of the three-year period. The status of the position is uncertain after that time.
OWEB	CREP Program		Limitation on recruiting private landowners for voluntary water quality restoration projects. Limitation to water quality restoration opportunities due to existing infrastructure. The limitation of CREP technical assistance has been demonstrated to be the single most important factor linked to enrollment.	Increased capital and non-capital funds	Funding
OWEB	Grant Program		Limitation on recruiting private landowners for voluntary water quality restoration projects. Limitation to water quality restoration opportunities due to existing infrastructure.	Increased capital and non-capital funds	Funding
OWRD	Enclosed Livestock Water Delivery Systems		When combined with riparian fencing programs, opportunities to protect and restore riparian communities, including filtering of fine sediments, while providing livestock watering capabilities are increased. There is currently no monitoring program in place to evaluate program effectiveness.	No modifications to program design are proposed. The program would benefit from expanded outreach and education.	The program is reliant on landowner interest. Construction and subsequent maintenance of fencing and off-channel watering devices require adequate financial resources.

Appendix 6. Program sufficiencies to address fish passage impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODF	Oregon Forest Practices Act		An improving trend for fish passage is clear. Past practices that constrained fish passage have been abandoned and passage will be systematically restored through the regulatory program at the time of normal structure replacement. Fish passage rules under the jurisdiction of the Department of Forestry were first established in 1973 and last modified in 1994. Prior to 1994, the design standard was for passage of adult fish upstream, without a clear requirement to maintain passage. Current rules require that all roads built since 1994 provide and maintain fish passage (adult and juvenile fish) and as culverts and other crossing structure on roads built prior to 1994 are replaced they will then be required to meet the current standards for fish passage. Landowners voluntarily increase the rate of restoring passage on roads built prior to 1994 as part of the Oregon plan. FPA monitoring shows high levels of fish passage are attained on new and replacement structures. Documentation Links Sufficiency Analysis: A Statewide Evaluation of Forest Practices Act Effectiveness in Protecting Water Quality, ODF and DEQ 2002. http://egov.oregon.gov/ODF/PRIVATE_FORESTS/docs/fp/AllSAv1031.pdf **FPMP Technical Report #14** (pdf) - Compliance With Fish Passage and Peak Flow Requirements at Stream Crossings - Final Study Results **FPMP Technical Report #6** (pdf) - 1998 Pilot Study Results Executive Summary - 1998 Pilot Study Results (pdf), March 2000 - brief overview of the Pilot Study Results	No modifications are currently needed.	Resources and collaboration remain constraining. Current resource needs include the resources necessary to implement Forestry Program for Oregon indicator monitoring for roads and fish passage and the resources necessary to conduct more Private Forests Program compliance and effectiveness monitoring.
ODF	Private forestry component of the Oregon Plan for Salmon and Watersheds		The trend for fish passage at road crossings is clearly improving. Landowners voluntarily increase the rate of restoring passage on roads built prior to 1994 as part of the Oregon plan. FPA monitoring shows high levels of fish passage are attained on new and replacement structures. OWEB reporting indicates high levels of work on forestlands. Reporting indicates many stream crossing structures built prior to 1994, while still functioning as crossing structure, are being replaced on forestland ahead of the normal replacement schedule. This is done to restore fish passage. The number and potential impacts of existing fish barriers and blocked habitat remain unknown, however, most landowners have inventoried and prioritized barriers based upon some type of restoration schedule. Documentation Oregon Watershed Enhancement Board Watershed Restoration Inventory	Oregon Plan Measures for Private Forestlands are in the process of being updated. Changes reflect that many landowners have shifted emphasis from a 'voluntary' approach and now include legacy road work in routine road & stream crossing maintenance plans.	More resources would increase project accomplishment, education, coordination, and monitoring. For some landowners, the OWEB grant cycle is a disincentive when road work is done on an opportunistic basis. While high levels of investment in this program exist, there has been little monitoring of effectivenss.

Appendix 6. Program sufficiencies to address fish passage impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODF	State Forest Program		FPA monitoring shows high levels of fish passage are attained on new and replacement structures. Monitoring results and on-the-ground consultation with ODF stewardship foresters and ODFW habitat biologists results in a high level of success. Additionally, the state forests program provides monitoring to ensure that fish passage meets the program's performance measures. Documentation Because program standards meet or exceed those under the FPA, the documentation listed to support the sufficiency of the FPA will also support the sufficiency of the State Forests Program. Future monitoring reports produced by the State Forests Program will likely document any additional benefits produced by FMP strategies	No modifications are currently needed.	New road construction and reconstruction projects are completed to current fish passage standards. Limited funding exists for passage improvement projects not associated with timber harvest. Highest priority projects are completed first, with lower priority projects being completed as funds become available. Some districts work closely with watershed councils to attain funding for non-timber related passage improvement projects.

Appendix Table 6. (continued). Program sufficiencies to address fish passage impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODFW	Conservation Strategy for Oregon		The Oregon Conservation Strategy is a new voluntary program. As such, monitoring and evaluation will be necessary to determine the effectiveness of the program.	None at this time. The role of this new program as it pertains specifically to listed salmon and steelhead is still being defined.	Voluntary measures – no assurance that it will be implemented
ODFW	Fish Passage Program		Compliance by owners or operators is obligatory, but approval is distributed, reporting mechanisms are not in place, and compliance rates are unknown; availability of funds to implement program.	Funding for staff to perform regulatory and outreach role.	None identified.

Appendix Table 6. (continued). Program sufficiencies to address fish passage impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODFW	Fish Screening and Passage Grant Program		Actions dependent on voluntary participation in the program; availability of funds to implement projects.	Funding for outreach.	None identified.
ODFW	Lands Resources Program		Uncertain of funding status or participation by public and private entities (i.e. Riparian Lands Tax Incentive Program).	Need further promotion of existing programs by I and E, Wildlife Division, and District staff.	Funding and staff time.
ODFW	Restoration and Enhancement Program		Funding for this program is through a surcharge imposed on all sport fishing licenses and commercial salmon fishing licenses and poundage fees. As such, funding is a subject to annual variations in fish abundance, harvest rates, and license sales.	None. The Program will evaluate their ability to shift resources to priorities that emerge from recovery planning. Further changes in program scope and focus would require legislative action.	Broad legal mandates of the program limit the ability of the program to focus solely on the needs of recovery planning, variable funding due to funding mechanism.
ODFW	Salmon Trout Enhancement Program		Current staffing and the broad scope of the program limits the capacity of the program to address any single program element.	Additional funding, additional FTE.	Funding.
ODFW	Watershed Council Liaison		Currently there are only two watershed council liaison positions in ODFW, both in the North Coast Watershed District. There are no positions for other regions of Oregon.	New positions.	Funding.
ODLCD	Statewide Comprehensive Land Use Planning		The land use actions taken by local governments can supplement and support other specific restoration activities but are not sufficient in themselves to achieve restoration. Local land use actions will likely not remediate legacy conditions or significantly alter current practices, but will affect future development.	None. The statewide land use program is not intended to be sufficient to recover salmon.	Technical and planning assistance to local governments would be highly beneficial in enlisting local planning efforts in salmon recovery.

Appendix Table 6. (continued). Program sufficiencies to address fish passage impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODOT	Salmon-Fish Passage Program		ODOT's Salmon-Fish Passage Program provides adequate technical and institutional capacity to implement the program within its jurisdictional area. The program selects, designs, constructs, monitors, and documents fish passage improvement projects. The program is held in high regards and is effective for improving fish passage at known fish passage impediments; however, it lacks budgetary capacity and a clear timeline for full implementation. Currently, the ODFW statewide artificial obstruction inventory (Inventory) identifies a total of 770 priority structures owned and managed by ODOT that do not provide adequate fish passage (255 or 33%=High Priority, 167 or 22%= Medium Priority, 348 45%=Low Priority for repair). From 1997 to 2006 the ODOT program repaired 109 high priority fish passage culverts (35 high priority culverts with replacements and 74 high priority culverts with retrofits) or 42% of the ODOT managed statewide high priority culvert inventory total. ODOT high priority culvert repairs have made 370 miles of stream habitat accessible to native migratory fish. Post construction effectiveness monitoring and documentation to satisfy federal and state regulatory agencies are complete for these projects. To date, 146 high priority culverts owned and managed by ODOT continue to need repairs. We anticipate the list will grow as more culverts are inventoried. At the current rate of ~4 culvert projects repaired each year it will take approximately 36 years to repair or replace the remaining balance of high priority culverts. Similarly, there are an additional 515 (67% of the statewide total) medium and low priority culverts that will need repairs once the high priority culvert list is complete. Using the projected rate of numbers of projects completed annually (n=4) it will take significantly longer to repair the medium and low priority culverts. At the current funding and repair rate, it will take decades (over 100 years) to make the appropriate repairs to all ODOT owned and managed culverts (n=661) that currently do not provide adequate fish passage.	ODOT is working to repair as many high priority fish passage culverts as program funds will allow. Additional funding for project development and construction is necessary to decrease the timeframe this program can repair the remaining high priority culverts owned and managed by ODOT. Another key program management tool that continues to be lacking is an updated and prioritized comprehensive artificial obstruction inventory. The current Inventory is not adequate for managers to make informed planning decisions for future investments of limited fish passage funds. The Inventory aggregates artificial obstructions into three priority categories: (high, medium, and low) and some culverts known to impede fish passage are not included in the Inventory. There is no systematic standardized method or protocol for the aggregation of these culverts into the three priority categories. It would be beneficial if high priority culverts were re-evaluated and re-ranked numerically either statewide and/or basin-wide. A numeric ordering of the high priority culverts will allow ODOT and other owners and operators of substandard culvert facilities to make more informed project selection decisions based on statewide or basin-wide priorities. A comprehensive artificial obstruction inventory and robust prioritization of know fish passage impediments will provide ODOT and other owners the management tools necessary to make informed planning decisions that are consistent with salmon recovery goals.	In addition to the limitations associated with this program's budget, project development and construction costs continue to escalate. During FY 2006, construction costs increased approximately 10% due to increased costs associated with engineering design, construction materials, fuel, contractor supervision and management, etc. These increased costs continue to burden the program and result in fewer fish passage projects constructed in a given year.

Appendix Table 6. (continued). Program sufficiencies to address fish passage impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODSL	Removal-Fill Program		DSL's removal-fill permitting process requires that permitted projects maintain or restore fish passage, and encourages removal or replacement of road crossings and other passage impediments. At current staffing levels, DSL does not always have the resources to do the outreach necessary to encourage landowners to remove or replace fish passage impediments. In addition, very few projects are monitored for compliance.	Additional funding would increase the effectiveness of the program. A greater number of projects need to be monitored for compliance. Additional, permanent compliance staff are needed.	The half-time Compliance Monitoring Specialist position is funded for three years and is subject to reauthorization each year of the three -year period. The status of the position is uncertain after that time.
OWEB	Grant Program		The primary limitation to effectively addressing fish passage barriers has been lack of complete information on the nature and location of barriers in relation to productive fish habitat. OWEB has funded data gathering on a watershed scale and used information to prioritize barriers for removal. Where this information is available grants have been available to remedy high priority barriers.	Increased capital and non-capital funds	Funding

Appendix Table 7. Program sufficiencies to address instream flow impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODEQ	Non-Point Source Program		The program relies on existing state and local authorities to address non point sources of pollution. Programs to address nonpoint sources, especially in urban and agricultural areas, are relatively recent and additional time and trend monitoring is needed to document results. Additionally, while a schedule for implementation is to be identified, timing of implementation is often dependent on adequate future funding which often is not guaranteed or certain.	Adequate monitoring program needed; see other programs listed in this document for modifications needed as it relies on other existing state and local authorities for implementation. See other programs listed in this document for Modifications Needed.	See other programs listed in this document for constraints as it relies on other existing state and local authorities for implementation.
OWEB	Grant Program		Limitation on willing participation and effective grant process for purchase of water rights	Increased capital and non-capital funds	Funding

Appendix Table 7. Program sufficiencies to address instream flow impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
OWRD	Administration of Water Rights		Program design for the review of new permits is sufficient to consider needs of listed fish species. OAR Chapter 690 Division 33 lays out public interest standards for new appropriations including surface waters and hydraulically connected groundwater with the potential for substantial interference (OAR 690-009-040). Included in Division 33 are interagency consultations to determine consistency of proposed applications with the Columbia River Basin Fish and Wildlife Program. Consultation occurs with NPPC, ODFW, USFWS, NMFS, Indian tribes and appropriate local governments. Permits that cannot be conditioned to achieve consistence are presumed to impair or be detrimental to the public interest. Ongoing implementation of these OARs includes completion of documentation for each new applicant. Surface water availability is modeled for each month and evaluated at the 80% exceedance level. This information is available through the OWRD on line interactive mapping program: http://map.wrd.state.or.us/apps/wr_mapping/.	Provide flow data to support the evaluation of flows and their sufficiency during critical periods, and the adaptive management process to help assure the review and consultation process for new permits remains sufficiently protective.	Funding to support monitoring capabilities has been unstable and declining. Funding for the 2007-2009 biennium will improve statewide monitoring capabilities.
OWRD	Flow Restoration Programs		These programs are voluntary in nature. Instream leases are limited to a five year period, but leases may be renewed indefinitely. Transfers may be temporary or permanent. Allocations of conserved water are permanent. Participation in Voluntary Flow Restoration programs continues to grow. Based on the best available data, over 287 cfs have been permanently restored and 580 cfs temporarily restored instream as of 12/31/2006. Benefits realized will vary by participation levels, season, stream reach, region, and by the duration of the lease or transfer. Although the benefits of incremental improvements to flow at various times and on various life stages of listed species may not be certain, OWRD encourages incremental improvements to flow through these voluntary programs. Voluntary flow restoration programs include temporary instream leases, permanent allocations of conserved water and temporary or permanent transfers. Performance is currently available through measures tracked annually (KPM#1). Performance measures are posted online through: http://www.wrd.state.or.us/OWRD/LAW/performance.shtml Performance is tied to flows restored in key watersheds. Key watersheds, or priority water availability basin, can be found through the online interactive mapper. The performance measure is tracked by Oregon fiscal year. Graphical representation of restored flows for 2006 is available through: http://www.wrd.state.or.us/OWRD/mgmt_flow_restoration.shtml. This representation shows a positive trend in participation as outreach continues and awareness of the program grows. Accessibility of these data via the OWRD website provides documentation of program success, tools to assist willing water right holders identify needs as they relate to key watersheds and flow restoration, and will provide data important to monitoring and adaptive management.	These programs would benefit from increased education and outreach to increase participation levels, and from coordinated follow-up to encourage re-enrollment where possible. Provide available flow restoration data to support the evaluation of flows and their sufficiency during critical periods and the adaptive management process. In September 2006, funding was awarded through the National Fish and Wildlife's Columbia Transactions Program to migrate instream leasing, transfer and allocations of conserved water data to OWRD's online Water Rights Information System (WRIS). Access through this OWRD website will provide critical data for evaluating current flow restoration activities and supporting adaptive management.	Programs are constrained by limited funding and resources for outreach and education, lease/transfer follow-up and re-enrollment, and accessibility of lease/transfer data to support monitoring and evaluation of flow restoration efforts and their impacts on listed species.

Appendix Table 7 (continued). Program sufficiencies to address instream flow impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
OWRD	Lease/Transfer Water Rights Associated with CREP Program		This program works in conjunction with CREP to benefit both the restoration of riparian function and minimum flows as lands are enrolled and associated water rights are returned instream. Participation in the CREP program and instream leasing or transfer of associated water rights are voluntary. Water rights that are not leased or transferred instream may be used consistent within the terms and conditions of the water right, which may, depending on the nature of the water right, reduce potential benefits to minimum flows and riparian function.	Outreach and education programs could be improved through increased resources and greater coordination. Provide available flow restoration data to support monitoring, evaluation and the adaptive management process.	The program is dependent upon private landowner awareness of the program and voluntary participation levels. Outreach and education are constrained by available resources.
OWRD	Water Distribution and Regulation		Instream water rights do not guarantee minimum flows. Rather, they establish a quantity of water for instream beneficial use, regulated by priority date. Many instream water rights have priority dates that are junior to other water rights, reducing opportunities to regulate on their behalf. The resulting impacts to instream flows may vary by stream reach, season and priority date of the instream right. Voluntary compliance with water rights and regulations was approximately 96% statewide in 2005. However, there are over 80,000 surface water rights in Oregon. Efforts to monitor streamflow and protect instream water rights are limited by staff resources and monitoring capabilities.	Increased monitoring capabilities will support water distribution and regulation activities on behalf of water rights, including instream water rights. These additional data may also support evaluation of incremental changes to flow and the sufficiency of those flows during critical periods	Funding for staff and monitoring capabilities has been unstable and declining. The 2007-2009 budget provides funding to add monitoring and distribution capacity. The junior status of some instream water rights may limit their flow benefit in some areas. In these instances, voluntary restoration measures are key to achieving recovery goals as they relate to flow.

Appendix Table 7 (continued). Program sufficiencies to address instream flow impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
OWRD	Water Supply and Conservation Planning		Water Management and Conservation Plans are not designed to directly address flow needs for listed fish species. However, stream flows may benefit from implementation of these plans and identified conservation measures. Plan implementation may delay the need for increased municipal diversions. Stream flows may improve through implementation of agricultural plans. OWRD encourages instream protection for all or a portion of increases to stream flow brought by implementation of agricultural plans. Voluntary enrollment in the Allocation of Conserved Water Program includes incentives for agricultural water suppliers and opportunities to restore instream flows and regulate on their behalf. Potential improvements to flow are dependent upon participation and full implementation of plans. There is currently no OWRD monitoring program in place to evaluate the effectiveness of these programs. While stream flows may benefit, for the recovery of listed species, this and other plans are best considered in aggregate. Considered in aggregate, the sufficiency of some programs may change.	The Agricultural Water Management and Conservation Plan program would benefit from expanded outreach and education. OWRD is currently developing a guidebook to assist agricultural water suppliers to prepare plans that meet Oregon and Federal requirements. This guidebook will help agricultural water suppliers describe their water systems and needs, identify their sources of water, and identify ways to manage and conserve those supplies to meet present and future needs. OWRD has also received funding for the majority of requested elements of a statewide Water Supply and Conservation Initiative. This initiative will strive to address statewide water supply needs through a statewide water needs assessment, inventory of potential above and below ground water storage sites, analyses of water conservation opportunities, investigation of basin yield estimates, and match funding for community-based and regional water supply planning.	Water supply and conservation planning is constrained by limited funding and resources for outreach, education, and program development. The 2007-2009 agency budget includes the majority of funding requested for the Water Supply and Conservation Initiative.
OWRD	Water Use Measurement Strategy		Measurement of water use does not directly protect flows, but may support the evaluation of needed flows. On a statewide scale, the Water Use Measurement and Reporting position was eliminated during the last biennium and has been restored for the 2007-2009 biennium. This position is responsible for database maintenance, maintenance of on-line reporting processes and helping to assure compliance with permit reporting conditions. Efforts to promote voluntary actions may be deterred by the cost associated with installation and maintenance of measuring equipment. A cost-share program to promote voluntary water use measurement and reporting is in place, but not currently funded. Ongoing implementation of the significant diversion program is constrained by staffing levels.	No modifications to the design of this program are suggested. Restoration of the Water Use Measurement and Reporting position and funding for the existing cost-share program for voluntary water use measurement and reporting will improve ongoing implementation of the water use measurement strategy. Restoration of county-based Assistant Watermasters would further aid this strategy.	Ongoing implementation of the water use measurement strategy is constrained by available resources and staff.

Appendix Table 8. Program sufficiencies to address agriculture and forestry chemical impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODA	Agricultural Water Quality Management (SB 1010)		Basin plans and rules are reviewed biennially to determine whether the plan is sufficient to meet and address water quality standards, and modified as necessary to meet deficiencies and new requirements or information. Reviews include review of compliance actions, outreach activities, projects, and monitoring results. ODA focuses efforts and resources on areas of highest priority and program is enforced. "Compliance" is based on inspections prompted by "notification" of inappropriate occurrences; increasing complaints and notifications reflect an increased public awareness and greater number of basin rules in place. Water quality monitoring is conducted by DEQ at permanent sites. Aerial photography at 4-5 yr intervals documents riparian condition trends.	Biennial reviews will determine if modifications are needed. Given more resources (funding) implementation of on-the-ground actions, including monitoring, would be accelerated. More monitoring would provide improved documentation of program adequacy.	Landowner cooperation, capacity for outreach, changing land ownerships and new landowners knowledge of agricultural issues, perception that this is only a complaint driven process, technical assistance, adequate monitoring at meaningful scales
ODA	Pesticides		ODA is the EPA designated agency to enforce FIFRA in Oregon. This program operates under an MOA with EPA and is consistent with FIFRA requirements. There are several layers of controls to maintain responsible use of pesticides by the agricultural industry.	None, meets federal requirements	capacity for outreach
ODEQ	TMDLs		TMDLs set targets to bring waters back into compliance with water quality standards. TMDLs can address those pesticides which have numeric standards established and can address excess nutrients which can cause other water quality standard exceedences (e.g. pH, dissolved oxygen). However, very few agricultural chemicals (such as pesticides that are currently in use) have numeric water quality standards established for them and would be addressed under this program only if they exceeded a narrative standard (e.g. introducing substances in levels that are harmful to aquatic life or bioaccumulate to levels that adversely affect public health or wildlife). Additionally, the cost for monitoring many of these chemicals is high so they are not routinely monitored, unless a problem is suspected. Given the limitation in monitoring for these chemicals and in having standards established to determine impact on beneficial uses, it is uncertain if the TMDL is adequate to address the universe of Agricultural Chemicals which could cause water quality problems. That is why, since 1999, ODEQ has been using a voluntary, collaborative approach called Pesticide Stewardship Partnerships (PSPs) to identify problems and improve water quality associated with pesticide use at the local level. The PSP approach uses local expertise in combination with water quality sampling and toxicology expertise of ODEQ to encourage and support voluntary changes that cause measurable environmental improvements.	Additional staffing for this program or for an alternative program, such as the Pesticide Stewardship Partnership, to address this issue (DEQ has a budget request in for the 2007 Legislature to develop a toxics monitoring program).	Sufficient resources for monitoring to identify chemicals of concern (see Water Quality Monitoring) and for developing water quality standards to identify levels that affect beneficial uses.

Appendix Table 8. (continued). Program sufficiencies to address agriculture and forestry chemical impacts

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODEQ	TMDLs		TMDLs set targets to bring waters back into compliance with water quality standards. TMDLs can address those pesticides which have numeric standards established and can address excess nutrients which can cause other water quality standard exceedences (e.g. pH, dissolved oxygen). However, very few agricultural chemicals (such as pesticides that are currently in use) have numeric water quality standards established for them and would be addressed under this program only if they exceeded a narrative standard (e.g. introducing substances in levels that are harmful to aquatic life or bioaccumulate to levels that adversely affect public health or wildlife). Additionally, the cost for monitoring many of these chemicals is high so they are not routinely monitored, unless a problem is suspected. Given the limitation in monitoring for these chemicals and in having standards established to determine impact on beneficial uses, it is uncertain if the TMDL is adequate to address the universe of Agricultural Chemicals which could cause water quality problems. That is why, since 1999, ODEQ has been using a voluntary, collaborative approach called Pesticide Stewardship Partnerships (PSPs) to identify problems and improve water quality associated with pesticide use at the local level. The PSP approach uses local expertise in combination with water quality sampling and toxicology expertise of ODEQ to encourage and support voluntary changes that cause measurable environmental improvements.	Additional staffing for this program or for an alternative program, such as the Pesticide Stewardship Partnership, to address this issue (DEQ has a budget request in for the 2007 Legislature to develop a toxics monitoring program).	Sufficient resources for monitoring to identify chemicals of concern (see Water Quality Monitoring) and for developing water quality standards to identify levels that affect beneficial uses.
ODF	Oregon Forest Practices Act		The rules include specific best management practices (BMPs) in addition to label requirements. Spill risks are addressed and reporting of spills is required. ODF Monitoring has shown that the BMPs protect water quality from drift impacts and otherwise protect riparian vegetation. Documented adverse impacts to salmonids from forestland chemical use are not known. Documentation Links Sufficiency Analysis: A Statewide Evaluation of Forest Practices Act Effectiveness in Protecting Water Quality, ODF and DEQ 2002. http://egov.oregon.gov/ODF/PRIVATE_FORESTS/docs/fp/AllSAv1031.pdf Chemicals/Pesticides **FPMP Technical Report #7** (pdf) - Aerial Pesticide Application Monitoring Final Report, March 2000 • Executive Summary (pdf) - shortened version of the Final Report • Eugene Water and Electric Board, Karl Morgenstern. May 2007. Case Study: Hydrologic Impacts of Forest Management on Municipal Water Supplies	None identified.	Lack of monitoring data related to post application runoff. Lack of funding and cooperation for monitoring across land uses.

Appendix 9. Program sufficiencies to address animal waste impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODA	Confined Animal Feeding Operation (CAFO)		This program limits/controls nutrient impacts on water quality for both surface and ground water. It is consistent with the federal Clean Water Act requirements for CAFOs. An Application to Register is a new requirement to meet the new federal and state requirements for permitting and concentrated animal feeding operations. A continued goal of the CAFO program is to inspect each permitted CAFO once per year. ODA also reviews, approves or rejects, Animal Waste Management Plans and specifications for animal waste control facilities to verify they have been prepared in accordance with OAR 340-051 design criteria, and USDA-NRCS conservation practice standard guidance 590 for Oregon. As a result of this increased effort, ODA has seen overall improvement in compliance on permitted operations.	None exceeds federal requirements.	Economic conditions impede the ability of operators to be more proactive in addressing fish habitat needs
ODEQ	TMDLs		TMDLs set targets to bring waters back into compliance with water quality standards, most typically targets for bacteria and nutrients that would address concerns from animal wastes. These targets include load allocations for sectors such as agriculture, forestry and urban land uses with animal wastes typically being of concern in agricultural and urban land uses. The agricultural sector has programs that address a portion of animal wastes from Confined Animal Feeding Operations (CAFO) and smaller live stock facilities through the CAFO and Agricultural Water Quality Management Plans respectively. However, programs in urban areas to address pet wastes or other sources of animal wastes (birds, etc) that get into streams via storm water runoff are relatively new, in development in many areas (especially the larger cities) or do not exist (especially in smaller cities). There is limited monitoring of the effectiveness of these programs, therefore it is uncertain if TMDLs will be adequate to address animal wastes.	None at this time.	Sufficient resources for monitoring and time to determine if programs to address storm water and agricultural water quality management are sufficient.

Appendix 10. Program sufficiencies to address human, urban, or industrial waste impacts.

Agency	Program	Sufficiency	Rationale	Modifications Needed	Constraints
ODEQ	Environmental Clean Ups		Clean up/remediation of sites addressed under this program occurs until DEQ determines that they pose no significant threat to human health or the environment and therefore require no further action. Monitoring is required to document the effectiveness of the Clean Up activity. Cleanups require documentation to assess "no further action" needed.	None	Need for a sustainable programs that matches revenues and expenses.
ODEQ	Point Source Permits		Permits are written to meet water quality standards, sources not in compliance have to come into compliance within the permit cycle (typically, 5 years). Compliance monitoring is required. Permits are reviewed and updated on at least 5-year basis or as needed, based on new requirements. Additionally, the TMDL program can require additional treatment to meet water quality based conditions. The Clean Water Act provides for citizen lawsuit as an oversight provision.	None	Number of staff is always a limitation. Funding is a blend of federal, state and fee support. Additional funding has recently been provided based on a Blue Ribbon Committee Report which recommended changes to fee structures and additional general funds.
ODEQ	TMDLs		TMDLs set targets to bring waters back into compliance with water quality standards. These targets include waste load allocations for industrial and municipal point sources and load allocation for sector specific (forestry, agricultural and urban) non-point sources of pollution. Typically municipal and industrial waste sources that discharge to waters are regulated under a permit program. Additional requirements can be established based on the TMDLs. The TMDL program is relatively new (TMDLs in Oregon have been established since the late 1980's but work is underway to develop them statewide) and has focused on a limited number of parameters (temperature, bacteria, nutrients, solids and selected toxics). It is likely that TMDLs are effective at addressing these waste sources but further documentation of the program effectiveness is needed. Also, as additional toxic pollutants are monitored and problems are identified, TMDLs or other similar types of programs will need be developed. Documentation is developed as part of the TMDL process which is often a part of the 401 certification.	None at this time	Sufficient resources for monitoring and developing TMDLs and time to determine if programs is being made.

Appendix 11. URLs of documents that further describe statewide management programs evaluated in this report.

Agency	Program	Supporting Documents - 1	Supporting Documents - 2	Supporting Documents -3
ODA	Agricultural Water Quality Management (SB 1010)	http://www.oregon.gov/ODA/NRD/water_quality_front.shtml		
ODA	Confined Animal Feeding Operation (CAFO)	http://www.oregon.gov/ODA/NRD/cafo_front.shtml		
ODA	Pesticides	http://www.oregon.gov/ODA/PEST/index.shtml		
ODA	Soil and Water Conservation Districts	http://www.oregon.gov/ODA/SWCD/index.shtml		
ODA	Weed Control and Invasive Species	http://www.oregon.gov/ODA/PLANT/index.shtml		
ODEQ	401 Dredge & Fill Certifications	http://www.deq.state.or.us/wq/401Cert/401CertHome.htm		
ODEQ	401 Hydroelectric Recertification	http://www.deq.state.or.us/wq/401Cert/401CertHome.htm		
ODEQ	Environmental Clean Ups	http://www.deq.state.or.us/lq/cu/		
ODEQ	Non-Point Source Program	http://www.deq.state.or.us/wq/nonpoint/nonpoint.htm	http://www.deq.state.or.us/wq/loans/srfloans.htm	
ODEQ	Point Source Permits	http://www.deq.state.or.us/wq/wqpermit/stminfo.htm		
ODEQ	Storm Water Permits	http://www.deq.state.or.us/wq/stormwater/swphome.htm		
ODEQ	TMDLs	http://www.deq.state.or.us/WQ/TMDLs/TMDLs.htm	http://www.deq.state.or.us/wq/pubs/factsheets/community/pesticide.pdf	
ODEQ	Water Quality Standards	http://www.deq.state.or.us/wq/standards/wqstdshome.htm		
ODF	Fire Program	http://www.odf.state.or.us/pcf/fp/fpa.asp?id=401010207		
ODF	Oregon Forest Practices Act	http://www.odf.state.or.us/pcf/fp/fpa.asp?id=401010207		
ODF	Private forestry component of the Oregon Plan for Salmon and Watersheds	http://www.oregon-plan.org/OPSW/cohoproject/PDFs/8-4-06.ODF.Coho.Plan.actions.pdf		
ODF	State Forest Program	http://www.odf.state.or.us/pcf/fp/fpa.asp?id=401010207	http://egov.oregon.gov/ODF/STATE_FORESTS/nwfmp.shtml	http://egov.oregon.gov/ODF/STATE_FORESTS/Roads_Manual.shtml
ODFW	Conservation Strategy for Oregon	http://www.dfw.state.or.us/conservationstrategy/		
ODFW	Fish Passage Program	www.dfw.state.or.us/fish/passage/		

Agency	Program	Supporting Documents - 1	Supporting Documents - 2	Supporting Documents -3
ODFW	Fish Screening and Passage Grant Program	www.dfw.state.or.us/ODFWhtml/InfoCntrFish/screen_passage_grants.htm		
ODFW	Lands Resources Program	http://www.dfw.state.or.us/lands/		
ODFW	Restoration and Enhancement Program	http://www.dfw.state.or.us/fish/RE/		
ODFW	Salmon Trout Enhancement Program	http://www.dfw.state.or.us/STEP/		
ODSL	Removal-Fill Program	http://www.oregon.gov/DSL/PERMITS/r-fintro.shtml		
ODSL	Voluntary Restoration Initiative	http://www.oregonstatelands.us/DSL/WETLAND/wetland_restoration.shtml		
OWEB	CREP Program	Oregon Watershed Enhancement Board		
OWEB	Grant Program	Oregon Watershed Enhancement Board		
OWRD	Administration of Water Rights	http://www.wrd.state.or.us/OWRD/PUBS/aquabook_newrights.shtml	http://www1.wrd.state.or.us/pdfs/reports/SW02-002.pdf	
OWRD	Flow Restoration Programs	http://www.wrd.state.or.us/OWRD/mgmt_opsw.shtml	http://www.wrd.state.or.us/OWRD/mgmt.shtml	http://www.oregon.gov/OWRD/mgmt.shtml-Water_Conservation
OWRD	Lease/Transfer Water Rights Associated with CREP Program	http://www.oregon.gov/OWRD/mgmt_leases.shtml	http://www1.wrd.state.or.us/pdfs/CREP_letter.pdf	
OWRD	Water Distribution and Regulation	http://www.wrd.state.or.us/OWRD/mgmt.shtml	http://www.wrd.state.or.us/OWRD/PUBS/aquabook_enforcing.shtml	
OWRD	Water Supply and Conservation Planning	http://www.wrd.state.or.us/OWRD/mgmt.shtml		
OWRD	Water Use Measurement Strategy	http://www.wrd.state.or.us/OWRD/WR/water_use_report.shtml		

Appendix G

Culverts which Need to be Improved or Replaced Within Oregon Mid-C Steelhead Populations

Number and location of culverts which need to be improved or replaced within steelhead populations in Fifteenmile Creek and the Deschutes River Basin. This is an incomplete list as comprehensive culvert inventories have not been conducted.

Fifteenmile Creek Total Culverts = 6				
5th Field HUC	Stream	Ownership	Number of Culverts	Priority
	Ramsey Cr (FS 4450 Rd)	USFS	1	H
	Fifteenmile Cr (FS 44 Rd)	USFS	1	H
	Threemile (Hwys I-84 & 197)	ODOT	2	M
	Chenowith Cr (Bridge at Hwy 30)	ODOT	1	M
	NF Mill Cr (RM 6.0)	Wasco Co	1	U
Deschutes River Eastside Total Culverts = 2				
5th Field HUC	Stream	Ownership	Number of Culverts	Priority
	Mud Springs Cr (RR culvert in Sec. 15 above Gateway)	Jefferson City	1	H
	Hay Cr (new channel near mouth)	Private	1	H
Deschutes River Westside Total Culverts = TBD				
5th Field HUC	Stream	Ownership	Number of Culverts	Priority
	Warm Springs River		TBD	H
	Beaver Cr		TBD	H
	Shitike Cr		TBD	H
	Oak Cr		TBD	
	Metolius River		TBD	

Number and location of culverts which need to be improved or replaced within steelhead populations in the John Day Basin.

Lower Mainstem John Day River Total Culverts = 84				
5th Field HUC	Stream	Ownership	Number of Culverts	Priority
Bridge Cr	Bridge Cr	Wheeler	1	H
Bridge Cr	Carroll Cr	Wheeler	1	L
Bridge Cr	Keyes Cr	Wheeler	1	L
Bridge Cr	Mud Cr	Wheeler	1	L
Bridge Cr	Myers Cyn	Wheeler	1	L
Bridge Cr	O'Kelly Cr	Wheeler	1	L
Bridge Cr	Un Cr	ODOT	2	L
Bridge Cr	Un Cr	Wheeler	1	L
Bridge Cr	West Br	Wheeler	1	L
Bridge Cr	West Br	Wheeler	1	M
Butte Cr	Butte Cr	ODOT	1	M
Butte Cr	Butte Cr	Wheeler	3	M
Butte Cr	Cottonwood Cr	ODOT	1	M
Grass Valley Cyn	Demoss Cyn	ODOT	1	L
Grass Valley Cyn	Grass Valley Cyn	Sherman	4	L
Lower JDR Kahler Cr	Alder Cr	Wheeler	3	M
Lower JDR Kahler Cr	Button Hollow	Wheeler	1	L
Lower JDR Kahler Cr	Horseshoe Cr	Wheeler	1	L
Lower JDR Kahler Cr	Indian Hollow	Wheeler	1	L
Lower JDR Kahler Cr	Kahler Cr	Wheeler	1	L
Lower JDR Kahler Cr	Parrish Cr	Wheeler	1	L
Lower JDR Kahler Cr	Parrish Cr	Wheeler	1	M
Lower JDR Kahler Cr	Un Cr	Wheeler	1	L
Lower JDR Muddy Cr	Current Cr	WASC	1	L
Lower JDR Muddy Cr	Cove Cr	ODOT	1	L
Lower JDR Muddy Cr	Indian Cyn	ODOT	1	L
Lower JDR Muddy Cr	John Day Gl	Wheeler	1	L
Lower JDR Muddy Cr	Lone Pine Cr	Wheeler	1	L
Lower JDR Muddy Cr	Pine Cr	Wheeler	1	L
Lower JDR Muddy Cr	Un Cr	ODOT	2	L
Lower JDR Service Cr	Dry Gulch	ODOT	1	L
Lower JDR Service Cr	Dry Hollow	Wheeler	1	L
Lower JDR Service Cr	Girds Cr	ODOT	3	L
Lower JDR Service Cr	Girds Cr	Wheeler	2	L
Lower JDR Service Cr	Little Service Cr	ODOT	1	L
Lower JDR Service Cr	Rowe Cr	Wheeler	3	L
Lower JDR Service Cr	Rowe Cr	Wheeler	2	M
Rock Cr	Birch Cr	Wheeler	1	L
Rock Cr	Fred Cr	Wheeler	1	L
Rock Cr	Juniper Gulch	ODOT	1	L
Rock Cr	Pine Hollow	Wheeler	1	M
Rock Cr	Rock Cr	ODOT	1	L
Rock Cr	Un Cr	Wheeler	1	L
Thirtymile Cr	Thirtymile Cr	Wheeler	4	M
Lower JDR Kahler Cr	East Bologna Cr	USDA-FS	1	H
5th Field HUC	Stream	Ownership	Number of Culverts	Priority

Lower JDR Kahler Cr	East Bologna trib	USDA-FS	1	H
Lower JDR Kahler Cr	Davis Cr	USDA-FS	3	H
Lower JDR Kahler Cr	Henry Cr	USDA-FS	1	H
Lower JDR Kahler Cr	Henry Cr trib	USDA-FS	1	H
Lower JDR Kahler Cr	Burnt Cabin Cr	USDA-FS	2	H
Lower JDR Kahler Cr	Tamarack Cr	USDA-FS	2	H
Lower JDR Kahler Cr	Tamarack Cr trib	USDA-FS	1	H
Lower JDR Kahler Cr	Alder Cr	USDA-FS	1	H
Lower JDR Kahler Cr	Alder Cr trib	USDA-FS	4	H
Lower JDR Kahler Cr	Wheeler Cr	USDA-FS	2	H
Rock Cr	Stahl Cyn	USDA-FS	2	H
Rock Cr	Wineland Cr	USDA-FS	1	H

North Fork John Day River
Total Culverts = 200

5th Field HUC	Stream	Ownership	Number of Culverts	Priority
Lower Camas Cr	Wilkins Cr	ODOT	1	M
Lower NF JDR	Deer Cr	Grant	1	L
NF JDR Potamus Cr	W Fk	ODOT	2	M
Upper NFJD	Davis Cr	USDA-FS	2	H
Upper NFJD	Trout Cr trib	USDA-FS	2	H
Upper NFJD	Crane Cr	USDA-FS	1	H
Granite Cr	Ten Cent Cr	USDA-FS	1	H
Granite Cr	W Ten Cent Cr	USDA-FS	2	H
Granite Cr	Lightning Cr	USDA-FS	1	H
Granite Cr	Lake Cr	USDA-FS	2	H
Granite Cr	Rabbit Cr trib	USDA-FS	1	H
Granite Cr	Lost Cr	USDA-FS	1	H
Granite Cr	Granite Cr	USDA-FS	1	H
Big Cr	Winom Cr	USDA-FS	1	H
Big Cr	Meadow Cr trib	USDA-FS	3	H
Big Cr	Squaw Cr	USDA-FS	1	H
Big Cr	White Cr	USDA-FS	1	H
Big Cr	Martin Cr	USDA-FS	2	H
Big Cr	SF Meadow Cr trib	USDA-FS	2	H
Big Cr	Big Cr	USDA-FS	1	H
Big Cr	White Cr	USDA-FS	1	H
Big Cr	Meadow Cr	USDA-FS	2	H
Big Cr	Texas Bar Cr trib	USDA-FS	3	H
Big Cr	Texas Bar Cr	USDA-FS	5	H
Big Cr	Juniper Cr	USDA-FS	1	H
Desolation Cr	NF Desolation Cr	USDA-FS	3	H
Desolation Cr	Sponge Cr	USDA-FS	1	H
Desolation Cr	Howard Cr	USDA-FS	2	H
Desolation Cr	SF Desolation Cr	USDA-FS	1	H
Desolation Cr	Skinner Cr	USDA-FS	1	H
Desolation Cr	NF Desolation Cr trib	USDA-FS	1	H
Desolation Cr	Battle Cr	USDA-FS	1	H
Desolation Cr	Little Kelsay Cr	USDA-FS	2	H
Desolation Cr	Bruin Cr	USDA-FS	1	H
Desolation Cr	Beeman Cr	USDA-FS	4	H
5th Field HUC	Stream	Ownership	Number of Culverts	Priority

Desolation Cr	Junkens Cr	USDA-FS	6	H
Desolation Cr	Desolation Cr trib	USDA-FS	1	H
Desolation Cr	Park Cr	USDA-FS	1	H
Upper Camas Cr	Neeves Cr	USDA-FS	1	H
Upper Camas Cr	SF Cable Cr	USDA-FS	2	H
Upper Camas Cr	NF Cable Cr	USDA-FS	1	H
Upper Camas Cr	Bear Wallow Cr	USDA-FS	3	H
Upper Camas Cr	Bowman Cr	USDA-FS	4	H
Upper Camas Cr	Bowman Cr trib	USDA-FS	1	H
Upper Camas Cr	Trib to Bowman Cr	USDA-FS	1	H
Upper Camas Cr	Frazier Cr	USDA-FS	3	H
Upper Camas Cr	Frazier Cr trib	USDA-FS	1	H
Upper Camas Cr	Butcher Knife Cr	USDA-FS	1	H
Upper Camas Cr	Camas Cr trib	USDA-FS	5	H
Upper Camas Cr	Camas Cr	USDA-FS	2	H
Upper Camas Cr	Dry Camas Cr	USDA-FS	1	H
Upper Camas Cr	Hidaway Cr	USDA-FS	1	H
Lower Camas Cr	Silver Cr	USDA-FS	1	H
Lower Camas Cr	Dry Five Mile Cr	USDA-FS	1	H
Lower Camas Cr	Taylor Cr	USDA-FS	2	H
Lower Camas Cr	Taylor Cr trib	USDA-FS	1	H
Lower Camas Cr	Tribble Cr	USDA-FS	1	H
Lower Camas Cr	Turpentine Cr	USDA-FS	1	H
Lower Camas Cr	Five Mile Cr	USDA-FS	1	H
Lower Camas Cr	Morsay Cr	USDA-FS	2	H
Lower Camas Cr	Sugarbowl Cr	USDA-FS	2	H
Lower Camas Cr	Silver Cr trib	USDA-FS	1	H
Lower Camas Cr	No Name 2	USDA-FS	1	H
Lower Camas Cr	Deer Lick Cr trib	USDA-FS	4	H
NF JDR Potamus Cr	Butcher Bill Cr	USDA-FS	1	H
NF JDR Potamus Cr	Ditch Cr	USDA-FS	3	H
NF JDR Potamus Cr	Ditch Cr trib	USDA-FS	2	H
NF JDR Potamus Cr	Horse Heaven Cr	USDA-FS	2	H
NF JDR Potamus Cr	Jones Canyon	USDA-FS	1	H
NF JDR Potamus Cr	Long Canyon	USDA-FS	1	H
NF JDR Potamus Cr	Mallory Cr	USDA-FS	3	H
NF JDR Potamus Cr	Martin Cr	USDA-FS	1	H
NF JDR Potamus Cr	Matlock Cr	USDA-FS	1	H
NF JDR Potamus Cr	Matlock Cr trib	USDA-FS	1	H
NF JDR Potamus Cr	Rush Cr trib	USDA-FS	1	H
NF JDR Potamus Cr	Thompson Cr	USDA-FS	3	H
NF JDR Potamus Cr	Thompson Cr trib	USDA-FS	2	H
NF JDR Potamus Cr	Smith Cr	USDA-FS	1	H
NF JDR Potamus Cr	WF Meadow Brook	USDA-FS	7	H
NF JDR Potamus Cr	EF Meadow Brook	USDA-FS	1	H
NF JDR Potamus Cr	Brush Cr	USDA-FS	1	H
NF JDR Potamus Cr	WF Meadow Brook trib	USDA-FS	1	H
NF JDR Potamus Cr	Pole Cr	USDA-FS	2	H
NF JDR Potamus Cr	Potamus Cr	USDA-FS	2	H
NF JDR Potamus Cr	Potamus Cr trib	USDA-FS	1	H
NF JDR Potamus Cr	Gilbert Cr trib	USDA-FS	3	H
5th Field HUC	Stream	Ownership	Number of Culverts	Priority
NF JDR Potamus Cr	Little Potamus Cr	USDA-FS	1	H

NF JDR Potamus Cr	Little Potamus Cr trib	USDA-FS	2	H
NF JDR Potamus Cr	Deep Cr	USDA-FS	1	H
NF JDR Potamus Cr	Gilbert Cr	USDA-FS	3	H
NF JDR Potamus Cr	Ellis Cr	USDA-FS	1	H
Wall Cr	Dry Swale Cr	USDA-FS	2	H
Wall Cr	Swale Cr	USDA-FS	3	H
Wall Cr	Bear Cr trib	USDA-FS	1	H
Wall Cr	Alder Cr trib	USDA-FS	4	H
Wall Cr	Skookum Cr	USDA-FS	1	H
Wall Cr	Swale Cr trib	USDA-FS	2	H
Wall Cr	Hog Cr	USDA-FS	1	H
Wall Cr	Hog Cr trib	USDA-FS	1	H
Wall Cr	Keeney Cr	USDA-FS	1	H
Wall Cr	Little Wall Cr	USDA-FS	2	H
Wall Cr	Three Trough Cr trib	USDA-FS	1	H
Wall Cr	Rough Cyn	USDA-FS	1	H
Wall Cr	Cat Cyn	USDA-FS	2	H
Wall Cr	Indian Cr	USDA-FS	3	H
Wall Cr	Dark Cyn Cr	USDA-FS	1	H
Wall Cr	Lost Cyn trib	USDA-FS	1	H
Wall Cr	Willow Spring Cr	USDA-FS	1	H
Wall Cr	Big Wall Cr	USDA-FS	2	H
Wall Cr	Grassy Butte Cr	USDA-FS	1	H
Wall Cr	SF Big Wall Cr	USDA-FS	1	H
Wall Cr	Keating Cr	USDA-FS	1	H
Wall Cr	SF Wall Cr	USDA-FS	1	H
Wall Cr	Colvin Cr	USDA-FS	2	H
Wall Cr	Big Wall Cr trib	USDA-FS	1	H
Wall Cr	Wilson Cr trib	USDA-FS	2	H
Wall Cr	Wilson Cr	USDA-FS	1	H

Middle Fork John Day River
Total Culverts = 242

5th Field HUC	Stream	Ownership	Number of Culverts	Priority
Upper MF JDR	Bridge Cr	ODOT	5	L
Upper MF JDR	Bridge Cr	ODOT	7	H
Upper MF JDR	Mill Cr	ODOT	1	L
Upper MF JDR	North Fk	ODOT	1	H
Lower MF JDR	Barnes Cr	ODOT	1	L
Lower MF JDR	Eightmile Cr	Grant	1	M
Lower MF JDR	Sixmile Cr	Grant	1	M
Lower MF JDR	Twelvemile Cr	Grant	1	M
MF JDR	Clear Cr	USDA-FS	1	H
Upper MF JDR	Bridge Cr	USDA-FS	3	G
Upper MF JDR	Bridge Cr	USDA-FS	20	H
Upper MF JDR	Bridge Cr	Private	1	H
Upper MF JDR	Bridge Cr trib	USDA-FS	3	H
Upper MF JDR	Clear Cr	USDA-FS	1	H
Upper MF JDR	Crawford Cr	USDA-FS	5	U
Upper MF JDR	Crawford Cr	USDA-FS	5	H
5th Field HUC	Stream	Ownership	Number of Culverts	Priority
Upper MF JDR	Dry Fork Clear Cr	USDA-FS	1	U

Upper MF JDR	Dry Fork Clear Cr	USDA-FS	5	H
Upper MF JDR	Fly Cr	USDA-FS	1	H
Upper MF JDR	Frosty Gulch	USDA-FS	3	H
Upper MF JDR	Idaho Cr	USDA-FS	1	U
Upper MF JDR	Idaho Cr	USDA-FS	1	H
Upper MF JDR	Little Phipps Cr	USDA-FS	2	U
Upper MF JDR	Little Phipps Cr	USDA-FS	1	H
Upper MF JDR	Lunch Cr	USDA-FS	2	H
Upper MF JDR	NF Bridge Cr	USDA-FS	1	U
Upper MF JDR	NF Bridge Cr	USDA-FS	9	H
Upper MF JDR	Olmstead Cr	USDA-FS	1	U
Upper MF JDR	Olmstead Cr	USDA-FS	2	H
Upper MF JDR	Papoose Cr	USDA-FS	2	H
Upper MF JDR	Phipps Cr	USDA-FS	2	H
Upper MF JDR	Road Cr	USDA-FS	2	H
Upper MF JDR	Rock Spring	USDA-FS	1	H
Upper MF JDR	Savage Cr	USDA-FS	1	H
Upper MF JDR	Sawtooth Cr	USDA-FS	1	H
Upper MF JDR	SF Bridge Cr	USDA-FS	2	H
Upper MF JDR	Sixteen Gulch	USDA-FS	1	H
Upper MF JDR	Squaw Cr	USDA-FS	5	U
Upper MF JDR	Squaw Cr	USDA-FS	6	H
Upper MF JDR	Summit Cr	USDA-FS	1	U
Upper MF JDR	Summit Cr	USDA-FS	11	H
Camp Cr	Bear Cr	USDA-FS	1	H
Camp Cr	Beaver Cr	USDA-FS	2	H
Camp Cr	Big Boulder Cr	USDA-FS	3	H
Camp Cr	Big Rock Cr	USDA-FS	1	H
Camp Cr	Blue Gulch	USDA-FS	2	H
Camp Cr	Butte Cr	USDA-FS	3	H
Camp Cr	Camp Cr	USDA-FS	1	U
Camp Cr	Camp Cr	USDA-FS	1	H
Camp Cr	Camp Cr trib	USDA-FS	4	H
Camp Cr	Caribou Cr	USDA-FS	2	U
Camp Cr	Cottonwood Cr	USDA-FS	2	U
Camp Cr	Cottonwood Cr	USDA-FS	2	H
Camp Cr	Cougar Cr	USDA-FS	1	U
Camp Cr	Cougar Cr	USDA-FS	2	H
Camp Cr	Coxie Cr	USDA-FS	1	H
Camp Cr	Coyote Cr	USDA-FS	1	U
Camp Cr	Coyote Cr	USDA-FS	2	H
Camp Cr	Deadwood Cr	USDA-FS	1	U
Camp Cr	Deadwood Cr	USDA-FS	4	H
Camp Cr	Deep Cr	USDA-FS	2	U
Camp Cr	Deep Cr	USDA-FS	3	H
Camp Cr	Dry Cr (Sunshine Cr)	USDA-FS	1	H
Camp Cr	E Fk Big Cr	USDA-FS	4	H
Camp Cr	E Fk Sunshine Cr	USDA-FS	1	H
Camp Cr	E Little Boulder Cr	USDA-FS	1	H
Camp Cr	Eagle Cr	USDA-FS	1	H
5th Field HUC	Stream	Ownership	Number of Culverts	Priority
Camp Cr	East Windlass Cr	USDA-FS	1	H
Camp Cr	Elk Cr	USDA-FS	1	H
Camp Cr	Granite Boulder Cr	USDA-FS	4	H
Camp Cr	Hawkins Cr	USDA-FS	1	H

Camp Cr	Lick Cr	USDA-FS	2	U
Camp Cr	Lick Cr	USDA-FS	2	H
Camp Cr	Little Boulder Cr	USDA-FS	5	H
Camp Cr	Little Trail Cr	USDA-FS	1	H
Camp Cr	Lost Cr	USDA-FS	3	H
Camp Cr	Lost Cr or Pizer Cr	USDA-FS	1	H
Camp Cr	MF Sunshine Cr	USDA-FS	1	H
Camp Cr	Morning Cr	USDA-FS	1	H
Camp Cr	Mosquito Cr	USDA-FS	1	H
Camp Cr	Murdock Cr	USDA-FS	3	H
Camp Cr	Myrtle Cr	USDA-FS	1	U
Camp Cr	Myrtle Cr	USDA-FS	1	H
Camp Cr	N Fk Elk Cr	USDA-FS	2	H
Camp Cr	N Fk Camp Cr	USDA-FS	1	U
Camp Cr	N Fk Camp Cr	USDA-FS	1	H
Camp Cr	Placer Gulch	USDA-FS	1	H
Camp Cr	Porky Cr	USDA-FS	2	H
Camp Cr	Ragged Cr	USDA-FS	2	H
Camp Cr	Ruby Cr	USDA-FS	1	U
Camp Cr	Sulpher Cr 2	USDA-FS	1	H
Camp Cr	Sunshine Cr	USDA-FS	2	H
Camp Cr	Swamp Gulch	USDA-FS	1	H
Camp Cr	Tin Cup Cr	USDA-FS	3	H
Camp Cr	Vincent Cr	USDA-FS	1	U
Camp Cr	Vincent Cr	USDA-FS	4	H
Camp Cr	Vinegar Cr	USDA-FS	2	H
Camp Cr	Vinegar Cr trib	USDA-FS	1	H
Camp Cr	W Fk Lick Cr	USDA-FS	1	H
Camp Cr	W Fk Lick Cr	USDA-FS	1	U
Camp Cr	Whiskey Cr	USDA-FS	3	H
Camp Cr	Windlass Cr	USDA-FS	2	H
Camp Cr	Wray Cr	USDA-FS	2	H
Big Cr	Slide Cr	USDA-FS	2	H
Long Cr	Dry Fk Clear Cr	USDA-FS	1	H
Long Cr	Jugow Cr	USDA-FS	1	H
Long Cr	Long Cr	USDA-FS	1	H
Long Cr	Long Cr	USDA-FS	2	U
Long Cr	S Fk Long Cr	USDA-FS	1	U

South Fork John Day River
Total Culverts = 74

5th Field HUC	Stream	Ownership	Number of Culverts	Priority
Lower SF JDR	Oliver Cr	Grant	1	L
Lower SF JDR	Smoky Cr	Grant	1	M
Middle SF JDR	Pine Cr	Grant	1	L
Middle SF JDR	Poison Cr	Grant	1	L
Middle SF JDR	Un Cr	Grant	1	L
5th Field HUC	Stream	Ownership	Number of Culverts	Priority
Upper SF JDR	Antelope Cr	Grant	1	L
Upper SF JDR	Lewis Cr	Grant	2	L
Upper SF JDR	Lewis Cr	Grant	1	M
Upper SF JDR	Venator Cr	Grant	1	M
Upper SF JDR	Cougar Cr	USDA-FS	1	H
Murderers Cr	Basin Cr	USDA-FS	2	H

Murderers Cr	Buck Cr	USDA-FS	2	H
Murderers Cr	Charlie Mack Cr	USDA-FS	1	H
Murderers Cr	Corral Cr	USDA-FS	2	U
Murderers Cr	Corral Cr	USDA-FS	3	H
Murderers Cr	Crazy Cr	USDA-FS	1	H
Murderers Cr	Dans Cr	USDA-FS	3	H
Murderers Cr	Dead Injun Cr	USDA-FS	6	H
Murderers Cr	Deer Cr	USDA-FS	7	H
Murderers Cr	Duncan Cr	USDA-FS	2	H
Murderers Cr	E Fk Deer Cr	USDA-FS	1	H
Murderers Cr	Lemon Cr	USDA-FS	3	H
Murderers Cr	Murderers Cr	USDA-FS	5	H
Murderers Cr	Murderers Cr	USDA-FS	1	U
Murderers Cr	Orange Cr	USDA-FS	1	H
Murderers Cr	Oregon Mine Cr	USDA-FS	2	H
Murderers Cr	SF Deer Cr	USDA-FS	1	U
Murderers Cr	SF Murderers Cr	USDA-FS	1	U
Murderers Cr	SF Murderers Cr	USDA-FS	2	H
Murderers Cr	Sugar Cr	USDA-FS	1	H
Murderers Cr	Tex Cr	USDA-FS	6	H
Murderers Cr	Thorn Cr	USDA-FS	8	H
Murderers Cr	Vester Cr	USDA-FS	1	H
Murderers Cr	White Cr	USDA-FS	1	H

Upper Mainstem John Day River
Total Culverts = 120

5th Field HUC	Stream	Ownership	Number of Culverts	Priority
Beech Cr	Beech Cr	ODOT	5	H
Beech Cr	Beech Cr	Grant	1	H
Beech Cr	Cottonwood Cr	ODOT	1	H
Beech Cr	McClellen Cr	Grant	1	M
Beech Cr	Thompson Cr	Grant	1	L
Beech Cr	Un Cr	Grant	1	L
Beech Cr	Warm Springs Cr	ODOT	1	L
Big Cr	Deep Cr	Grant	1	L
Canyon Cr	Alder Gl	Grant	1	L
Canyon Cr	East Gl Cr	Grant	1	L
Canyon Cr	Sheep Gulch	ODOT	1	L
Canyon Cr	Vance Cr	ODOT	1	L
Cottonwood Cr	Wiley Cr	ODOT	1	H
Laycock Cr	Coal Pit Cr	Grant	1	L
Laycock Cr	Harper Cr	Grant	1	M
Laycock Cr	Ingle Cr	Grant	1	M
Laycock Cr	Luce Cr	ODOT	1	L
Laycock Cr	Luce Cr	Grant	1	L
5th Field HUC	Stream	Ownership	Number of Culverts	Priority
Mountain Cr	Marshall Cr	ODOT	1	L
Mountain Cr	Thorn Hollow	ODOT	1	L
Mountain Cr	Tubb Cr	ODOT	1	L
Mountain Cr	Un Cr	ODOT	2	L
Mountain Cr	Whiskey Cr	ODOT	1	L
Strawberry Cr	Cow Cr	Grant	1	L
Strawberry Cr	Dixie Cr	Grant	1	M

Strawberry Cr	Dog Cr	Grant	3	L
Strawberry Cr	Dog Cr	Grant	2	M
Strawberry Cr	Grub Cr	Grant	5	L
Strawberry Cr	Gwyn Cr	Grant	1	L
Strawberry Cr	Hall Cr	ODOT	1	L
Strawberry Cr	Little Indian Cr	Grant	2	L
Strawberry Cr	Little Pine Cr	ODOT	1	H
Strawberry Cr	Little Pine Cr	Grant	2	L
Strawberry Cr	Pine Cr	ODOT	1	L
Strawberry Cr	Pine Cr	Grant	2	L
Strawberry Cr	Slyfe Cr	Grant	1	L
Strawberry Cr	Spring Cr	Grant	1	L
Strawberry Cr	Squaw Cr	Grant	1	L
Strawberry Cr	Un Cr	Grant	1	L
Strawberry Cr	Un Cr	ODOT	2	L
Strawberry Cr	West Fork	Grant	1	M
Upper JDR	Dans Cr	Grant	1	M
Upper JDR	Graham Cr	Grant	1	L
Upper JDR	Jeff Davis Cr	Grant	1	L
Upper JDR	John Day R	Grant	1	H
Upper JDR	John Day R	Grant	1	M
Upper JDR	Un Cr	Grant	3	L
Upper JDR	Winegar Gl	Grant	1	L
Cottonwood Cr	Day Cr	USDA-FS	1	H
Upper JDR	Call Cr	USDA-FS	1	H
Upper JDR	Dans Cr	USDA-FS	1	H
Upper JDR	Deardorff Cr	USDA-FS	1	H
Upper JDR	Isham Cr	USDA-FS	1	H
Upper JDR	John Day R	USDA-FS	5	H
Upper JDR	Mossy Gulch	USDA-FS	2	H
Upper JDR	NF Reynolds Cr	USDA-FS	3	H
Upper JDR	Reynolds Cr	USDA-FS	2	H
Upper JDR	Roberts Cr	USDA-FS	1	U
Upper JDR	SF Deardorff Cr	USDA-FS	1	H
Canyon Cr	Canyon Cr	USDA-FS	3	H
Canyon Cr	Crazy Cr	USDA-FS	2	H
Canyon Cr	MF Canyon Cr	USDA-FS	1	H
Strawberry Cr	Dixie Cr	USDA-FS	2	H
Strawberry Cr	Hall Cr	USDA-FS	3	H
Strawberry Cr	John Day R	USDA-FS	1	H
Strawberry Cr	Onion Cr	USDA-FS	1	H
Strawberry Cr	Strawberry Cr	USDA-FS	1	H
Strawberry Cr	W Fk Little Indian Cr	USDA-FS	1	H
Beech Cr	Bear Cr	USDA-FS	1	H
5th Field HUC	Stream	Ownership	Number of Culverts	Priority
Beech Cr	Bear Cr trib	USDA-FS	1	H
Beech Cr	E Fk Beech Cr	USDA-FS	1	U
Beech Cr	E Fk Beech Cr	USDA-FS	1	H
Beech Cr	Lake Cr	USDA-FS	1	H
Beech Cr	Tinker Cr	USDA-FS	1	H
Laycock Cr	Riely Cr	USDA-FS	2	H
Laycock Cr	Umatilla Cr	USDA-FS	1	H
Fields Cr	Belshaw Cr	USDA-FS	1	U
Fields Cr	Buck Cabin Cr	USDA-FS	2	H
Fields Cr	Fields Cr	USDA-FS	1	U

Fields Cr	Fields Cr	USDA-FS	6	H
Fields Cr	Last Cr	USDA-FS	1	H

Number and location of culverts which need to be improved or replaced within steelhead populations in the Umatilla River. This is an incomplete list as comprehensive culvert inventories have not been conducted.

Umatilla River Total Culverts = 25				
5th Field HUC	Stream	Ownership	Number of Culverts	Priority
	Johnson Cr. (Butter Trib-RM 0.3)		1	M
	Bridge Cr (West Birch-RM 2.0)		1	H
	Jungle/Windy Spr (Pearson-RM 0.1)		1	L
	Whitman Spr (RM 0.1)		1	L
	Red Elk Can. (RM 0.2)		1	L
	Minthorn Spr (RM 0.1)		1	L
	Un Trib to SF Umatilla at RM 1.5 (RM 0.1)		1	M
	Un Trib to Umatilla R. at RM 81.2 (RM 0.1)		1	L
	Twomile Cr (RM 1.250		1	L
	Butter Cr	USDA-FS	6	H
	Willow Cr	USDA-FS	6	H
	Umatilla R.	USDA-FS	2	H
	Umatilla R.	USDA-FS	1	H
	Meacham Cr	USDA-FS	1	H

Number and location of culverts which need to be improved or replaced within steelhead populations in the Walla Walla River. This is an incomplete list as comprehensive culvert inventories have not been conducted.

Walla Walla River Total Culverts = 22				
5th Field HUC	Stream	Ownership	Number of Culverts	Priority
	Pine Cr at Johnson Rd		1	M
	Pine Cr at Hwy 11		1	M
	Pine Cr at Pine Cr Rd		1	M
	Dry Cr (Upper Dry Cr Rd)		1	M
	Little Dry Cr (Winn Rd)		1	M
	Dr Cr (upstream of Sapolil Rd)		1	M
	East Little Walla Walla (Locust Rd)		1	M
	East Little Walla Walla (Appleton Rd)		1	M
	East Little Walla Walla (Crockett Rd)		1	M
	East Little Walla Walla (Ballou Rd)		1	M
	East Little Walla Walla (Stateline Rd)		1	M
	West Little Walla Walla (Winesap Rd)		1	M
	West Little Walla Walla (Appleton Rd)		1	M
	West Little Walla Walla (Sunquist Rd)		1	M
	West Little Walla Walla (Stateline Rd)		1	M
	Middle Branch Mud Cr (Triangle Rd)		1	M
	Middle Branch Mud Cr (County Rd 332)		2	M
	Titus Cr (at mouth)		1	M
	Birch Cr (Powerline Rd)		1	H
	Couse Cr (gravel pit entrance RM 1.1)		1	H
	Cup Gulch (NF Walla Walla River Rd)		1	M

APPENDIX H

Management Actions Effectiveness and Model Data and Assumptions

Management Actions Effectiveness and Model Data and Assumptions

This appendix is presented in two parts. Part 1 provides action effectiveness assumptions and related factor scalars used in analyzing actions. Part 2 provides a series of graphic reports that give additional information about the predicted outcomes of the subbasin habitat scenarios analyzed in Section 10. These graphic reports are extracted from output produced by EDT.

Part 1: Action Effectiveness Assumptions

Part 1 consists of fifteen tables that describe action effectiveness assumptions and related factor scalars used in analyzing the subbasin habitat actions, as well as, the life stage specific survival rate assumptions applied to the component life stages from smolt leaving the subbasin to adult return to the subbasin. See Section 10 of the report for a full description of how the assumptions and scalars are applied. The tables are:

- H-1. List of habitat actions analyzed within the subbasins.
- H-2. Subbasins where habitat actions were designated to be applied.
- H-3. Action effectiveness assumptions and levels applied in analysis.
- H-4. Action implementation intensity assumptions and levels applied in analysis.
- H-5. Action effectiveness lag scalars applied to habitat actions.
- H-6. Action implementation schedule scalars at 25 years applied to habitat actions.
- H-7. Action implementation schedule scalars at 100 years applied to habitat actions.
- H-8. Attribute scalars applied to habitat actions.
- H-9. Definitions of freshwater habitat attributes shown in Table H-8.
- H-10. Out-of-basin survival rates in AHA modeling for baseline (B), current (C) and prospective future action scenarios for Fifteenmile Creek winter steelhead.
- H-11. Out-of-basin survival rates in AHA modeling for baseline (B), current (C) and prospective future action scenarios for Deschutes River Eastside and Westside summer steelhead.
- H-12. Out-of-basin survival rates in AHA modeling for baseline (B), current (C) and prospective future action scenarios for John Day River summer steelhead populations.
- H-13. Out-of-basin survival rates in AHA modeling for baseline (B), current (C) and prospective future action scenarios for Umatilla River summer steelhead.
- H-14. Out-of-basin survival rates in AHA modeling for baseline (B), current (C) and prospective future action scenarios for Walla Walla River summer steelhead.

Tributary Habitat Action Effectiveness Assumptions

Tributary habitat actions, locations, intensity, time scalars, and effectiveness scalars are presented in tables H-1 – H-9.

Table H-1. Habitat actions analyzed within Oregon subbasins for their effects on population performance of Mid-Columbia steelhead. See Section 9 for further descriptive details of actions.

(Table H-1. List of actions.)

Strategy	Action	Description
1. Protect/conserve ecological processes		
	Acquisition/conservation	Protect the highest quality habitats through acquisition or conservation measures.
	Protect rare functioning habitats	Protect and conserve rare and unique functioning habitats.
	BMPs to conserve eco processes	Consistently apply Best Management Practices (BMPs) and existing laws to protect and conserve natural ecological processes.
	Cooperative Agreements	Adopt and manage Cooperative Agreements.
	Special mgmt designations	Special management designations on public lands.
	Increase wild-scenic status	Designate additional wilderness and wild and scenic status.
	Protect access to key habitats	Protect access to key habitats.
	Outreach to users and managers	Conduct outreach to resource users and managers (resulting in improved management practices).
	Public lands protection	Continue existing protections and/or increase protection of Federal lands; implement Forest Practices Act and PACFISH/INFISH.
	Waterway setbacks	Establish setbacks to protect waterways from forest management, agricultural activities, and other land use practices that would disrupt ecosystem function.
	Enforce floodplain regs	Review, modify and enforce existing land use planning documents and ordinances pertaining to riparian and floodplain management to better address habitat and water quality issues.
	Natural Area Overlay Zone	Incorporate priority habitat areas into the Natural Area Overlay Zone provision of the Umatilla County Development Ordinance.
	Legislate priority areas	Explore opportunities to incorporate priority areas into state legislation (resulting in improved management practices).
2. Restore fish passage blocked/impaired by barriers		
	Barrier removal	Replace barriers blocking passage including dams, road culverts and irrigation structures.
	Add irrigation screening	Provide screening at 100% of irrigation diversions.
	Pelton Round Butte passage	Restore passage at Pelton Round Butte Complex in the Deschutes river system.
	Upgrade irrigation screening	Replace screens that do not meet criteria.
	Reduce push up dams	Remove or minimize use of push up dams.
	Fish ladder construction	Construct ladders over existing permanent concrete or earth fill dams, or remove the barrier.
	Maintain passage facilities	Operate and maintain fish passage facilities to meet criteria.
3. Restore floodplain connectivity and function		
	Reconnect floodplain	Reconnect floodplains to channels.
	Reconnect side channels	Reconnect side channels and off-channel habitats to stream channels.

(Table H-1. List of actions.)

Strategy	Action	Description
	Reintroduce beaver	Reintroduce beaver in suitable habitat.
	Restore wet meadows	Restore wet meadows.
	Dike removal	Remove dikes and levies.
	Manage beavers	Manage beaver population and educate public.
4. Restore degraded channel structure/complexity		
	Restore natural channel form	Restore natural channel form.
	Large wood enhancement	Increase role and abundance of wood and large organic debris in streambeds.
	Add structure	Increase instream habitat through manual placement of structures.
	Stabilize streambanks	Stabilize streambanks.
	Build pool weirs	Construct rock and log weirs to create pool habitats or elevate incised channels.
	BMP bridge maintenance	Implement bridge maintenance BMPs.
	LWD education	Educate landowners on importance of large woody debris (LWD)(resulting in improved LWD management practices).
5. Restore riparian condition and LWD recruitment		
	Restore riparian communities	Restore natural riparian communities.
	Improve grazing practices	Develop grazing strategies that promote riparian recovery (and implement).
	Eradicate invasive plants	Eradicate invasive plant species from riparian areas.
	Fencing	Install fencing to exclude livestock from riparian areas.
	Off-stream livestock watering	Install off-stream livestock watering.
	Riparian plantings	Plant riparian vegetation where appropriate.
	Increase riparian shading	Plant riparian vegetation where appropriate.
	No cultivation buffer zones	Develop no-cultivation riparian buffer on agricultural lands and establish riparian setbacks for structures in areas where activities could upset riparian function.
	Maintain RHCAs on USFS lands	Maintain existing widths of riparian habitat conservation areas (RHCAs) on USFS lands.
	Remove riparian roads	Close, remove, and restore riparian road prisms.
	Riparian protection	Protect high quality riparian habitats and unstable areas.
6. Restore natural hydrograph components		
	Ag water conservation	Implement agricultural water conservation measures.
	Improve irrigation conveyance	Improve irrigation conveyance and efficiency.
	Orchard Ridge/Wolf Run	Finish piping Orchard Ridge and Wolf Run diversions.
	Urban conservation	Implement urban conservation measures.
	Convert water rights	Lease or purchase water rights and convert to instream.
	Regulate water withdrawals	Monitor/regulate water withdrawals.
	Water retention structures	Water retention structures.

(Table H-1. List of actions.)

Strategy	Action	Description
	Increase pool habitat (beav ponds)	Increase pool habitat (beaver ponds).
	Floodplain aquifer recharge	Floodplain aquifer recharge.
	H2O rights transfer downstream	Downstream water rights transfers.
	Water storage investigate	Investigate feasibility of water storage or exchange to improve instream flows for steelhead (assumed to improve water conservation/management).
	No new H2O appropriation	Close areas to appropriation of new water uses.
	Criteria for new H2O appropriation	Set criteria to protect flows for fish habitat from new appropriations.
	Enhance hyporheic flows	Enhance hyporheic flows and spring inputs.
	Recharge shallow aquifers	Implement shallow aquifer recharge.
	Aquifer storage & recovery	Aquifer storage and recovery.
	Umatilla Basin Project Phase I and II	Implement Umatilla Basin Project Phase I and II. The Umatilla Basin Project Act, passed by Congress in 1988, allows irrigators to exchange Umatilla River water for Columbia River water. Two phases of the Act have been completed and a third phase has been proposed. This action that addresses Phases 1 and II would continue the operation of the project under these phases.
	Umatilla Basin Project Phase III	Implement Umatilla Basin Project Phase III. This action would provide a substantial increase of Umatilla River water to remain instream compared to the action associated with just Phases I and II.
	ISWRs	File for additional instream water rights (ISWRs) (assumed to be successful). While instream water rights have been established on many of the important spawning and rearing stream in the Umatilla and Walla Walla subbasins, some have not. Where important spawning and rearing streams have not been protected by instream water rights, instream flow studies would be conducted and instream water rights applied for (it is assumed that some would be granted).
7. Improve degraded water quality		
	Manage irrigation return flow	Manage irrigation return flow to reduce extreme stream temperatures.
	Measures to improve DO	Minimize unnatural factors that lead to fluctuations in dissolved oxygen levels.
	Reduce chemical pollution	Reduce chemical pollution inputs.
	Implement Ag WQP	Implement an Agricultural Water Quality Plan. (Oregon's agricultural water quality plans created by Senate Bill 1010 are locally-driven area-wide plans addressing agricultural water quality problems while providing a regulatory backstop. They provide landowner flexibility in solving local water quality issues. Enforcement is not a primary method for assuring success, although compliance is a component. The premise is that when landowners are given opportunities to address issues, and offered technical assistance, success will generally follow. This approach has proven successful in some subbasins (see http://www.oregon.gov/ODA/news/0407aq.shtml)

(Table H-1. List of actions.)

Strategy	Action	Description
	TMDL monitoring	Continue TMDL monitoring. A TMDL is the calculated pollutant amount that a waterbody can receive and still meet Oregon water quality standards. The process for building a plan to improve water quality starts when a waterbody appears on DEQ's 303(d) list, which lists waterbodies that do not meet water quality standards. Federal law requires that streams, rivers, lakes and estuaries that appear on the 303(d) list be managed to meet state water quality standards. Plans to restore streams and rivers to water quality standards are developed by governmental agencies in cooperation with landowners. Agriculture issues are addressed by the Oregon Department of Agriculture working with landowners (under Senate Bill 1010 -- see Ag Water Quality plan above). Private and state forest issues are addressed the Oregon Department of Forestry (through the Forest Practices Act). Federal agencies (such the U.S. Forest Service or the Bureau of Land Management) have responsibility for federal lands. Urban and rural areas not covered by other state or federal agencies are addressed by cities and counties, working with local watershed councils.
	Reduce mine discharge toxicants	Address contamination from mine related discharge.
	Animal feeding BMPs	Apply BMPs to animal feeding operations.
	Point source pollution controls	Address point sources of water pollution.
	H2O quality mgmt plans	Implement water quality management plans (it is not specified that these are Agricultural Water Quality Plans but it is presumed; this is kept separate from the Agricultural Water Quality Plan due to uncertainty in the type of plan and in implementation).
	Pest mgmt plans for fruit growers	Implement pest management plans for fruit growers. Note: it is assumed that this action would entail an integrated pest management program comparable to the action below specified as "Implement IFPnet plans" to be implemented in Fifteenmile subbasin.
	Municipal stormwater mgmt	Improve municipal stormwater management and treatment.
	Waterway alteration permitting	Permit waterway alteration activities and enforce rules. "Waterway alteration" means any action that will result in excavation, dredging, filling, rechannelization, construction, or any other type of modification of an aquatic habitat area occupied by ESA-listed species that will affect the conservation value of that habitat. This action is only relevant for analysis if other actions are to be analyzed that consist of waterway alternations, in which case, the action would serve as a measure of protection. Permitting can require compensation or mitigation but would be assumed to only offset any take.
	Permitting for H2O quality activities	Permit and enforce actions that could affect water quality. This action is aimed at improving permitting/enforcement of land/water use activities that could impact water quality. This action is only relevant in the present analysis if other actions (such as build-out) are to be analyzed that would degrade water quality, in which case the action would serve protect.

(Table H-1. List of actions.)

Strategy	Action	Description
8. Restore upland processes to reduce erosion		
	Convert till farming	Provide incentives to farmers to convert to no till farming; target achieving 95% conversion to no till farming in specified areas.
	Convert to perennial crops	Convert to perennial crops/vegetation.
	Implement IFPnet plans	The project encourages growers in Wasco County (Fifteenmile Creek subbasin) to reduce the use of broad-spectrum OP pesticides and replace them with new generation, less toxic pesticides. It utilizes methods referred to as integrated fruit management. Using a web-based interface, IFP project participants use the degree-day models and data to make better decisions and precise timed application of new generation, less toxic pesticides. Note: action should more correctly be placed under Strategy 7.
	Improve/remove forest roads	Upgrade or remove problem forest roads.
	Reforest/fuels management	Promote fuel management.
	Upland demo projects	Initiate demonstration projects (assumed to be instrumental in improving upland lands management).
	BMPS to reduce soil erosion	Employ BMPs to minimize unnatural rates of erosion.
	Remove junipers	Remove junipers.
	Restore native upland plants	Restore native upland plants.
	Invasive plant mgmt & junipers	Manage vegetation, including juniper removal.
	BMPs on land uses	Employ BMPs to forest practices, livestock grazing, road management and agricultural practices.
	CREP & CCRP buffers	Implement Continuous Conservation Reserve Program and Conservation Reserve Enhancement Program (CREP and CCRP) buffers; voluntary, non-competitive, programs for agricultural landowners providing financial incentives.
	Outreach to upland users	Conduct outreach to resource users and managers (assumed to lead to improvements in uplands lands management).

Table H-2. Subbasins where habitat actions were designated to be applied. See Section 9 for further descriptive details of actions.

(Table H-2. Subbasins where actions were applied.)

Strategy	Action	Fifteenmile	Deschutes	John Day	Umatilla	Walla Walla
1. Protect/conserve ecological processes						
	Acquisition/conservation	X	X	X	X	X
	Protect rare functioning habitats	X	X	X		X
	BMPs to conserve eco processes	X	X	X	X	X
	Cooperative Agreements		X	X		
	Special mgmt designations		X	X		
	Increase wild-scenic status			X		
	Protect access to key habitats			X		
	Outreach to users and managers			X		
	Public lands protection				X	X
	Waterway setbacks				X	X
	Enforce floodplain regs				X	X
	Natural Area Overlay Zone				X	X
	Legislate priority areas				X	X
2. Restore fish passage blocked/impaired by barriers						
	Barrier removal	X	X	X	X	X
	Add irrigation screening		X	X	X	X
	Pelton Round Butte passage		X			
	Upgrade irrigation screening		X	X	X	X
	Reduce push up dams			X		
	Fish ladder construction	(addressed with barrier removal)				
	Maintain passage facilities	X	X	X	X	X
3. Restore floodplain connectivity and function						
	Reconnect floodplain	X	X	X	X	X
	Reconnect side channels	X	X	X	X	X
	Reintroduce beaver	X	X	X		
	Restore wet meadows			X		
	Dike removal				X	X
	Manage beavers					X

(Table H-2. Subbasins where actions were applied.)

Strategy	Action	Fifteenmile	Deschutes	John Day	Umatilla	Walla Walla
4. Restore degraded channel structure/complexity						
	Restore natural channel form	X	X	X	X	X
	Large wood enhancement	X	X	X	X	X
	Add structure	X	X			
	Stabilize streambanks	X	X	X	X	X
	Build pool weirs				X	X
	BMP bridge maintenance					X
	LWD education					X
5. Restore riparian condition and LWD recruitment						
	Restore riparian communities	X	X	X	X	X
	Improve grazing practices	X	X	X	X	X
	Eradicate invasive plants	X	X			
	Fencing	X	X		X	X
	Off-stream livestock watering	X	X			
	Riparian plantings	X				
	Increase riparian shading		X	X		
	No cultivation buffer zones				X	X
	Maintain RHCAs on USFS lands				X	
	Remove riparian roads				X	X
	Riparian protection					X
6. Restore natural hydrograph components						
	Ag water conservation	X	X	X	X	
	Improve irrigation conveyance	X	X	X		X
	Orchard Ridge/Wolf Run	X				
	Urban conservation	X				
	Convert water rights	X	X	X	X	X
	Regulate water withdrawals	X	X	X	X	X
	Water retention structures		X			
	Increase pool habitat (beaver ponds)			X		
	Floodplain aquifer recharge			X		
	H2O rights transfer downstream				X	X
	Water storage investigate					X

(Table H-2. Subbasins where actions were applied.)

Strategy	Action	Fifteenmile	Deschutes	John Day	Umatilla	Walla Walla
	No new H2O appropriation					X
	Criteria for new H2O appropriation					X
	Enhance hyporheic flows					X
	Recharge shallow aquifers					X
	Aquifer storage & recovery					X
	Umatilla Basin Project Phase I and II				X	
	Umatilla Basin Project Phase III				X	
	ISWRs				X	X
7. Improve degraded water quality						
	Manage irrigation return flow	X	X	X		
	Measures to improve DO	X	X			
	Reduce chemical pollution	X	X	X		
	Implement Ag WQP	X	X			
	TMDL monitoring		X	X		
	Reduce mine discharge toxicants			X		
	Animal feeding BMPs			X		
	Point source pollution controls				X	X
	H2O quality mgmt plans				X	X
	Pest mgmt plans for fruit growers					X
	Municipal stormwater mgmt					X
	Waterway alteration permitting					X
	Permitting for H2O quality activities					X
8. Restore upland processes to reduce erosion						
	Convert till farming	X	X	X		
	Convert to perennial crops	X	X			
	Implement IFPnet plans	X				
	Improve/remove forest roads	X	X	X	X	X
	Reforest/fuels management	X	X			
	Upland demo projects	X		X	X	X
	BMPS to reduce soil erosion	X	X			
	Remove junipers		X			
	Restore native upland plants		X	X	X	X

(Table H-2. Subbasins where actions were applied.)

Strategy	Action	Fifteenmile	Deschutes	John Day	Umatilla	Walla Walla
	Invasive plant mgmt & junipers			X		
	BMPs on land uses			X	X	X
	CREP & CCRP buffers					X
	Outreach to upland users					X

Table H-3A and B. Action effectiveness assumptions and levels applied in analysis (A) and corresponding effectiveness values assigned to each action with rationale/comments (B). See Section 10 for how effectiveness values were applied.

Table H-3A. Action effectiveness levels.

Effectiveness level	Definition	Effectiveness
1	Very high	0.80
2	Moderately high	0.56
3	Moderate	0.32
4	Low	0.08
5	Negligible	0.01
6	No effect	0.00

Table H-3B. Action effectiveness values.

Strategy	Action	Effect.	Rationale/comment
1. Protect/conserve ecological processes			
	Acquisition/conservation	0.80	Land set-asides can be expected to return to their natural condition over time, passively restoring adjacent aquatic habitats. Maximum effectiveness should be very high unless constraints have been imposed by previous land uses. Such an effectiveness level assumes a sufficient scale of implementation to affect an entire stream reach. The action would also have very high effectiveness for protection purposes.
	Protect rare functioning habitats	0.08	It is assumed that rare functioning habitats are very limited in size and distribution. Therefore, actions to restore such habitats would likely be limited by being able to fully address the suite of conditions that create such habitats, providing only low effectiveness. Protection of such habitats against further degradation would be more effective than in restoring them (protection against further degradation would be analyzed if build-out actions were to be addressed).
	BMPs to conserve eco processes	0.32	Best management practices to conserve ecological processes within watersheds are generally known and further improvements in understanding can be expected in the near future as there are on-going studies to address this issue. These practices would be aimed at root causes of how ecological processes have been altered by land use (Beechie and Bolton 1999). Bolton et al. (2005) suggest that such practices will be beneficial in first conserving, then restoring natural processes, especially in watersheds where urbanization is not increasing. A moderate effectiveness is reasonable to expect.
	Cooperative Agreements	0.08	Cooperative Agreements involving voluntary agreements between private land owners and governments can address a variety of issues. Lack of specificity here is assumed to provide a generally low potential for effectiveness that addressing wide scale issues.
	Special mgmt designations	0.32	Special management designations can specify types of management that can occur on lands, here taken to mean federal lands (no actions in the Oregon plan call for special designations on state lands). Such designations can specify areas of critical environmental concern or other types of designations, and limit types of management practices allowed. Moderate effectiveness is assumed because the type of special management designation has not been specified.

Table H-3B. Action effectiveness values.

Strategy	Action	Effect.	Rationale/comment
	Increase wild-scenic status	0.32	Wild and scenic status limits types of management practices allowed but not all activities. This status would provide for passive restoration within the areas specified. A moderate level of effectiveness is assumed given that various types of management practices can still occur.
	Protect access to key habitats	--	Issue is covered completely by other actions as this action was described; not given an effectiveness value here.
	Outreach to users and managers	0.08	Modest results as a separate action are expected from this because education can be expected to accompany other line item actions. Low effectiveness assumed.
	Public lands protection	0.32	This action continues previously enacted protection policies/practices on public lands. The action can be expected to have high value to protect against further degradation. For restoration purposes, the action would be passive, which would continue to maintain or improve conditions on certain public lands; moderate effectiveness assumed.
	Waterway setbacks	0.56	This action would establish setbacks (like buffers) along selected waterways to minimize active land uses such as agriculture and forest harvest. When enforced, setbacks can be particularly effective at protecting and restoring riparian and floodplain processes. Moderately high effectiveness is assumed.
	Enforce floodplain regs	0.32	Action calls for making floodplain regulations more effective than they are currently and providing for enforcement. Action is assumed to be only moderately effective because of the on-going need that will occur to maintain some level of protection against flooding and stream channel instability in areas where roads, bridges, and private lands exist.
	Natural Area Overlay Zone	0.08	This provision of the Umatilla County Development Ordinance was developed to protect and preserve ecologically and scientifically significant natural areas; it was developed as an add on, being added to other provisions that addressed protection of riparian zones and stream setbacks. It was assigned a low effectiveness value because it is an add on to other provisions that already address similar issues. It would be given greater values for protection benefits, but here would serve mainly as a passive restoration action.
	Legislate priority areas	0.01	This action would be mainly investigative, considering new legislation to identify and protect priority habitat issues. As such it is considered here to have a negligible effect because of uncertainty it what it would address; many other avenues are considered to be in place or proposed for action to address such issues.
2. Restore fish passage blocked/impaired by barriers			
	Barrier removal	>0.80	Where barriers are identified in the actions to be fixed or removed, it is assumed that passage will be provided in full.
	Add irrigation screening	0.80	Adding irrigation screening where absent will almost always correct any screening related mortalities at the immediate site. Very high effectiveness is assumed.
	Pelton Round Butte passage	0.75-0.99	Don Ratliff of PGE provided passage values to be applied: 75% for downstream juvenile passage and 99% for upstream adult passage.
	Upgrade irrigation screening	0.80	Where need for upgrading irrigation screening exists, it is assumed these screens would be outdated. It is assumed that such upgrading would be highly effective.
	Reduce push up dams	0.56	Concerted efforts to reduce or eliminate push up dams can be assumed to be moderately high if measures are so enacted. Even with such measures, their effectiveness would be limited because of likely difficulties in fully enforcing or requiring their elimination.
	Fish ladder construction	--	This measure is addressed as part of barrier removal in the analysis.

Table H-3B. Action effectiveness values.

Strategy	Action	Effect.	Rationale/comment
	Maintain passage facilities	0.00	Maintenance of fish passage facilities is assumed to occur in the analysis. A separate action that specifies maintenance is not considered to add to effectiveness.
3. Restore floodplain connectivity and function			
	Reconnect floodplain	0.32	Measures to reconnect floodplain channels can be limited by how channels and floodplains have been altered by past land use practices. Channel incision, for example, can be difficult to reverse. A moderate level of effectiveness is assumed.
	Reconnect side channels	0.32	Measures to reconnect side channels can be limited by how channels and floodplains have been altered by past land use practices. Channel incision, for example, can be difficult to reverse. A moderate level of effectiveness is assumed.
	Reintroduce beaver	0.56	Beavers historically were a significant factor in the creation and maintenance of channel structure and off-channel habitats in some types of streams (Naiman et al. 1988). When reintroduced, and managed, they can be an effective way of restoring some types of habitats and natural channel form. Moderately high effectiveness is assumed.
	Restore wet meadows	0.32	Wet meadows are a key element in some streams for helping to maintain flows and in providing some aspects of off-channel habitats in some seasons. A moderate level of effectiveness is assumed where such sites can be targeted for restoration, where land use practices can be effectively controlled. Effectiveness is not regarded as high because of constraining factors in the drainage that would tend to limit the degree that completely restored channel function could occur where impacts have been high in the past.
	Dike removal	0.56	This action would have a comparable effectiveness to waterway setbacks. When implemented, dike removal can be particularly effective at restoring riparian and floodplain processes. Moderately high effectiveness is assumed. Limitations would exist in watersheds where development has occurred.
	Manage beavers	0.56	Beavers historically were a significant factor in the creation and maintenance of channel structure and off-channel habitats in some types of streams (Naiman et al. 1988). When reintroduced, and managed, they can be an effective way of restoring some types of habitats and natural channel form. Moderately high effectiveness is assumed.
4. Restore degraded channel structure/complexity			
	Restore natural channel form	0.32	Measures to natural channel form can be limited by how channels and floodplains have been altered by past land use practices. Channel incision, for example, can be difficult to reverse. A moderate level of effectiveness is assumed.

Table H-3B. Action effectiveness values.

Strategy	Action	Effect.	Rationale/comment
	Large wood enhancement	0.32	Enhancement of large wood can have a significant effect on channel form and function, in both small and large streams. The ability of large wood to so function depends in part on its abundance, size, and type of wood, and on the size and geomorphology of the stream system (Maser and Sedell 1994; Collins et al. 2003; Fox 2001; Fox 2003). When wood can be completely restored to its pre-development level, it can very effectively restore channel conditions, though not necessarily to pre-development conditions due to other operating factors (such as change in hydrograph, sediment loading, floodplain development, etc.). However, wood enhancement is often limited by availability, size classes available, ability to locate properly, and other logistical difficulties. Additionally, wood enhancement is usually not maintained, hence it can be naturally depleted without future recruitment. A moderate level of effectiveness is assumed.
	Add structure	0.32	Similar limitations exist in adding structure of various kinds to streams as for large wood enhancement. A moderate level of effectiveness is assumed.
	Stabilize streambanks	0.32	Stream bank stabilization is affected by various factors besides just what can be affected at specific sites at the time of implementation. Success is often determined by factors occurring at the landscape level. Well designed stabilization projects can be quite effective, however. Overall, a moderate level of effectiveness is assumed.
	Build pool weirs	0.08	Success of actions that construct pool weirs are often strongly affected by factors outside the control of managers, such as those occurring at the landscape scale (Beechie and Bolton 1999). Such structures often fail. Well designed structures do sometimes persist and can promote creation of long-term habitats that are desired. Overall, a low level of effectiveness would be more normal; a low level is assumed here.
	BMP bridge maintenance	0.01	BMPs to maintain bridges, their footings, and adjacent stream banks are needed to reduce effects of bridges on surrounding aquatic habitats. Overall, a negligible effectiveness is assumed, however, due the limited scope of their effect on stream habitat.
	LWD education	0.32	Maintenance and protection of large wood recruited to streams is often highly dependent on the level of scavenging that occurs for wood from active flood channels by local residents. In some areas, wood recruited to streams is very rapidly removed by local residents. Reasons for removal are use for firewood and a belief that wood removal will promote stream stability. Well designed, concerted efforts to educate local residents about the importance of maintaining in-stream wood is assumed to be moderately effective--such effectiveness could only be achieved by a long-term commitment to address the issue.\
5. Restore riparian condition and LWD recruitment			
	Restore riparian communities	0.80	It is assumed here that restoring riparian communities over a substantially long reach can be very effective when various conditions can be controlled (such as controlling grazing----Platts 1991) and where natural watershed processes are largely intact (such as having a normative or natural hydrograph--Naiman et al. 2005). Intensive efforts to restore riparian conditions can produce significant progress towards predevelopment conditions in relatively few years in some ecoregions (Opperman and Merenlender 2004). This level of effectiveness is assumed to be applicable to an eastside ecoregion. With an intensive application to restore conditions, and in conjunction with activities that simultaneously restore the natural hydrograph, effectiveness is assumed to be very high.

Table H-3B. Action effectiveness values.

Strategy	Action	Effect.	Rationale/comment
	Improve grazing practices	0.32	Grazing practices can be managed to reduce impacts on sediment loading, temperature, stream bank and channel stability, and other aspects of stream habitat (Elmore 1992). A moderate level of effectiveness is assumed for a comprehensive program of improving grazing practices.
	Eradicate invasive plants	0.08	Invasive plants are widespread in all Northwest watersheds. Some species are changing the structure of stream channels due to their prolific growth. An intensive effort to control invasives would have very limited success due to their extensive distributions and productivity. A low level of effectiveness is assumed.
	Fencing	0.80	Enclosures, such as by fencing, can have significant success in restoring riparian areas within eastside streams (Opperman and Merenlender 2004). A similar level of effectiveness is assumed here as described for "Restore riparian communities", i.e., very high effectiveness.
	Off-stream livestock watering	0.32	Off-stream livestock watering can significantly aid in reducing grazing pressure immediately adjacent to streams. A moderate level of effectiveness is assumed with a concerted effort to achieve the objective.
	Riparian plantings	0.32	Riparian plantings can accelerate and promote restoration of riparian areas. However, they would have limited success without on-going efforts to control grazing. A moderate level of effectiveness is assumed.
	Increase riparian shading	0.32	This action is like that of "Riparian plantings." A moderate level of effectiveness is assumed.
	No cultivation buffer zones	0.56	In areas where farming occurs, no cultivation buffer zones will be effective at re-establishing riparian communities. A moderately high level of effectiveness is assumed where such restrictions are maintained; some level of impact could remain present due to other activities besides cultivation.
	Maintain RHCAs on USFS lands	0.32	The action would maintain existing widths on USFW riparian habitat conservation areas, which provide some level of protection while allowing for grazing and other management activities. The level of effectiveness for this action is considered moderate, as certain types of impacts would persist, but conditions in the riparian area would be improved over existing conditions.
	Remove riparian roads	0.56	This action would remove riparian riparian roads, which are highly intrusive to riparian corridors, adding sediment, intercepting and diverting groundwater seeps, and impeding other floodplain functions. Effectiveness at restoring certain conditions within the floodplain corridor of this action is deemed moderately high.
	Riparian protection	0.32	This action would afford protection to some types of riparian areas and any unstable areas associated with them. The action would also provide passive restoration, which would help recover any degraded aspects of the riparian area. It is considered to be moderately effective as it is unclear what types of activities might continue to be allowed.
6. Restore natural hydrograph components			
	Ag water conservation	0.32	This action would implement certain conservation measures on agricultural uses of water to the extent that opportunities exist. In areas where such opportunities do exist, a moderate level of effectiveness is assumed. Actual realized effectiveness would be limited by opportunities.
	Improve irrigation conveyance	0.56	This action would target irrigation conveyance systems to improve their efficiency and reduce water wastage.

Table H-3B. Action effectiveness values.

Strategy	Action	Effect.	Rationale/comment
	Orchard Ridge/Wolf Run	0.32	Within the Fifteenmile subbasin, Orchard Ridge Ditch and Wolf Run Ditch have a combined total of about 12 miles of unpiped ditches with significant water loss. Piping both of these ditches would save approximately 1.5 cfs each, which, according to the Oregon State "Allocation of Conserved Water Statute", could be allocated partially to instream flow and partially to the water rights holders (Fifteenmile subbasin plan). Because of this sharing between providing for instream use, together with providing an allocation to users, a moderate level of effectiveness was assigned.
	Urban conservation	0.08	Urban water users are considered a relatively small water use in the subbasins of concern, except in some specific areas. Also, continued growth in these areas will limit effectiveness of conservation measures. A low effectiveness is assigned.
	Convert water rights	0.32	Under an aggressive program to lease or purchase rights and convert the water to flow downstream, a moderate level of effectiveness is assumed. Realized effectiveness would be a function of opportunity (seen in action intensity).
	Regulate water withdrawals	0.32	This action would implement a more accountable form of monitoring and regulation to better ensure compliance on water withdrawals. A moderate level of effectiveness is assumed.
	Water retention structures	0.08	This action is only applicable to some areas in the Deschutes subbasin. It would place water retention structures in key tributaries to augment flow during low flow periods. The type of structures and their operation remain uncertain and undefined. A low effectiveness is assumed.
	Increase pool habitat (beaver ponds)	0.32	This action would seek to increase pool area habitat (thereby augmenting flow during low flow periods) by facilitating creation of beaver ponds. In areas suitable for such habitat creation, the action should be quite effective. A moderate level of effectiveness is assumed where opportunities exist (specified by the intensity assumption). This action would only be implemented in some areas of the John Day system.
	Floodplain aquifer recharge	0.32	This action would seek to recharge the floodplain aquifer at specific sites and thereby increase flows downstream during periods of low flow. Plan specifics, though not described, suggest a high level of certainty. The level of effectiveness was assumed to be moderate, but realized effectiveness would be limited to opportunities and willingness of land owners.
	H2O rights transfer downstream	0.32	This action would seek to transfer water rights downstream, presumably creating more instream flow within reaches affected by those existing rights. Realized benefits downstream would depend on issues existing in those areas. A moderate level of effectiveness is assumed, but realized benefits would depend on opportunities and arrangements of water rights along the stream corridor.
	Water storage investigate	0.01	This action would be mainly investigative, considering ways of learning new ways of storing water and improving overall efficiency of use in the subbasin. Due to uncertainties, a negligible effectiveness is assumed.
	No new H2O appropriation	0.00	This action would close areas to new water appropriation. While it would protect against increases in water use, it would have no effect on current use.
	Criteria for new H2O appropriation	0.32	This action would set updated criteria to protect flows for fish habitat from new appropriations and it is assumed that it could have a carryover effect to save more water for instream uses than currently allowed. Where opportunities exist, it is assumed to have a moderate effectiveness (though a low intensity of likely opportunities for water savings would make realized effectiveness very small).

Table H-3B. Action effectiveness values.

Strategy	Action	Effect.	Rationale/comment
	Enhance hyporheic flows	0.08	This action would seek to enhance hyporheic flows and flows in springs. Uncertainty in action details result in this action being assigned a low effectiveness. These types of projects are highly experimental in nature with uncertain expected results.
	Recharge shallow aquifers	0.08	This action would seek to recharge shallow aquifers. Uncertainty in action details result in this action being assigned a low effectiveness. Plan specifics state that certainty of outcome is undetermined. These types of projects are highly experimental in nature with uncertain expected results.
	Aquifer storage & recovery	0.08	This action would seek to improve aquifer storage and recharge. Plan specifics state that the effectiveness of the action is "unknown." A low effectiveness is assumed.
	Umatilla Basin Project Phase I and II	0.32	Phase I and II of the Umatilla Basin Project are currently meeting certain critical flow needs in the mainstem of the Umatilla River. The program would be continued under this action. Target flows for the Umatilla River mainstem were established as part of the Basin Project to meet essential life history needs of Chinook and coho salmon and steelhead. The Basin Project as currently implemented does not provide adequate water to meet the target flows throughout all of the times needed by these species, and fails to provide any flow mitigation for a significant length of the river in July and August. It is assumed that project effectiveness under this action is moderate (see additional details spelled out in the Umatilla subbasin plan).
	Umatilla Basin Project Phase III	0.32	Phase I and II of the Umatilla Basin Project are currently meeting certain critical flow needs in the mainstem of the Umatilla River. Target flows for the Umatilla River mainstem were established as part of the Basin Project to meet essential life history needs of Chinook and coho salmon and steelhead. Phases 1 and II do not provide adequate water to meet the target flows throughout all of the times needed by these species, and fails to provide any flow mitigation for a significant length of the river in July and August. Phase III would keep a substantial amount of Umatilla River water instream. This action is assigned a moderate level of effectiveness (combined with Phase I and II action, it would result in an overall effectiveness of moderately high).
	ISWRs	0.32	While instream water rights (ISWRs) have been established on many of the important spawning and rearing stream in the Umatilla and Walla Walla subbasins, some have not. Where important spawning and rearing streams have not been protected by instream water rights, appropriate instream flow studies would be conducted and instream water rights applied for. It is assumed that a moderate level of effectiveness for this action would result.
7. Improve degraded water quality			
	Manage irrigation return flow	0.08	This action would consist of measures to reduce irrigation return flow to streams--or improve its quality--to reduce extreme water temperatures. This action is assigned a low effectiveness due to strong influence of other factors affecting high water temperatures in the subbasins of interest. Types of measures to minimize return flows are listed as use of cover crops, straw mulch, and grass filter strips (Middle Deschutes Local Advisory Committee 2006).
	Measures to improve DO	0.08	This action would consist of measures to reduce unnatural factors that affect dissolved oxygen levels in the streams of interest. This action is assigned a low effectiveness due to strong influence of other factors affecting nutrient loading, flow levels, water temperatures and related oxygen levels in the subbasins of interest.

Table H-3B. Action effectiveness values.

Strategy	Action	Effect.	Rationale/comment
	Reduce chemical pollution	0.32	This action addresses chemical (e.g., pesticides) pollution related to agricultural practices in the Fifteenmile, Deschutes, and John Day subbasins. Actions specified in the plan state that levels reaching streams are generally unknown and need to be determined. The plan also states that certainty of outcome of treatment is moderate to high (depending on subbasin). Action effectiveness assigned here is moderate. Realized effectiveness would be determined by the intensity of application of the action (but given uncertainties in where and when the problem is occurring, a low intensity is applied.
	Implement Ag WQP	0.32	This action calls for implementation of an agricultural water quality plan in the Fifteenmile and Deschutes subbasins. The plans are locally-driven area-wide plans that address agricultural water quality problems while providing a regulatory backstop. The plans provide landowner flexibility in solving local water quality issues. Enforcement is not a primary method for assuring success, although compliance is a component. The planning teams responsible for Section 9 (this plan) expect certainty of outcome to be high in both basins and suggest a significant degree of success. A moderate level of effectiveness is assumed here in both subbasins (with a high level of intensity of application).
	TMDL monitoring	0.08	This action utilizes TMDL monitoring to help trigger the formulation of management plans to address specific water quality issues. All of the issues that might trigger a TMDL response management plan are addressed through other actions in this suite of actions. Therefore, an effectiveness of low is assigned to this action as an add-on effect, presuming that TMDL monitoring will aid in making other actions more effective.
	Reduce mine discharge toxicants	0.32	This action addresses past mining in the John Day subbasin. The action is described by the planning team as having a high certainty of outcome, although it would be contingent upon adequate maintenance of needed components. The action would require long term implementation. An effectiveness of moderate is assumed given uncertainties associated with long-term maintenance.
	Animal feeding BMPs	0.56	This action is aimed at a small number of feedlots in the John Day subbasin, which operate in conjunction with use of riverside meadows for winter feeding operations. The plan (Section 9) states that certainty of outcome, once a treatment has been agreed upon, is high. A moderately high effectiveness level is assigned to the action.
	Point source pollution controls	0.56	This action addresses point source pollutants in the Umatilla and Walla Walla subbasins. It primarily targets chemical pollutants. The planning team (Section 9) identified a high certainty of outcome. Because point sources are easier to control than non-point sources, and means have been identified for assessing load levels in streams of concern, a high effectiveness is assigned here.
	H2O quality mgmt plans	0.32	This action that addresses water quality issues is specified to be applied in the Umatilla and Walla Walla subbasins. It is not specifically stated to be an Agricultural Water Quality Plan (implemented through provisions of Senate Bill 1010) but presumably it could be. See related rationale for effectiveness under "Implement Ag WQP" above. The planning teams that outlined this action (Section 9) identified the degree of implementation for this action to be uncertain in both subbasins but suggested a moderate level of success. The level of effectiveness assumed here is moderate (realized effectiveness will be a function of implementation intensity, which here is also assumed to be moderate).

Table H-3B. Action effectiveness values.

Strategy	Action	Effect.	Rationale/comment
	Pest mgmt plans for fruit growers	0.32	This action addresses fruit pests in the Walla Walla subbasin. It is assumed here that it encompasses all aspects described below for "Implement IFPnet plans." A moderate level of effectiveness is assumed.
	Municipal stormwater mgmt	0.32	This action addresses municipal stormwater management in the Walla Walla basin. Technology for managing stormwater runoff in municipalities is developed in general and can be applied. The level of effectiveness is related to some degree by how aggressive a program is designed to be. The planning team (Section 9) stated that the outcome of implementation is uncertain. Part of this uncertainty may be related to the human population growth in the targeted areas. A moderate level of effectiveness is assumed here because of the relatively small areal extent of urbanization in the targeted subbasins relative to the extent in other areas of the Pacific Northwest. Effectiveness is likely to be related to the extent of urbanization and remains essentially experimental (Konrad 2003).
	Waterway alteration permitting	0.00	This action would require permitting of waterway alteration activities, presumably that are expected in the mainstem Walla Walla River. "Waterway alteration" means any action that will result in excavation, dredging, filling, rechannelization, construction, or any other type of modification of an aquatic habitat areas occupied by ESA-listed species that will affect the conservation value of that habitat. Under Section 9 of this document, it states "While permit processes implemented by the US Army Corps of Engineers are thorough and actions authorized are protective of aquatic resources, the program lacks personnel resources to insure that terms and conditions of permitted actions are followed. In addition, this agency lacks resources to adequately monitor waterways for non-permitted actions or act upon non-permitted situations reported by other agencies or private parties." This action is meant to provide protection against presumed future waterway alterations in the Walla Walla River. As such, an effectiveness of "no effect" is assigned here that would benefit habitat values.
	Permitting for H2O quality activities	0.00	This action would provide for improved permitting and enforcement of activities that might degrade water quality in the Walla Walla subbasin. The action is only relevant in the present analysis if other actions (such as build-out) are to be analyzed that would degrade water quality, in which case the action would serve protect. As such, an effectiveness of "no effect" is assigned here that would benefit habitat values.
8. Restore upland processes to reduce erosion			
	Convert till farming	0.32	Conversion to no till farming would reduce sediment loading to streams. Replacement of conventional tillage systems for dryland wheat production with new methods, such as direct seed/no till systems, is known to reduce sediment delivery to streams from these typically highly erodible soils. This action would seek to achieve a 95% conversion in targeted areas. A moderate level of effectiveness is assumed though available information is not readily available on effectiveness; realized effectiveness will be strongly driven by the overall scope and distribution of targeted areas.
	Convert to perennial crops	0.32	This action would entail shifting from annual grains to perennial crops in order to reduce erosion. The scope of the action is uncertain but it potentially could produce a significant reduction in sediment delivery to streams. A moderate level of effectiveness was assumed; realized effectiveness will be strongly driven by the overall scope and distribution of targeted areas.
	Implement IFPnet plans	0.32	This action is aimed at promoting use of less toxic pesticides in the concentrated fruit orchards of the Fifteenmile subbasin. The program is described in Cockrum and Omeg (2003). A moderate level of effectiveness is assumed on reported results. Note: action should more correctly be placed under Strategy 7.

Table H-3B. Action effectiveness values.

Strategy	Action	Effect.	Rationale/comment
	Improve/remove forest roads	0.32	Roads are a major source of sediment in managed watersheds. Road closures, obliteration, and improvements known to be effective at reducing sediment loading to streams. A moderate level of effectiveness is assumed; realized effectiveness will be strongly driven by the amount of roads closed or improved (defined by the intensity factor).
	Reforest/fuels management	0.32	This action calls for improvements in fuels management and should overtime reduce potential erosion of soils and sediment delivery to streams. Intensive application should provide a moderate level of effectiveness.
	Upland demo projects	0.32	This action calls for demonstration projects to show the benefits of new concepts in land management, thus their scale of implementation is necessarily small. In areas where implemented, it can be assumed that they should demonstrate benefits, hence a moderate level of effectiveness is assumed.
	BMPS to reduce soil erosion	0.32	Best management practices to promote improved land use practices are generally known and further improvements in understanding can be expected in the near future as there are on-going studies to address this issue. A moderate effectiveness is reasonable to expect as a result of continued progress in how lands are being managed. It is expected that land owners will over time improve their practices in the uplands. (This action is essentially the same as "BMPs on land uses" - the two actions are called for in different subbasins.)
	Remove junipers	0.32	Western juniper has increased in abundance in eastern Oregon due to changes in land use management practices, principally reduction in fire. Juniper removal is one management technique to reduce the density of junipers. Because of the water use of junipers, groundwater levels have been affected (even significantly) where junipers are in high abundance. Removal of junipers has been shown to have a significant effect on water yield where removal is extensive. This can also change vegetation patterns and species, promoting grasses and reducing erosion. It is assumed that effectiveness is moderate when removal occurs on a large enough scale. See for example http://egov.oregon.gov/ODF/AGENCY_AFFAIRS/Juniper_Story.shtml and http://www.oregon.gov/OPSW/stories/lakes_basin.shtml
	Restore native upland plants	0.32	This action would seek to restore natural assemblages of plant species in upland communities, promoting more natural hydrographs and improved erosion control. When intensively conducted, a moderate effectiveness is assumed.
	Invasive plant mgmt & junipers	0.32	This action would combine activities in the two actions above, affording improved erosion control and more natural water yield patterns. When intensively conducted, a moderate effectiveness is assumed.
	BMPs on land uses	0.32	Best management practices to promote improved land use practices are generally known and further improvements in understanding can be expected in the near future as there are on-going studies to address this issue. A moderate effectiveness is reasonable to expect as a result of continued progress in how lands are being managed. It is expected that land owners will over time improve their practices in the uplands.
	CREP & CCRP buffers	0.32	This action would implement a Continuous Conservation Reserve Program and a Conservation Reserve Enhancement Program for streamside buffers, affording voluntary, non-competitive, programs for agricultural landowners built on financial incentives. Voluntary participation by local landowners is sought through a cost share program designed to restore and enhance habitat and increase bank stability along waterways on private lands with a cropping history. It is implemented in areas with highly erodible soils. When implemented fully, it should be quite effective, here it was assumed to have a moderate effectiveness (vs. a higher effectiveness) due to uncertainties in reported results that were reviewed.

Table H-3B. Action effectiveness values.

Strategy	Action	Effect.	Rationale/comment
	Outreach to upland users	0.32	Education and on-going interactions with upland land owners is deemed critical to restore vegetation and reduce erosion. Where intensively implemented, an add-on benefit is assumed, producing a greater effectiveness to targeted practices for reducing erosion. A moderate level of effectiveness is assumed.

Table H-4A and B. Action implementation intensity assumptions and levels applied in analysis (A) and corresponding intensity scalars assigned to each action with rationale/comments (B). See Section 10 for how intensity scalars were applied.

Table H-4A. Action implementation intensity levels.

Intensity level	Definition	Scalar
1	Very high	0.85
2	High	0.40
3	Moderate	0.15
4	Low	0.05
5	Negligible	0.02
6	None	0.00

Table H-4B. Action implementation intensity scalars.

Strategy	Action	Scalar	Rationale/comment
1. Protect/conserve ecological processes			
	Acquisition/conservation	0.05	Areas to be acquired or conserved for habitat values will likely be low relative to the sheer size of areas designated to encompass set-asides.
	Protect rare functioning habitats	0.15	Reasonable attempts would be made to fully protect rare functioning habitats where opportunities exist; assume moderate intensity.
	BMPs to conserve eco processes	0.15	Moderate intensity overall would be reasonable to expect for realizing BMPs in conserving ecological processes.
	Cooperative Agreements	0.40	A high intensity of implementation would be prudent in initiating new cooperative agreements.
	Special mgmt designations	0.05	New Special Management Designations are not expected to exceed a low intensity of implementation.
	Increase wild-scenic status	0.15	New Wild and Scenic Status could likely not be expected to exceed a moderate intensity of implementation.
	Protect access to key habitats	0.00	Issue is covered completely by other actions as this action was described; not given an intensity value here.
	Outreach to users and managers	0.05	Low intensity of implementation is expected for this action because education can be expected to accompany other line item actions.
	Public lands protection	0.05	Protection of public lands are integral part of various other actions within the action list; a low intensity of additional implementation is afforded this action as an add-on to the other actions.
	Waterway setbacks	0.15	Moderate intensity overall would be reasonable to expect for initiating new waterway setbacks in targeted stream segments.
	Enforce floodplain regs	0.15	Moderate intensity overall would be reasonable to expect for implementing new activities designed to enforce floodplain regulations.
	Natural Area Overlay Zone	0.15	Moderate intensity overall would be reasonable to expect for realizing BMPs in conserving ecological processes.
	Legislate priority areas	0.02	A very low (negligible) level of intensity is envisioned in legislating new priority measures. This measure is largely investigative. Many other avenues are considered to be in place or proposed for action to address such issues.
2. Restore fish passage blocked/impaired by barriers			
	Barrier removal	--	All barriers identified in Section 9 to be addressed would be targeted for action.
	Add irrigation screening	0.85	A very high level of intensity of implementation is assumed to add irrigation screening where it is currently lacking.

Table H-4B. Action implementation intensity scalars.

Strategy	Action	Scalar	Rationale/comment
	Pelton Round Butte passage	--	Passage will be implemented at the Pelton Round Butte complex; it is also assumed that passage will be implemented at diversion barriers in Whychus Creek.
	Upgrade irrigation screening	0.40	A high level of implementation intensity overall would be prudent to expect for upgrading screens as they are determined to be under performing.
	Reduce push up dams	0.40	A high level of implementation intensity overall would be prudent to address push up dams in selected stream segments.
	Fish ladder construction	--	This matter is addressed under Barrier removal above.
	Maintain passage facilities	--	It is expected that efforts will be sufficiently implemented to maintain passage facilities in good working condition.
3. Restore floodplain connectivity and function			
	Reconnect floodplain	0.15	A moderate level of implementation intensity overall is reasonable to expect for reconnecting floodplain habitats in selected stream segments.
	Reconnect side channels	0.15	A moderate level of implementation intensity overall is reasonable to expect for reconnecting side channels in selected stream segments.
	Reintroduce beaver	0.15	A moderate level of implementation intensity overall is reasonable to expect for restoring beaver populations as watershed functions are gradually restored, and more normative stream channel and floodplain conditions are restored.
	Restore wet meadows	0.15	A moderate level of implementation intensity overall is reasonable to expect for restoring wet meadows in selected stream segments as related watershed functions are gradually restored.
	Dike removal	0.15	A moderate level of implementation intensity overall is reasonable to expect for dike removal in selected stream segments as watershed function gradually restored.
	Manage beavers	0.05	A low level of implementation intensity is assumed to be needed for beaver management. Uncertainty about issues related to effects of beavers on private properties in the targeted areas exist, however.
4. Restore degraded channel structure/complexity			
	Restore natural channel form	0.15	A moderate level of implementation intensity overall is reasonable to expect for restoring channel form in selected stream segments as related watershed functions are gradually restored.
	Large wood enhancement	0.15	A moderate level of implementation intensity overall is reasonable to expect for actively enhancing large wood quantities in the active channel in selected stream segments (in conjunction with related actions such as LWD education).
	Add structure	0.15	A moderate level of implementation intensity overall is reasonable to expect for adding a diversity of structure to selected stream reach segments.
	Stabilize streambanks	0.15	A moderate level of implementation intensity overall is reasonable to expect for stabilizing streambanks in selected stream segments.
	Build pool weirs	0.02	Because this action frequently is ineffective, only a very low (negligible) level of implementation intensity overall is expected in selected stream segments.
	BMP bridge maintenance	0.02	A low level of implementation is assigned to this action (note: the author of the analysis subsequently concluded that a high level of intensity would be prudent for this action - though this would have an inconsequential effect on the overall analysis due to the very low effectiveness assigned to this action).
	LWD education	0.15	A moderate level of implementation intensity overall is reasonable to expect for providing LWD education in areas targeted for restoration.

Table H-4B. Action implementation intensity scalars.

Strategy	Action	Scalar	Rationale/comment
5. Restore riparian condition and LWD recruitment			
	Restore riparian communities	0.40	A high level of implementation intensity overall should be pursued for this action, as riparian integrity is deemed so important for the overall health of the stream and its populations. Riparian restoration has a very high effectiveness.
	Improve grazing practices	0.15	A moderate level of implementation intensity overall is prudent to expect for improving grazing practices in areas targeted for restoration work.
	Eradicate invasive plants	0.15	A moderate level of implementation intensity overall is reasonable to expect for eradicating invasive plants in areas targeted for restoration work.
	Fencing	0.40	A high level of implementation intensity overall should be pursued for this action in stream segments with opportunities for restoration. Fencing is an effective tool for restoring riparian zones. Riparian restoration has a very high effectiveness.
	Off-stream livestock watering	0.15	A moderate level of implementation intensity overall is prudent to expect for achieving off-stream livestock watering.
	Riparian plantings	0.15	A moderate level of implementation intensity overall is reasonable to expect for using riparian plantings in selected stream segments.
	Increase riparian shading	0.15	A moderate level of implementation intensity overall is reasonable to expect using various means to increase riparian shading in selected stream segments.
	No cultivation buffer zones	0.05	A low level of implementation is assigned to this action due to uncertainties about opportunities for establishing no cultivation buffers.
	Maintain RHCAs on USFS lands	0.85	A high level of implementation intensity overall should be pursued for this action in stream segments targeted with USFW lands.
	Remove riparian roads	0.15	A moderate level of implementation intensity overall is prudent to expect for removal of riparian roads in the stream segments targeted.
	Riparian protection	0.15	A moderate level of implementation intensity overall is prudent to expect protecting riparian areas associated with new riparian measures.
6. Restore natural hydrograph components			
	Ag water conservation	0.15	A moderate level of implementation intensity overall is prudent to expect for initiating new water conservation measures on agricultural lands. This action includes application and not conveyance systems.
	Improve irrigation conveyance	0.40	A high level of implementation intensity overall is warranted for improving irrigation conveyance as an effective way of reducing leakage/loss of water in arid areas selected for restoration work.
	Orchard Ridge/Wolf Run	0.85	A very high level of implementation intensity overall is assumed for completion of these two irrigation systems in Fifteenmile subbasin.
	Urban conservation	0.15	A moderate level of implementation intensity overall is assumed for urban water conservation measures.
	Convert water rights	0.05	A low level of implementation intensity is assigned to this action due to uncertainties about opportunities.
	Regulate water withdrawals	0.40	A high level of implementation intensity overall is warranted for monitoring and regulating water withdrawals consistent with laws, regulations, and agreements.
	Water retention structures	0.05	A low level of implementation intensity is assigned to this action due to uncertainties about opportunities.
	Increase pool habitat (beaver ponds)	0.05	A low level of implementation intensity is assigned to this action due to uncertainties about opportunities that would likely have the desired result for augmenting stream flow.

Table H-4B. Action implementation intensity scalars.

Strategy	Action	Scalar	Rationale/comment
	Floodplain aquifer recharge	0.05	A low level of implementation intensity is assigned to this action due to uncertainties about opportunities that would likely have the desired result for augmenting stream flow. The action is seen as being highly experimental.
	H2O rights transfer downstream	0.15	A moderate level of implementation intensity overall is prudent to expect for transfer of water rights downstream, if opportunities avail themselves to implementation.
	Water storage investigate	0.02	This action would be mainly investigative, considering ways of learning new ways of storing water and improving overall efficiency of use in the subbasin. Due to uncertainties, a negligible intensity of implementation is assumed here. Other actions would serve the same purpose and are included with higher intensities.
	No new H2O appropriation	0.00	This action would close areas to new water appropriation. While it would protect against increases in water use, it would have no effect on current use. A zero intensity of implementation would occur that could help restore flow to the stream.
	Criteria for new H2O appropriation	0.05	A low level of implementation intensity is assigned to this action due to uncertainties about real opportunities for new water appropriations.
	Enhance hyporheic flows	0.05	A low level of implementation intensity is assigned to this action due to uncertainties about opportunities that would likely have the desired result for augmenting stream flow. The action is seen as being highly experimental.
	Recharge shallow aquifers	0.05	A low level of implementation intensity is assigned to this action due to uncertainties about opportunities that would likely have the desired result for augmenting stream flow. The action is seen as being highly experimental.
	Aquifer storage & recovery	0.05	A low level of implementation intensity is assigned to this action due to uncertainties about opportunities that would likely have the desired result for augmenting stream flow. The action is seen as being highly experimental.
	Umatilla Basin Project Phase I and II	0.85	A very high level of implementation intensity is assumed in maintaining Phases I and II of the project.
	Umatilla Basin Project Phase III	0.85	A very high level of implementation intensity is assumed in implementing Phase III of the project.
	ISWRs	0.05	A low level of implementation intensity is assigned to this action due to uncertainties about opportunities.
7. Improve degraded water quality			
	Manage irrigation return flow	0.40	A high level of implementation intensity overall is warranted so that irrigators are performing as effectively as they can reasonably do in reducing effects of return flow.
	Measures to improve DO	0.15	A moderate level of implementation intensity overall is prudent to expect for reducing unnatural factors that affect dissolved oxygen in targeted stream segments.
	Reduce chemical pollution	0.05	A low level of implementation intensity is assigned to this action given uncertainties in where and when the problem is occurring.
	Implement Ag WQP	0.40	A high level of implementation intensity overall is expected in the Fifteenmile and Deschutes subbasins in implementing Agricultural Water Quality Plans.
	TMDL monitoring	0.15	A moderate level of implementation intensity is expected for TMDL monitoring in the targeted subbasins.
	Reduce mine discharge toxicants	0.40	A high level of implementation intensity overall is expected to be targeted on known areas of mining pollution in the John Day subbasin.

Table H-4B. Action implementation intensity scalars.

Strategy	Action	Scalar	Rationale/comment
	Animal feeding BMPs	0.15	A moderate level of implementation intensity overall is expected to be targeted on areas used as animal feedlots, as there are only a few sites of concern.
	Point source pollution controls	0.40	A high level of implementation intensity overall should be pursued for this action in targeted stream segments. Point source pollution is readily identifiable and can be addressed through monitoring and attentive solutions.
	H2O quality mgmt plans	0.15	A moderate level of implementation intensity overall is expected in the Umatilla and Walla subbasins in implementing new water quality plans due to uncertainties about participation (as described in Section 9 for this action).
	Pest mgmt plans for fruit growers	0.40	A high level of implementation intensity overall is prudent to expect in targeted stream segments using the IFPnet model developed on in Fifteenmile Creek, based on. The IFP project has grown out of the public's concern over pesticide residues on food, exposure to farm workers, and contamination in the environment (Cockrum and Omeg 2004).
	Municipal stormwater mgmt	0.15	A moderate level of implementation intensity overall is prudent to expect for addressing stormwater runoff in municipal areas given the level of concern that accompanies this in watersheds of the Pacific Northwest as it relates to effects on salmonids (Konrad 2004). Uncertainties exist, however, about effectiveness and approaches are still largely experimental.
	Waterway alteration permitting	--	This action is by intent for protection purposes only -- it provides no restoration purpose. The effectiveness assumption was set to zero, therefore intensity of implementation has no scaling effect in this case.
	Permitting for H2O quality activities	--	This action is by intent for protection purposes only -- it provides no restoration purpose. The effectiveness assumption was set to zero, therefore intensity of implementation has no scaling effect in this case.
8. Restore upland processes to reduce erosion			
	Convert till farming	0.15	A moderate level of implementation intensity overall is prudent to expect for reducing erosion through this action given levels of concern about soil loss and sedimentation of streams in the targeted subbasins.
	Convert to perennial crops	0.15	A moderate level of implementation intensity overall is prudent to expect for reducing erosion through this action given levels of concern about soil loss and sedimentation of streams in the targeted subbasins.
	Implement IFPnet plans	0.40	A high level of implementation intensity overall is prudent to expect in targeted stream segments using the IFPnet model developed on in Fifteenmile Creek, based on. The IFP project has grown out of the public's concern over pesticide residues on food, exposure to farm workers, and contamination in the environment (Cockrum and Omeg 2004).
	Improve/remove forest roads	0.40	A high level of implementation intensity overall is expected for this action in targeted areas of the subbasins. Forest roads are frequently major sources of sediment in streams of the Pacific Northwest, including those in central and northeast Oregon.
	Reforest/fuels management	0.40	A high level of implementation intensity overall is expected for this action in targeted areas of the subbasins. Significant concerns about forest health and fire management exist in the forested portions of watersheds in central and northeast Oregon.
	Upland demo projects	0.02	An overall very low (negligible) implementation intensity is expected for this action given uncertainties about benefits relative to other actions with known benefits.

Table H-4B. Action implementation intensity scalars.

Strategy	Action	Scalar	Rationale/comment
	BMPS to reduce soil erosion	0.40	A high level of implementation intensity is prudent to achieve BMPs on land practices that result in elevated sediment delivery to targeted segments of streams in the designated subbasins (Fifteenmile and Deschutes). The planning teams that described actions in Section 9 identified certainty of outcome for this action as high, indicating a high degree of participation by stakeholders.
	Remove junipers	0.15	A moderate level of implementation intensity is expected to reduce juniper abundance in targeted areas in the Deschutes subbasin. Benefits accrue to water conservation, fire management, and juniper harvesters. See planninhttp://egov.oregon.gov/ODF/AGENCY_AFFAIRS/Juniper_Story.shtml
	Restore native upland plants	0.05	A low level of implementation intensity is assigned to this action due to uncertainties about participation suggested in description of action in Section 9 in the designated subbasins.
	Invasive plant mgmt & junipers	0.05	A low level of implementation intensity is assigned to this action due to uncertainties about participation suggested in description of action in Section 9 in the designated subbasins.
	BMPs on land uses	0.15	A moderate level of implementation intensity is expected to achieve BMPs on land practices associated with a variety of factors afffecting targeted segments of streams in the designated subbasins (John Day, Umatilla, and Walla Walla). The planning teams that described actions in Section 9 identified certainty of outcome for this action as moderate based on uncertainties about extent of voluntary participation by stakeholders.
	CREP & CCRP buffers	0.15	A moderate level of implementation intensity is expected for participation in the CREP and CCRP programs in the Walla Walla subbasin. Walla Walla County has roughly 25% of the CREP for the entire state of Washington, though state funding is currently uncertain.
	Outreach to upland users	0.02	Very low (negligible) intensity of implementation is projected for this action because education can be expected to accompany other line item actions.

Table H-5. Action effectiveness lag scalars applied to habitat actions. Lag scalars are assumed values, representing the expected amount of the potential effectiveness that would be realized 25 years after implementation. A lag scalar value reflects the expected rate that an action's effectiveness will mature with time (e.g., due to tree growth, change in sediment load, reshaping of hydrograph) . All lag scalars were assumed to attain values of 1.0 after 100 years. See Section 10 for how lag scalars were applied.

Table H-5. Action effectiveness lag scalars at 25 years.

Strategy	Action	Scalar
1. Protect/conserve ecological processes		
	Acquisition/conservation	0.50
	Protect rare functioning habitats	0.80
	BMPs to conserve eco processes	0.80
	Cooperative Agreements	0.70
	Special mgmt designations	0.70
	Increase wild-scenic status	0.70
	Protect access to key habitats	0.70
	Outreach to users and managers	0.70
	Public lands protection	0.50
	Waterway setbacks	0.80
	Enforce floodplain regs	0.80
	Natural Area Overlay Zone	1.00
	Legislate priority areas	0.80
2. Restore fish passage blocked/impaired by barriers		
	Barrier removal	1.00
	Add irrigation screening	1.00
	Pelton Round Butte passage	1.00
	Upgrade irrigation screening	1.00
	Reduce push up dams	1.00
	Fish ladder construction	1.00
	Maintain passage facilities	1.00
3. Restore floodplain connectivity and function		
	Reconnect floodplain	0.80
	Reconnect side channels	0.80
	Reintroduce beaver	0.80
	Restore wet meadows	0.70
	Dike removal	0.90
	Manage beavers	0.90
4. Restore degraded channel structure/complexity		
	Restore natural channel form	0.80
	Large wood enhancement	1.00
	Add structure	0.90
	Stabilize streambanks	0.90
	Build pool weirs	1.00
	BMP bridge maintenance	1.00
	LWD education	1.00

Table H-5. Action effectiveness lag scalars at 25 years.

Strategy	Action	Scalar
5. Restore riparian condition and LWD recruitment		
	Restore riparian communities	0.70
	Improve grazing practices	0.80
	Eradicate invasive plants	0.90
	Fencing	0.80
	Off-stream livestock watering	1.00
	Riparian plantings	0.80
	Increase riparian shading	0.80
	No cultivation buffer zones	1.00
	Maintain RHCAs on USFS lands	0.70
	Remove riparian roads	0.90
	Riparian protection	1.00
6. Restore natural hydrograph components		
	Ag water conservation	1.00
	Improve irrigation conveyance	1.00
	Orchard Ridge/Wolf Run	1.00
	Urban conservation	1.00
	Convert water rights	1.00
	Regulate water withdrawals	1.00
	Water retention structures	1.00
	Increase pool habitat (beaver ponds)	0.80
	Floodplain aquifer recharge	0.70
	H2O rights transfer downstream	0.70
	Water storage investigate	1.00
	No new H2O appropriation	1.00
	Criteria for new H2O appropriation	0.80
	Enhance hyporheic flows	0.80
	Recharge shallow aquifers	0.50
	Aquifer storage & recovery	0.70
	Umatilla Basin Project Phase I and II	1.00
	Umatilla Basin Project Phase III	1.00
	ISWRs	1.00
7. Improve degraded water quality		
	Manage irrigation return flow	1.00
	Measures to improve DO	1.00
	Reduce chemical pollution	0.80
	Implement Ag WQP	1.00
	TMDL monitoring	1.00
	Reduce mine discharge toxicants	0.70
	Animal feeding BMPs	1.00
	Point source pollution controls	0.80
	H2O quality mgmt plans	0.80

Table H-5. Action effectiveness lag scalars at 25 years.

Strategy	Action	Scalar
	Pest mgmt plans for fruit growers	0.70
	Municipal stormwater mgmt	0.70
	Waterway alteration permitting	0.70
	Permitting for H2O quality activities	0.70
8. Restore upland processes to reduce erosion		
	Convert till farming	0.80
	Convert to perennial crops	0.80
	Implement IFPnet plans	0.80
	Improve/remove forest roads	0.70
	Reforest/fuels management	0.50
	Upland demo projects	0.80
	BMPS to reduce soil erosion	0.70
	Remove junipers	0.80
	Restore native upland plants	0.70
	Invasive plant mgmt & junipers	0.70
	BMPs on land uses	0.80
	CREP & CCRP buffers	0.70
	Outreach to upland users	0.80

Table H-6. Action implementation schedule scalars at 25 years applied to habitat actions. Implementation schedule scalars define how the schedule for implementing an action—relative to what might be considered year 0 of a recovery program—would affect realized effectiveness in either year 25 or year 100 of the program. Use of this scalar in the analysis recognizes that the recovery programs will be long-term in implementation due to their very extensive scope. The planning teams who described actions (Section 9) specified implementation schedules. See Section 10 for how lag scalars were applied.

Table H-6. Action implementation schedule scalars at 25 years.

Strategy	Action	Fifteenmile	Deschutes	John Day	Umatilla	Walla Walla
1. Protect/conserve ecological processes						
	Acquisition/conservation	0.80	0.96	0.80	0.80	0.80
	Protect rare functioning habitats	0.96	0.96	0.60		0.60
	BMPs to conserve eco processes	0.60	0.60	0.60	0.60	0.60
	Cooperative Agreements		0.80	0.80		
	Special mgmt designations		0.96	0.96		
	Increase wild-scenic status			0.96		
	Protect access to key habitats			0.80		
	Outreach to users and managers			0.60		
	Public lands protection				0.60	0.60
	Waterway setbacks				0.60	0.60
	Enforce floodplain regs				0.60	0.60
	Natural Area Overlay Zone				0.96	0.96
	Legislate priority areas				0.60	0.60
2. Restore fish passage blocked/impaired by barriers						
	Barrier removal	0.60	0.80	0.60	0.96	0.80
	Add irrigation screening	0.80	0.60	0.60	0.60	0.60
	Pelton Round Butte passage		0.80			
	Upgrade irrigation screening		0.60	0.80	0.60	0.60
	Reduce push up dams			0.60		
	Fish ladder construction			0.60	0.80	0.80
	Maintain passage facilities				0.96	0.96
3. Restore floodplain connectivity and function						
	Reconnect floodplain	0.80	0.60	0.60	0.80	0.80
	Reconnect side channels	0.80	0.60	0.60	0.80	0.80
	Reintroduce beaver	0.80	0.60	0.60		
	Restore wet meadows			0.80		
	Dike removal				0.80	0.80
	Manage beavers					0.60
4. Restore degraded channel structure/complexity						
	Restore natural channel form	0.60	0.60	0.60	0.60	0.60
	Large wood enhancement	0.80	0.60	0.80	0.96	0.96
	Add structure	0.80	0.60			
	Stabilize streambanks	0.80	0.60	0.60	0.80	0.80
	Build pool weirs				0.60	0.60
	BMP bridge maintenance					0.60
	LWD education					0.60
5. Restore riparian condition and LWD recruitment						
	Restore riparian communities	0.60	0.60	0.60	0.60	0.60
	Improve grazing practices	0.60	0.60	0.60	0.60	0.60
	Eradicate invasive plants	0.60	0.60			
	Fencing	0.60	0.96		0.60	0.60

Table H-6. Action implementation schedule scalars at 25 years.

Strategy	Action	Fifteenmile	Deschutes	John Day	Umatilla	Walla Walla
	Off-stream livestock watering	0.60	0.60			
	Riparian plantings	0.60				
	Increase riparian shading		0.60	0.60		
	No cultivation buffer zones				0.60	0.60
	Maintain RHCAs on USFS lands				0.60	
	Remove riparian roads				0.60	0.60
	Riparian protection					0.60
6. Restore natural hydrograph components						
	Ag water conservation	0.60	0.80	0.60	0.96	
	Improve irrigation conveyance	0.80	0.96	0.60		0.60
	Orchard Ridge/Wolf Run	0.80				
	Urban conservation	0.80				
	Convert water rights	0.60	0.96	0.60	0.60	0.80
	Regulate water withdrawals	0.60	0.60	0.60	0.60	0.80
	Water retention structures		0.96			
	Increase pool habitat (beaver ponds)			0.60		
	Floodplain aquifer recharge			0.60		
	H2O rights transfer downstream				0.60	0.80
	Water storage investigate					0.60
	No new H2O appropriation					0.60
	Criteria for new H2O appropriation					0.60
	Enhance hyporheic flows					0.96
	Recharge shallow aquifers					0.60
	Aquifer storage & recovery					0.60
	Umatilla Basin Project Phase I and II				0.60	
	Umatilla Basin Project Phase III				0.60	
	ISWRs				0.60	0.60
7. Improve degraded water quality						
	Manage irrigation return flow	0.80	0.60	0.80		
	Measures to improve DO	0.80	0.80			
	Reduce chemical pollution	0.80	0.80	0.80		
	Implement Ag WQP	0.80	0.96			
	TMDL monitoring		0.80	0.80		
	Reduce mine discharge toxicants			0.60		
	Animal feeding BMPs			0.96		
	Point source pollution controls				0.80	0.80
	H2O quality mgmt plans				0.80	0.80
	Pest mgmt plans for fruit growers					0.60
	Municipal stormwater management					0.60
	Waterway alteration permitting					0.80
	Permitting for H2O quality activities					0.80
8. Restore upland processes to reduce erosion						
	Convert till farming	0.96	0.96	0.60		
	Convert to perennial crops	0.60	0.96			
	Implement IFPnet plans	0.80				
	Improve/remove forest roads	0.60	0.60	0.60	0.60	0.60
	Reforest/fuels management	0.60	0.60			
	Upland demo projects	0.80		0.60	0.60	0.60
	BMPS to reduce soil erosion	0.80	0.80			

Table H-6. Action implementation schedule scalars at 25 years.

Strategy	Action	Fifteenmile	Deschutes	John Day	Umatilla	Walla Walla
	Remove junipers		0.96			
	Restore native upland plants		0.60	0.60	0.60	0.60
	Invasive plant mgmt & junipers			0.60		
	BMPs on land uses			0.60	0.60	0.60
	CREP & CCRP buffers					0.80
	Outreach to upland users					0.60

Table H-7. Action implementation schedule scalars at 100 years applied to habitat actions. Implementation schedule scalars define how the schedule for implementing an action—relative to what might be considered year 0 of a recovery program—would affect realized effectiveness in either year 25 or year 100 of the program. Use of this scalar in the analysis recognizes that the recovery programs will be long-term in implementation due to their very extensive scope. The planning teams who described actions (Section 9) specified implementation schedules. See Section 10 for how lag scalars were applied.

Table H-7. Action implementation schedule scalars at 100 years.

Strategy	Action	Fifteenmile	Deschutes	John Day	Umatilla	Walla Walla
1. Protect/conserve ecological processes						
	Acquisition/conservation	0.95	0.99	0.95	0.95	0.95
	Protect rare functioning habitats	0.99	0.99	0.90		0.90
	BMPs to conserve eco processes	0.90	0.90	0.90	0.90	0.90
	Cooperative Agreements		0.95	0.95		
	Special mgmt designations		0.99	0.99		
	Increase wild-scenic status			0.99		
	Protect access to key habitats			0.95		
	Outreach to users and managers			0.90		
	Public lands protection				0.90	0.90
	Waterway setbacks				0.90	0.90
	Enforce floodplain regs				0.90	0.90
	Natural Area Overlay Zone				0.99	0.99
	Legislate priority areas				0.90	0.90
2. Restore fish passage blocked/impaired by barriers						
	Barrier removal	0.90	0.95	0.90	0.99	0.95
	Add irrigation screening	0.95	0.90	0.90	0.90	0.90
	Pelton Round Butte passage		0.95			
	Upgrade irrigation screening		0.90	0.95	0.90	0.90
	Reduce push up dams			0.90		
	Fish ladder construction			0.90	0.95	0.95
	Maintain passage facilities				0.99	0.99
3. Restore floodplain connectivity and function						
	Reconnect floodplain	0.95	0.90	0.90	0.95	0.95
	Reconnect side channels	0.95	0.90	0.90	0.95	0.95
	Reintroduce beaver	0.95	0.90	0.90		
	Restore wet meadows			0.95		
	Dike removal				0.95	0.95
	Manage beavers					0.90
4. Restore degraded channel structure/complexity						
	Restore natural channel form	0.90	0.90	0.90	0.90	0.90
	Large wood enhancement	0.95	0.90	0.95	0.99	0.99
	Add structure	0.95	0.90			
	Stabilize streambanks	0.95	0.90	0.90	0.95	0.95
	Build pool weirs				0.90	0.90
	BMP bridge maintenance					0.90
	LWD education					0.90

Table H-7. Action implementation schedule scalars at 100 years.

Strategy	Action	Fifteenmile	Deschutes	John Day	Umatilla	Walla Walla
5. Restore riparian condition and LWD recruitment						
	Restore riparian communities	0.90	0.90	0.90	0.90	0.90
	Improve grazing practices	0.90	0.90	0.90	0.90	0.90
	Eradicate invasive plants	0.90	0.90			
	Fencing	0.90	0.99		0.90	0.90
	Off-stream livestock watering	0.90	0.90			
	Riparian plantings	0.90				
	Increase riparian shading		0.90	0.90		
	No cultivation buffer zones				0.90	0.90
	Maintain RHCAs on USFS lands				0.90	
	Remove riparian roads				0.90	0.90
	Riparian protection					0.90
6. Restore natural hydrograph components						
	Ag water conservation	0.90	0.95	0.90	0.99	
	Improve irrigation conveyance	0.95	0.99	0.90		0.90
	Orchard Ridge/Wolf Run	0.95				
	Urban conservation	0.95				
	Convert water rights	0.90	0.99	0.90	0.90	0.95
	Regulate water withdrawals	0.90	0.90	0.90	0.90	0.95
	Water retention structures		0.99			
	Increase pool habitat (beaver ponds)			0.90		
	Floodplain aquifer recharge			0.90		
	H2O rights transfer downstream				0.90	0.95
	Water storage investigate					0.90
	No new H2O appropriation					0.90
	Criteria for new H2O appropriation					0.90
	Enhance hyporheic flows					0.99
	Recharge shallow aquifers					0.90
	Aquifer storage & recovery					0.90
	Umatilla Basin Project Phase I and II				0.90	
	Umatilla Basin Project Phase III				0.90	
	ISWRs				0.90	0.90
7. Improve degraded water quality						
	Manage irrigation return flow	0.95	0.90	0.95		
	Measures to improve DO	0.95	0.95			
	Reduce chemical pollution	0.95	0.95	0.95		
	Implement Ag WQP	0.95	0.99			
	TMDL monitoring		0.95	0.95		
	Reduce mine discharge toxicants			0.90		
	Animal feeding BMPs			0.99		
	Point source pollution controls				0.95	0.95
	H2O quality mgmt plans				0.95	0.95
	Pest mgmt plans for fruit growers					0.90

Table H-7. Action implementation schedule scalars at 100 years.

Strategy	Action	Fifteenmile	Deschutes	John Day	Umatilla	Walla Walla
	Municipal stormwater management					0.90
	Waterway alteration permitting					0.95
	Permitting for H2O quality activities					0.95
8. Restore upland processes to reduce erosion						
	Convert till farming	0.99	0.99	0.90		
	Convert to perennial crops	0.90	0.99			
	Implement IFPnet plans	0.95				
	Improve/remove forest roads	0.90	0.90	0.90	0.90	0.90
	Reforest/fuels management	0.90	0.90			
	Upland demo projects	0.95		0.90	0.90	0.90
	BMPS to reduce soil erosion	0.95	0.95			
	Remove junipers		0.99			
	Restore native upland plants		0.90	0.90	0.90	0.90
	Invasive plant mgmt & junipers			0.90		
	BMPs on land uses			0.90	0.90	0.90
	CREP & CCRP buffers					0.95
	Outreach to upland users					0.90

Table H-8. Attribute scalars applied to habitat actions. Attribute scalars define whether the potential effectiveness of an action will be the full amount (scalar = 1) or reduced due to an attribute effect. Some actions have no effect on some attributes (scalar = 0). For each action, attributes were identified as being affected or not affected. A scalar of 1 was assigned to any attribute that would be affected, except for those that characterize some aspect of sediment, flow, and temperature. Scalars for these were set to 0.75, recognizing that these attributes are broadly affected by watershed conditions and can be more difficult to influence than attributes driven mainly by site-specific conditions. See Section 10 for how scalars were applied. See Table H-9 for definitions of attributes.

Table H-8. Attribute scalars.

Strategy	Action	BdScour	BenComRch	ConfineHydro	DisOxy	Emb	FlwDielVar	FlwHigh	FlwIntraAnn	FlwLow	FnSedi	HbOfChFctr	HbPls	Icing	MscToxWat	NutEnrch	Obstr	RipFunc	TmpMonMn	TmpMonMx	TmpSptVar	Turb	WdDeb	Wdrwl	WidthMn	WidthMx
1. Protect/conserve ecological processes																										
	Acquisition/conservation	1.00	1.00	1.00	1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
	Protect rare functioning habitats	1.00	1.00	1.00	1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
	BMPs to conserve eco processes	1.00	1.00	1.00	1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
	Cooperative Agreements	1.00	1.00	1.00	1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
	Special mgmt designations	1.00	1.00	1.00	1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
	Increase wild-scenic status	1.00	1.00	1.00	1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
	Protect access to key habitats						1.00	0.75	0.75	0.75		1.00						1.00								
	Outreach to users and managers	1.00	1.00	1.00	1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00
	Public lands protection	1.00	1.00	1.00	1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
	Waterway setbacks	1.00	1.00	1.00	1.00	0.75		0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
	Enforce floodplain regs	1.00	1.00	1.00	1.00	0.75		0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
	Natural Area Overlay Zone	1.00	1.00	1.00	1.00	0.75		0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
	Legislate priority areas	1.00	1.00	1.00	1.00	0.75		0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
2. Restore fish passage blocked/impaired by barriers																										
	Barrier removal																1.00									
	Add irrigation screening																							1.00		
	Pelton Round Butte passage																1.00									
	Upgrade irrigation screening																							1.00		
	Reduce push up dams	1.00								0.75														1.00		
	Fish ladder construction																1.00									
	Maintain passage facilities																1.00									
3. Restore floodplain connectivity and function																										
	Reconnect floodplain	1.00	1.00	1.00	1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
	Reconnect side channels	1.00	1.00	1.00	1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
	Reintroduce beaver	1.00	1.00	1.00	1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
	Restore wet meadows	1.00	1.00				1.00	0.75	0.75	0.75		1.00		1.00				1.00	0.75	0.75	0.75					

Table H-8. Attribute scalars.

Strategy	Action	BdScour	BenComRch	ConfineHydro	DisOxy	Emb	FlwDielVar	FlwHigh	FlwIntraAnn	FlwLow	FnSedi	HbOfChFctr	HbPls	Icing	MscToxWat	NutEnrch	Obstr	RipFunc	TmpMonMn	TmpMonMx	TmpSptVar	Turb	WdDeb	Wdrwl	WidthMn	WidthMx
	Dike removal	1.00	1.00	1.00	1.00	0.75		0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
	Manage beavers	1.00	1.00	1.00	1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
4. Restore degraded channel structure/complexity																										
	Restore natural channel form	1.00	1.00	1.00	1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
	Large wood enhancement	1.00		1.00						0.75		1.00	1.00								0.75		1.00		1.00	1.00
	Add structure	1.00		1.00						0.75		1.00	1.00								0.75		1.00		1.00	1.00
	Stabilize streambanks	1.00	1.00	1.00	1.00	0.75				0.75	0.75	1.00	1.00	1.00				1.00			0.75	1.00	1.00		1.00	1.00
	Build pool weirs									0.75			1.00													
	BMP bridge maintenance	1.00											1.00													
	LWD education	1.00		1.00						0.75		1.00	1.00								0.75		1.00		1.00	1.00
5. Restore riparian condition and LWD recruitment																										
	Restore riparian communities	1.00	1.00	1.00	1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
	Improve grazing practices	1.00	1.00	1.00	1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
	Eradicate invasive plants									0.75		1.00	1.00					1.00								
	Fencing	1.00	1.00	1.00	1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
	Off-stream livestock watering	1.00	1.00	1.00	1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
	Riparian plantings													1.00				1.00	0.75	0.75	0.75					
	Increase riparian shading													1.00				1.00	0.75	0.75	0.75					
	No cultivation buffer zones	1.00	1.00	1.00	1.00	0.75					0.75							1.00	0.75	0.75	0.75	1.00				
	Maintain RHCAs on USFS lands	1.00	1.00	1.00	1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
	Remove riparian roads	1.00	1.00	1.00	1.00	0.75					0.75							1.00	0.75	0.75	0.75	1.00				
	Riparian protection	1.00	1.00	1.00	1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
6. Restore natural hydrograph components																										
	Ag water conservation		1.00		1.00	0.75	1.00	0.75	0.75	0.75	0.75		1.00			1.00			0.75	0.75	0.75	1.00			1.00	1.00
	Improve irrigation conveyance		1.00		1.00	0.75	1.00	0.75	0.75	0.75	0.75		1.00			1.00			0.75	0.75	0.75	1.00			1.00	1.00
	Orchard Ridge/Wolf Run		1.00		1.00	0.75	1.00	0.75	0.75	0.75	0.75		1.00			1.00			0.75	0.75	0.75	1.00			1.00	1.00
	Urban conservation		1.00		1.00	0.75	1.00	0.75	0.75	0.75	0.75		1.00			1.00			0.75	0.75	0.75	1.00			1.00	1.00
	Convert water rights		1.00		1.00	0.75	1.00	0.75	0.75	0.75	0.75		1.00			1.00			0.75	0.75	0.75	1.00			1.00	1.00
	Regulate water withdrawals		1.00		1.00	0.75	1.00	0.75	0.75	0.75	0.75		1.00			1.00			0.75	0.75	0.75	1.00			1.00	1.00
	Water retention structures		1.00		1.00	0.75	1.00	0.75	0.75	0.75	0.75		1.00			1.00			0.75	0.75	0.75	1.00			1.00	1.00
	Increase pool habitat (beaver ponds)									0.75		1.00	1.00													
	Floodplain aquifer recharge									0.75		1.00		1.00					0.75	0.75	0.75					
	H2O rights transfer downstream		1.00		1.00	0.75	1.00	0.75	0.75	0.75	0.75		1.00			1.00			0.75	0.75	0.75	1.00			1.00	1.00
	Water storage investigate	1.00	1.00		1.00			0.75	0.75	0.75	0.75		1.00			1.00			0.75	0.75	0.75				1.00	
	No new H2O appropriation	1.00	1.00		1.00	0.75	1.00	0.75	0.75	0.75	0.75		1.00			1.00			0.75	0.75	0.75	1.00		1.00	1.00	1.00

Table H-8. Attribute scalars.

Strategy	Action	BdScour	BenComRch	ConfineHydro	DisOxy	Emb	FlwDielVar	FlwHigh	FlwIntraAnn	FlwLow	FnSedi	HbOfChFctr	HbPls	Icing	MscToxWat	NutEnrch	Obstr	RipFunc	TmpMonMn	TmpMonMx	TmpSptVar	Turb	WdDeb	Wdrwl	WidthMn	WidthMx
	Criteria for new H2O appropriation	1.00	1.00		1.00	0.75	1.00	0.75	0.75	0.75	0.75		1.00	1.00		1.00			0.75	0.75	0.75	1.00		1.00	1.00	1.00
	Enhance hyporheic flows	1.00	1.00		1.00	0.75	1.00	0.75	0.75	0.75	0.75		1.00	1.00		1.00			0.75	0.75	0.75	1.00		1.00	1.00	1.00
	Recharge shallow aquifers	1.00	1.00		1.00	0.75	1.00	0.75	0.75	0.75	0.75		1.00	1.00		1.00			0.75	0.75	0.75	1.00		1.00	1.00	1.00
	Aquifer storage & recovery	1.00	1.00		1.00	0.75	1.00	0.75	0.75	0.75	0.75		1.00	1.00		1.00			0.75	0.75	0.75	1.00		1.00	1.00	1.00
	Umatilla Basin Project Phase I and II		1.00		1.00	0.75	1.00	0.75	0.75	0.75	0.75		1.00			1.00			0.75	0.75	0.75	1.00			1.00	1.00
	Umatilla Basin Project Phase III		1.00		1.00	0.75	1.00	0.75	0.75	0.75	0.75		1.00			1.00			0.75	0.75	0.75	1.00			1.00	1.00
	ISWRs	1.00	1.00		1.00	0.75	1.00	0.75	0.75	0.75	0.75		1.00	1.00		1.00			0.75	0.75	0.75	1.00		1.00	1.00	1.00
7. Improve degraded water quality																										
	Manage irrigation return flow		1.00		1.00	0.75	1.00	0.75	0.75	0.75	0.75		1.00			1.00			0.75	0.75	0.75	1.00			1.00	1.00
	Measures to improve DO				1.00					0.75					1.00	1.00		1.00	0.75	0.75	0.75	1.00				
	Reduce chemical pollution				1.00	0.75									1.00	1.00						1.00				
	Implement Ag WQP				1.00					0.75					1.00	1.00		1.00	0.75	0.75	0.75	1.00				
	TMDL monitoring																									
	Reduce mine discharge toxicants														1.00											
	Animal feeding BMPs		1.00		1.00	1.00					1.00					1.00						1.00				
	Point source pollution controls				1.00	0.75									1.00	1.00						1.00				
	H2O quality mgmt plans				1.00	0.75									1.00	1.00			0.75	0.75	0.75	1.00				
	Pest mgmt plans for fruit growers														1.00											
	Municipal stormwater mgmt	1.00	1.00		1.00	0.75	1.00	0.75	0.75	0.75	0.75		1.00			1.00			0.75	0.75	0.75	1.00			1.00	1.00
	Waterway alteration permitting	1.00	1.00	1.00	1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
	Permitting for H2O quality activities				1.00	0.75									1.00	1.00			0.75	0.75	0.75	1.00				
8. Restore upland processes to reduce erosion																										
	Convert till farming	1.00	1.00		1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00		1.00	1.00						1.00			1.00	1.00
	Convert to perennial crops	1.00	1.00		1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00		1.00	1.00						1.00			1.00	1.00
	Implement IFPnet plans				1.00	0.75									1.00	1.00						1.00				
	Improve/remove forest roads	1.00		1.00		0.75	1.00	0.75	0.75	0.75	0.75		1.00					1.00	0.75	0.75	0.75	1.00			1.00	1.00
	Reforest/fuels management	1.00		1.00		0.75	1.00	0.75	0.75	0.75	0.75		1.00					1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00
	Upland demo projects	1.00	1.00		1.00	0.75	1.00	0.75	0.75	0.75	1.00							1.00	0.75	0.75	0.75	1.00			1.00	1.00
	BMPS to reduce soil erosion	1.00		1.00		0.75	1.00	0.75	0.75	0.75	0.75		1.00					1.00	0.75	0.75	0.75	1.00			1.00	1.00
	Remove junipers	1.00	1.00		1.00	0.75	1.00	0.75	0.75	0.75								1.00	0.75	0.75	0.75	1.00			1.00	1.00
	Restore native upland plants	1.00	1.00		1.00	0.75	1.00	0.75	0.75	0.75								1.00	0.75	0.75	0.75	1.00			1.00	1.00
	Invasive plant mgmt & junipers	1.00	1.00		1.00	0.75	1.00	0.75	0.75	0.75								1.00	0.75	0.75	0.75	1.00			1.00	1.00
	BMPs on land uses	1.00	1.00		1.00	0.75	1.00	0.75	0.75	0.75	1.00							1.00	0.75	0.75	0.75	1.00			1.00	1.00
	CREP & CCRP buffers	1.00	1.00	1.00	1.00	0.75	1.00	0.75	0.75	0.75	0.75	1.00	1.00	1.00	1.00	1.00		1.00	0.75	0.75	0.75	1.00	1.00		1.00	1.00

Table H-8. Attribute scalars.

Strategy	Action	BdScour	BenComRch	ConfineHydro	DisOxy	Emb	FlwDielVar	FlwHigh	FlwIntraAnn	FlwLow	FnSedi	HbOfChFctr	HbPls	Icing	MscToxWat	NutEnrch	Obstr	RipFunc	TmpMonMn	TmpMonMx	TmpSptVar	Turb	WdDeb	Wdrwl	WidthMn	WidthMx
	Outreach to upland users	1.00	1.00		1.00	0.75	1.00	0.75	0.75	0.75	1.00							1.00	0.75	0.75	0.75	1.00			1.00	1.00

Table H-9. Definitions of freshwater habitat attributes shown in Table H-8 (shown as attribute codes there). The attributes are applied in EDT analysis.

Attribute code	Attribute name	Definition
BdScour	Bed scour	Average depth and frequency of bed scour of small-cobble/gravel substrates of pool-tail outs, glides, and riffles during high flow events.
BenComRch	Benthos diversity and production	Measure of the diversity and production of the benthos community.
ConfineHydro	Confinement - Hydromodifications	The extent that man-made structures within or adjacent to the stream channel constrict flow (as at bridges) or restrict flow access to the stream's floodplain (due to streamside roads, revetments, diking or levees) or the extent that the channel has been ditched or channelized.
DisOxy	Dissolved oxygen	Average dissolved oxygen within the water column for the specified time interval.
Emb	Embeddedness	The extent that larger cobbles or gravel are surrounded by or covered by fine sediment.
FlwDielVar	Flow - Intra daily (diel) variation	Variability in flow level during a daily period. This attribute is informative mainly for regulated rivers or when flow patterns are influenced by storm water runoff.
FlwHigh	Flow - change in interannual variability in high flows	A measure of between year variation in magnitude of high flow levels and/or the extent of change in overall high flow level during a month relative to an undisturbed watershed of comparable size, geology, and geography.
FlwIntraAnn	Flow - intra-annual flow pattern	The average extent of intra-annual flow variation during a month -- a measure of a stream's "flashiness" during a season.
FlwLow	Flow - changes in interannual variability in low flows	A measure of between year variation in the severity of low flow discharge during a month. Variation in low flows as applied here is relative to an undisturbed watershed of comparable size, geology, and geography.
FnSedi	Fine sediment	Percentage of fine sediment within pool-tailouts and riffles.
HbOfChFctr	Habitat type - off-channel habitat factor	A multiplier used to estimate the amount of off-channel habitat based on the wetted surface area of the all combined in-channel habitat.
HbPls	Habitat type - primary pools	Percentage of the wetted channel surface area comprising pools.
Icing	Icing	Extent (magnitude and frequency) of icing events.
MscToxWat	Miscellaneous toxic pollutants - water column	The extent of miscellaneous toxic pollantants within the water column.
NutEnrch	Nutrient enrichment	The amount of nutrient enrichment consisting of such items as ammonia, nitrogen, phosphorous.
Obstr	Obstructions to fish migration	Obstructions to fish passage by physical barriers (not dewatered channels or hinderances to migration caused by pollutants or lack of oxygen).
RipFunc	Riparian function	A measure of riparian function that has been altered within the reach.

Attribute code	Attribute name	Definition
TmpMonMn	Temperature - daily minimum (by month)	Minimum water temperatures within the stream reach reach during a month.
TmpMonMx	Temperature - daily maximum (by month)	Maximum water temperatures within the stream reach reach during a month.
TmpSptVar	Temperature - spatial variation	The extent of water temperature variation within the reach as influenced by inputs of groundwater.
Turb	Turbidity	The relative extent of turbidity episodes within the stream reach.
WdDeb	Wood	The amount of wood within the reach. Note definition of "large wood" under terms/clarification.
Wdrwl	Water withdrawals	The number and relative size of water withdrawals in the stream reach.
WidthMn	Channel month Minimum width (ft)	Average width of the wetted channel. If the stream is braided or contains multiple channels, then the width would represent the sum of the wetted widths along a transect that extends across all channels.
WidthMx	Channel month Maximum width (ft)	Average width of the wetted channel during peak flow month (average monthly conditions). If the stream is braided or contains multiple channels, then the width would represent the sum of the wetted widths along a transect that extends across all channels.

Out-of-Basin Survival Rates Assumptions

Out-of-subbasin survival rates incorporated into the AHA modeling are listed in Tables H-10 to H-14; their derivation is described below. Each table lists survivals by life stage segment for baseline, current, and prospective future conditions. Prospective future conditions are the scenarios formulated in a stepwise fashion by adding in actions sequentially, each effect being added to the previous scenario (see Table 10-1). Survivals are listed for three life stage segments, followed by the combined survival across the three segments. The survival for each of the three life stage segments encompasses the following:

1. Smolt to smolt (smt-smt) – survival of migrant smolts from the time of departing the subbasin (i.e., entry into the mainstem Columbia River) to the point of immediately downstream of Bonneville Dam;
2. Estuary and ocean (est-ocn) – the smolt to adult survival rate (SAR) covering the entirety of the time spent in the Columbia River estuary (i.e., beginning immediately below Bonneville Dam) and ocean as smolts, sub-adults, and adults; and
3. Adult to adult (adt-adt) – survival of returning adults from the time of departing the Columbia River estuary (i.e., beginning with passage at Bonneville Dam) to the point of entry into the natal subbasin.

Baseline survival rates were formulated from several sources. The baseline smolt to smolt rates were provided for each population by NOAA Fisheries (correspondence between Ritchie Graves and Tracy Hillman dated August 9, 2007). The combined estuary and ocean survival rate was based on an average default value applied in EDT analysis, here rounded to an average of 7.5%. This average rate was applied to each of the populations modeled in AHA. The adult to adult rate was derived by using the survival rate applied in EDT (extracted by analyzing life history trajectories used in EDT modeling) and the average mainstem harvest rate for the baseline period (converted to a survival rate).[1]

The current years survival rates for each life stage segment *k* ($Csurv_k$) then are derived as

$$Csurv_k = Bsurv_k \times \prod m_{i,j}$$

where $Bsurv_k$ is baseline survival rate in life stage segment *k*

$m_{i,j}$ is the survival multiplier for survival factor *i* and scenario *j* (here the scenario is the current condition)

The prospective future years (i.e., including future scenario actions) survival rates for each life stage segment *k* ($Psurv_k$) are then derived as

$$Psurv_k = Csurv_k \times \prod m_{i,j}$$

[1] / The average harvest rate (0.1267) for years 1991-2003 was used for the baseline period, as given in Appendix G of the Comprehensive Analysis dated August 2007.

Table H-10. Out-of-subbasin survival rates applied in AHA modeling for baseline (B), current (C), and prospective future action scenarios for Fifteenmile Creek winter steelhead. Future action scenarios were modeled sequentially, where hydro (Hyd) actions were added to current conditions, predation (Pred) actions were added to hydro, estuarine (Est) actions were added to predation, and harvest (Harv) actions were added to estuarine. Decreased (MarLow) and increased (MarHigh) marine survival rate scenarios were then added to the combined prospective future action scenarios.

Life stage	Scen	Survival multiplier by factor						Scen surv
		Hydro	Avian	Pikemin	Estuary	Harvest	Marine	
Smt-smt	B							0.9140
Est-ocn	B							0.0750
Adt-adt	B							0.8466
Smt-adt	B							**0.0580**
Smt-smt	C	1.031	0.997	1.000				0.9395
Est-ocn	C				1.003		1.000	0.0752
Adt-adt	C					1.043		0.8830
Smt-adt	C							**0.0624**
Smt-smt	Hyd	1.002	1.000	1.000				0.9414
Est-ocn	Hyd				1.000		1.000	0.0752
Adt-adt	Hyd					1.000		0.8830
Smt-adt	Hyd							**0.0625**
Smt-smt	Pred	1.002	1.034	1.010				0.9831
Est-ocn	Pred				1.000		1.000	0.0752
Adt-adt	Pred					1.000		0.8830
Smt-adt	Pred							**0.0653**
Smt-smt	Est	1.002	1.034	1.010				0.9831
Est-ocn	Est				1.057		1.000	0.0795
Adt-adt	Est					1.000		0.8830
Smt-adt	Est							**0.0690**
Smt-smt	Harv	1.002	1.034	1.010				0.9831
Est-ocn	Harv				1.057		1.000	0.0795
Adt-adt	Harv					1.000		0.8830
Smt-adt	Harv							**0.0690**
Smt-smt	MarLow	1.002	1.034	1.010				0.9831
Est-ocn	MarLow				1.057		0.750	0.0596
Adt-adt	MarLow					1.000		0.8830
Smt-adt	MarLow							**0.0518**
Smt-smt	MarHigh	1.002	1.034	1.010				0.9831
Est-ocn	MarHigh				1.057		1.250	0.0994
Adt-adt	MarHigh					1.000		0.8830
Smt-adt	MarHigh							**0.0863**

Table H-11. Out-of-subbasin survival rates applied in AHA modeling for baseline (B), current (C), and prospective future action scenarios for Deschutes River Eastside and Westside summer steelhead. Future action scenarios were modeled sequentially, where hydro (Hyd) actions were added to current conditions, predation (Pred) actions were added to hydro, estuarine (Est) actions were added to predation, and harvest (Harv) actions were added to estuarine. Decreased (MarLow) and increased (MarHigh) marine survival rate scenarios were then added to the combined prospective future action scenarios.

Life stage	Scen	Survival multiplier by factor						Scen surv
		Hydro	Avian	Pikemin	Estuary	Harvest	Marine	
Smt-smt	B							0.7580
Est-ocn	B							0.0750
Adt-adt	B							0.8015
Smt-adt	B							**0.0456**
Smt-smt	C	1.064	0.997	1.000				0.8041
Est-ocn	C				1.003		1.000	0.0752
Adt-adt	C					1.043		0.8360
Smt-adt	C							**0.0506**
Smt-smt	Hyd	1.051	1.000	1.000				0.8451
Est-ocn	Hyd				1.000		1.000	0.0752
Adt-adt	Hyd					1.000		0.8360
Smt-adt	Hyd							**0.0531**
Smt-smt	Pred	1.051	1.034	1.010				0.8826
Est-ocn	Pred				1.000		1.000	0.0752
Adt-adt	Pred					1.000		0.8360
Smt-adt	Pred							**0.0555**
Smt-smt	Est	1.051	1.034	1.010				0.8826
Est-ocn	Est				1.057		1.000	0.0795
Adt-adt	Est					1.000		0.8360
Smt-adt	Est							**0.0587**
Smt-smt	Harv	1.051	1.034	1.010				0.8826
Est-ocn	Harv				1.057		1.000	0.0795
Adt-adt	Harv					1.000		0.8360
Smt-adt	Harv							**0.0587**
Smt-smt	MarLow	1.051	1.034	1.010				0.8826
Est-ocn	MarLow				1.057		0.750	0.0596
Adt-adt	MarLow					1.000		0.8360
Smt-adt	MarLow							**0.0440**
Smt-smt	MarHigh	1.051	1.034	1.010				0.8826
Est-ocn	MarHigh				1.057		1.250	0.0994
Adt-adt	MarHigh					1.000		0.8360
Smt-adt	MarHigh							**0.0733**

Table H-12. Out-of-subbasin survival rates applied in AHA modeling for baseline (B), current (C), and prospective future action scenarios for John Day River summer steelhead populations. Future action scenarios were modeled sequentially, where hydro (Hyd) actions were added to current conditions, predation (Pred) actions were added to hydro, estuarine (Est) actions were added to predation, and harvest (Harv) actions were added to estuarine. Decreased (MarLow) and increased (MarHigh) marine survival rate scenarios were then added to the combined prospective future action scenarios.

Life stage	Scen	Survival multiplier by factor						Scen surv
		Hydro	Avian	Pikemin	Estuary	Harvest	Marine	
Smt-smt	B							0.5850
Est-ocn	B							0.0750
Adt-adt	B							0.7526
Smt-adt	B							**0.0330**
Smt-smt	C	1.103	0.997	1.000				0.6433
Est-ocn	C				1.003		1.000	0.0752
Adt-adt	C					1.043		0.7849
Smt-adt	C							**0.0380**
Smt-smt	Hyd	1.100	1.000	1.000				0.7077
Est-ocn	Hyd				1.000		1.000	0.0752
Adt-adt	Hyd					1.000		0.7849
Smt-adt	Hyd							**0.0418**
Smt-smt	Pred	1.100	1.034	1.010				0.7390
Est-ocn	Pred				1.000		1.000	0.0752
Adt-adt	Pred					1.000		0.7849
Smt-adt	Pred							**0.0436**
Smt-smt	Est	1.100	1.034	1.010				0.7390
Est-ocn	Est				1.057		1.000	0.0795
Adt-adt	Est					1.000		0.7849
Smt-adt	Est							**0.0461**
Smt-smt	Harv	1.100	1.034	1.010				0.7390
Est-ocn	Harv				1.057		1.000	0.0795
Adt-adt	Harv					1.000		0.7849
Smt-adt	Harv							**0.0461**
Smt-smt	MarLow	1.100	1.034	1.010				0.7390
Est-ocn	MarLow				1.057		0.750	0.0596
Adt-adt	MarLow					1.000		0.7849
Smt-adt	MarLow							**0.0346**
Smt-smt	MarHigh	1.100	1.034	1.010				0.7390
Est-ocn	MarHigh				1.057		1.250	0.0994
Adt-adt	MarHigh					1.000		0.7849
Smt-adt	MarHigh							**0.0577**

Table H-13. Out-of-subbasin survival rates applied in AHA modeling for baseline (B), current (C), and prospective future action scenarios for Umatilla River summer steelhead. Future action scenarios were modeled sequentially, where hydro (Hyd) actions were added to current conditions, predation (Pred) actions were added to hydro, estuarine (Est) actions were added to predation, and harvest (Harv) actions were added to estuarine. Decreased (MarLow) and increased (MarHigh) marine survival rate scenarios were then added to the combined prospective future action scenarios.

Life stage	Scen	Survival multiplier by factor						Scen surv
		Hydro	Avian	Pikemin	Estuary	Harvest	Marine	
Smt-smt	B							0.5850
Est-ocn	B							0.0750
Adt-adt	B							0.7577
Smt-adt	B							**0.0332**
Smt-smt	C	1.103	1.000	0.997				0.6433
Est-ocn	C				1.003		1.000	0.0752
Adt-adt	C					1.043		0.7902
Smt-adt	C							**0.0382**
Smt-smt	Hyd	1.100	1.000	1.000				0.7077
Est-ocn	Hyd				1.000		1.000	0.0752
Adt-adt	Hyd					1.000		0.7902
Smt-adt	Hyd							**0.0421**
Smt-smt	Pred	1.100	1.034	1.010				0.7390
Est-ocn	Pred				1.000		1.000	0.0752
Adt-adt	Pred					1.000		0.7902
Smt-adt	Pred							**0.0439**
Smt-smt	Est	1.100	1.034	1.010				0.7390
Est-ocn	Est				1.057		1.000	0.0795
Adt-adt	Est					1.000		0.7902
Smt-adt	Est							**0.0464**
Smt-smt	Harv	1.100	1.034	1.010				0.7390
Est-ocn	Harv				1.057		1.000	0.0795
Adt-adt	Harv					1.000		0.7902
Smt-adt	Harv							**0.0464**
Smt-smt	MarLow	1.100	1.034	1.010				0.7390
Est-ocn	MarLow				1.057		0.750	0.0596
Adt-adt	MarLow					1.000		0.7902
Smt-adt	MarLow							**0.0348**
Smt-smt	MarHigh	1.100	1.034	1.010				0.7390
Est-ocn	MarHigh				1.057		1.250	0.0994
Adt-adt	MarHigh					1.000		0.7902
Smt-adt	MarHigh							**0.0580**

Table H-14. Out-of-subbasin survival rates applied in AHA modeling for baseline (B), current (C), and prospective future action scenarios for Walla Walla River summer steelhead. Future action scenarios were modeled sequentially, where hydro (Hyd) actions were added to current conditions, predation (Pred) actions were added to hydro, estuarine (Est) actions were added to predation, and harvest (Harv) actions were added to estuarine. Decreased (MarLow) and increased (MarHigh) marine survival rate scenarios were then added to the combined prospective future action scenarios.

Life stage	Scen	Survival multiplier by factor						Scen surv
		Hydro	Avian	Pikemin	Estuary	Harvest	Marine	
Smt-smt	B							0.5150
Est-ocn	B							0.0750
Adt-adt	B							0.6818
Smt-adt	B							**0.0263**
Smt-smt	C	1.143	0.997	1.000				0.5869
Est-ocn	C				1.003		1.000	0.0752
Adt-adt	C					1.043		0.7111
Smt-adt	C							**0.0314**
Smt-smt	Hyd	1.122	1.000	1.000				0.6585
Est-ocn	Hyd				1.000		1.000	0.0752
Adt-adt	Hyd					1.000		0.7111
Smt-adt	Hyd							**0.0352**
Smt-smt	Pred	1.122	1.034	1.010				0.6877
Est-ocn	Pred				1.000		1.000	0.0752
Adt-adt	Pred					1.000		0.7111
Smt-adt	Pred							**0.0368**
Smt-smt	Est	1.122	1.034	1.010				0.6877
Est-ocn	Est				1.057		1.000	0.0795
Adt-adt	Est					1.000		0.7111
Smt-adt	Est							**0.0389**
Smt-smt	Harv	1.122	1.034	1.010				0.6877
Est-ocn	Harv				1.057		1.000	0.0795
Adt-adt	Harv					1.000		0.7111
Smt-adt	Harv							**0.0389**
Smt-smt	MarLow	1.122	1.034	1.010				0.6877
Est-ocn	MarLow				1.057		0.750	0.0596
Adt-adt	MarLow					1.000		0.7111
Smt-adt	MarLow							**0.0292**
Smt-smt	MarHigh	1.122	1.034	1.010				0.6877
Est-ocn	MarHigh				1.057		1.250	0.0994
Adt-adt	MarHigh					1.000		0.7111
Smt-adt	MarHigh							**0.0486**

Part 2: Summaries of Diagnostic Reports

A series of graphic reports are presented here giving additional information about the predicted outcomes of the subbasin habitat scenarios analyzed in Section 10. These reports are extracted from output produced by EDT.

Summaries from three different EDT reports are provided for each steelhead population. The first report—the Baseline Diagnostic Report—summarizes basic diagnostic information for each population under baseline habitat conditions within the relevant subbasin. It is based on a comparison of habitat conditions within the baseline period to the pre-development state (see Lichatowich et al. 1995). Some of this information served as the basis of parts of the diagnostic summaries described in Section 8 of this report. The baseline diagnostic report serves here to help illustrate—in conjunction the other reports described below—the extent that subbasin habitat factors responsible for changes in population performance are expected to be affected by the proposed habitat scenarios. It shows the relative extent that population performance has been affected by habitat changes (due to land and water uses) within each individual stream reach or geographic area within the subbasin.[2] One aspect of the report displays the potential benefits of full restoration or full protection (i.e., avoiding future habitat degradation) for each stream reach or geographic area. This report (together with a more detailed presentation in the full EDT output) summarizes the limiting factors analysis produced by the EDT model.

The second report—the Scenario Profile Report—summarizes the extent of changes to the habitat factors expected to result from a habitat action scenario once implemented within a subbasin. It identifies the relative gain (or loss in some cases) in population performance that would occur as a result of the scenario's effect within the subbasin. The extent of changes to population performance are shown for the scenario's effects within each stream reach or geographic area.

The third report—the Scenario Diagnostic Report—is like the baseline diagnostic report, only instead of comparing the baseline to the pre-development state, it compares the habitat scenario to the pre-development condition. It identifies the geographic areas and habitat factors that would be expected to still be inhibiting population performance after action implementation relative to the pre-development habitat condition. The report is essentially a limiting factors analysis of the habitat as it is predicted to exist following implementation and maturation of effects of the habitat scenario. As such, it helps identify areas/factors where additional habitat actions might be considered. Hence, it can serve to further refine proposed actions as a part of future planning efforts.

Each report consists of two figures. The first one is a "tornado chart" displaying the potential benefits from restoration or protection actions—or in the case of the Scenario Profile Report the

[2] / The spatial scale used in this report was defined by the individuals who did the original EDT analysis for subbasin planning. In some cases, individuals grouped stream reaches into geographic areas for the sake of simplifying the diagnosis. In some subbasins, reaches were not grouped in such a manner. The graphic reports presented in this appendix employ whatever scale was used in subbasin planning. For definitions of stream reaches or geographic areas, see the appropriate subbasin report.

relative gain/loss of the habitat scenario. Geographic areas near the top of the chart offer the highest potential for gain in performance (or that would result in the highest gain in the Scenario Profile Report). The charts show an assigned level of benefit, listed as A through E, where A areas are those the greatest amount of benefit and D and E provide essentially no benefit. The charts also show the expectation of amount of benefit/loss in population performance as the percentage of increase or decrease in a particular performance measure. (See Section 10 for definitions of performance measures.)

Each tornado chart is followed by a second figure giving a summary of the diagnostics for the various habitat factors affecting survival within each stream reach or geographic area. This chart summarizes where and what factors are most responsible for the loss in population performance. For the Scenario Profile Report, it shows the relative extent that each factor is expected to be affected by the scenario as pertaining to population performance. The chart is meant only to be a summary snapshot of the effects of each factor (or the effects on each factor for the Scenario Profile Report).

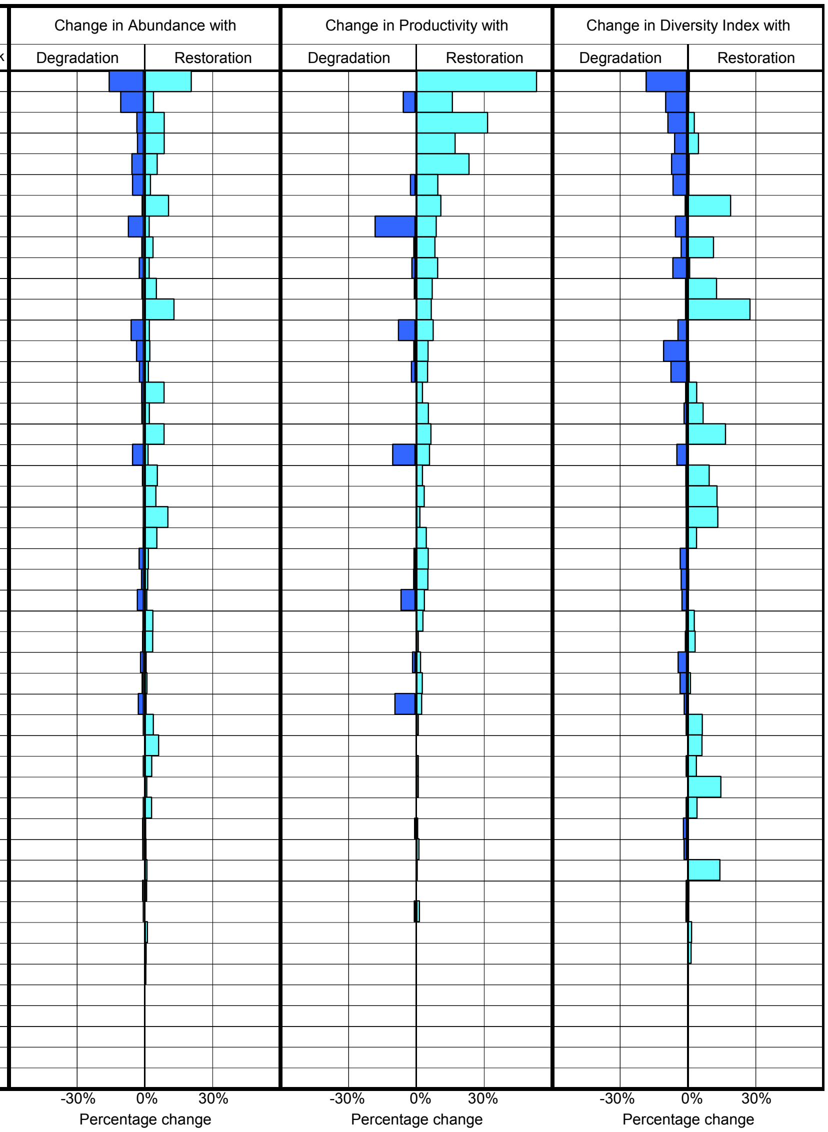
Results for the habitat scenario consisting of all subbasin actions (both Priority 1 and 2) at 100 years are presented. For the Deschutes westside population, results are shown passage provided at the Pelton-Round Butte Complex.

Baseline Diagnostic Report – Tornado Chart

Fifteenmile Creek Winter Steelhead

Relative Importance Of Geographic Areas For Protection and Restoration Measures - current condition

Geographic Area	Protection benefit Category/rank		Restoration benefit Category/rank	
Eightmile Cr-8	A	5	A	5
Ramsey Cr-4	A	1	B	15
Fifteenmile Cr-9	B	11	A	6
Fivemile Cr-4	B	14	A	3
Ramsey Cr-3	B	9	B	10
Eightmile Cr-10	A	5	C	17
Fivemile Cr-3	D	23	A	1
Fifteenmile Cr-12	A	2	C	23
Fifteenmile Cr-8	C	18	B	8
Fifteenmile Cr-11	B	10	C	18
Fifteenmile Cr-7	D	21	B	7
Fifteenmile Cr-5	E	28	A	2
Fifteenmile Cr-13	A	3	C	28
Fivemile Cr MF-1	B	7	C	26
Eightmile Cr-7	B	8	C	26
Fifteenmile Cr-3	D	23	B	13
Ramsey Cr-1	D	20	B	16
Eightmile Cr-6	E	33	A	4
Fifteenmile Cr-14	A	3	D	34
Fivemile Cr-1	E	27	B	12
Fifteenmile Cr-6	E	30	B	11
Fifteenmile Cr-4	E	36	B	9
Eightmile Cr-3	E	33	B	14
Eightmile Cr-9	C	16	D	32
Fifteenmile Cr-10	C	17	D	31
Fifteenmile Cr-16	B	12	D	36
Fivemile Cr-2	E	30	C	19
Eightmile Cr-4	E	26	C	25
Cedar Cr	B	14	D	38
Ramsey Cr-2	C	19	D	33
Fifteenmile Cr-15	B	13	D	40
Eightmile Cr-5	E	37	C	21
Eightmile Cr-13	E	41	C	19
Eightmile Cr-2	E	38	C	22
Dry Cr-2	E	40	C	23
Eightmile Cr-1	E	35	C	28
Fivemile Cr SF-1	D	22	E	44
Ramsey Cr-6	D	25	E	41
Dry Cr-1	E	39	C	28
Fifteenmile Cr-1	E	29	D	39
Eightmile Cr-12	E	32	E	41
Ramsey Cr-7	E	41	D	35
Fivemile Cr MF-2	E	41	D	37
Ramsey Cr-5	E	41	E	43
Eightmile Cr-11	E	41	E	45
Eightmile Cr-14	E	41	E	45
Fifteenmile Cr-2	E	41	E	45
Fivemile Cr MF-3	E	41	E	45
Ramsey Cr-8	E	41	E	45



Baseline Diagnostic Report – Diagnostic Summary

Fifteenmile Creek Winter Steelhead
Protection and Restoration Strategic Priority Summary - current condition

Geographic area priority			Attribute class priority for restoration															
Geographic area	**Protection benefit**	**Restoration benefit**	*Channel stability*	*Chemicals*	*Competition (w/ hatch)*	*Competition (other sp)*	*Flow*	*Food*	*Habitat diversity*	*Harassment/poaching*	*Obstructions*	*Oxygen*	*Pathogens*	*Predation*	*Sediment load*	*Temperature*	*Withdrawals*	*Key habitat quantity*
Fifteenmile Cr-1							B		C			C	B	C	C	B		C
Fifteenmile Cr-2																		
Fifteenmile Cr-3		B	C				B	C	B	C		B	B		A	A		C
Eightmile Cr-1		C	C		C		B	C	B	C			B		B	A		C
Fivemile Cr-1		B	B		C		B	C	B	B			B			A		B
Fivemile Cr-2		C	B				B	C	B	C			B	C		A	B	B
Fivemile Cr-3		A	B		C		B	C	B	B			B	C		A	B	B
Fivemile Cr-4	B	A	C				C		B	C					B	C		C
Fivemile Cr SF-1							C		C									C
Fivemile Cr MF-1	B	C	C				C		C									B
Fivemile Cr MF-2											A							
Fivemile Cr MF-3			C				C		C									
Eightmile Cr-2		C	B		C		B	C	B	C			B	C	A	A		B
Eightmile Cr-3		B	B		C		B	C	B	C			B		A	A		C
Eightmile Cr-4		C	B				B	C	B	C			C		A	A		A
Eightmile Cr-5		C	C		C		B	C	B	C			B		A	A		C
Eightmile Cr-6		A	B		C		B	C	B	C			B		A	A		C
Eightmile Cr-7	B	C	B				C	C	C	C						C		C
Eightmile Cr-8	A	A	C				C	C	B						B			C
Eightmile Cr-9	C		C				C		C						B			C
Eightmile Cr-10	A	C	C				C		C						B			B
Eightmile Cr-11																		
Eightmile Cr-12			C				C		C						A			B
Eightmile Cr-13		C									A							
Eightmile Cr-14							C		C						A			B
Fifteenmile Cr-4		B	C		C		B	C	B	C		B	B		A	A		C
Fifteenmile Cr-5		A	C		C		B	C	B	C		B	B		B	A		C
Fifteenmile Cr-6		B	C		C		B	C	B	C		C	B		B	A		C
Dry Cr-1		C	C		C		B	C	B	C			B		B	A		B
Dry Cr-2		C	C		C		B	C	A				B	C		A		B
Fifteenmile Cr-7		B	C		C		B	C	B	C			B		B	A		C
Fifteenmile Cr-8	C	B	C		C		C	C	B	C			B			A		C
Ramsey Cr-1		B	C				B	C	B	C			C		B	B		C
Ramsey Cr-2	C		C				B	C	B	C					A	C		B
Ramsey Cr-3	B	B	C				C		C						B			B
Ramsey Cr-4	A	B					C		C									
Ramsey Cr-5											A							
Ramsey Cr-6			C				C		B						A			C
Ramsey Cr-7											A							
Ramsey Cr-8			B				C		C						A			B
Fifteenmile Cr-9	B	A	B		C		C	C	B	C					B	B		C
Fifteenmile Cr-10	C		B				C		C						B	C		C
Fifteenmile Cr-11	B	C	B				C		C						A	C		C
Fifteenmile Cr-12	A	C																C
Fifteenmile Cr-13	A	C							C									C
Cedar Cr	B		C				C		C									C
Fifteenmile Cr-14	A								C									C
Fifteenmile Cr-15	B																	C
Fifteenmile Cr-16	B		C						C									C

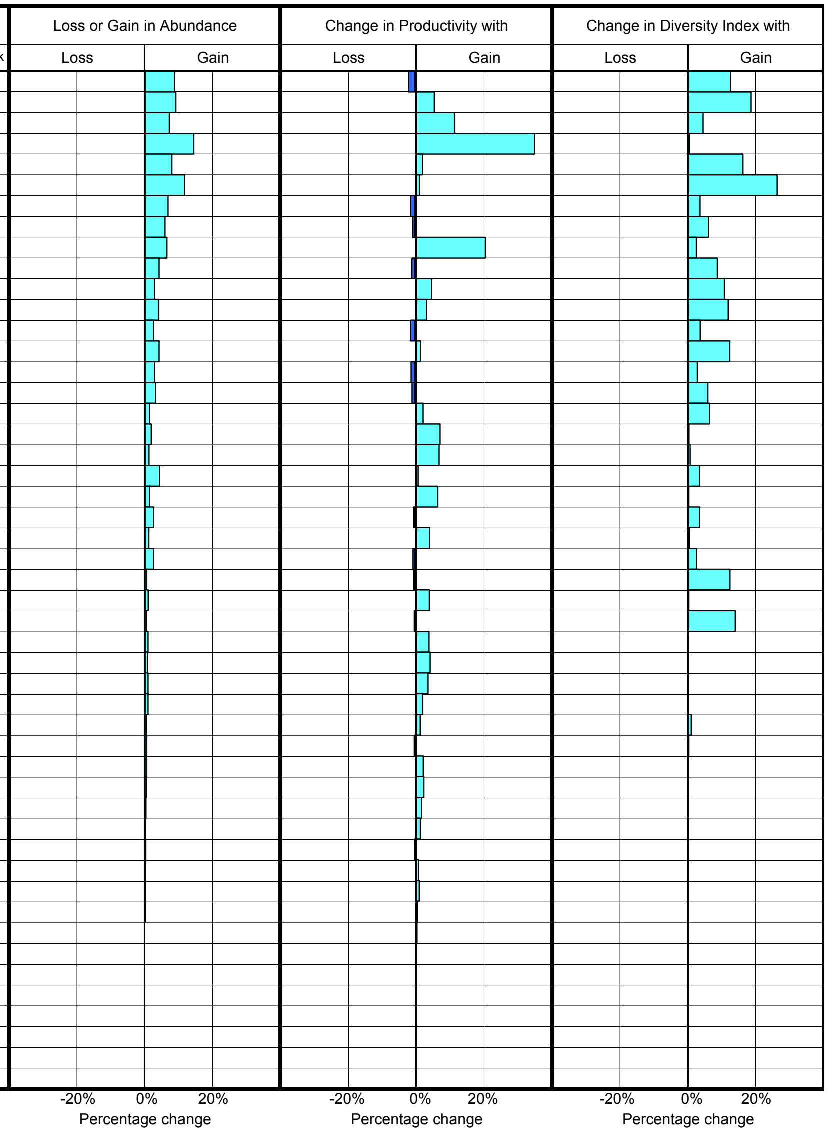
Key to strategic priority (corresponding Benefit Category letter also shown)

A	B	C	D & E
High	Medium	Low	Indirect or General

1/ "Channel stability" applies to freshwater areas only.

Scenario Profile Report – Tornado Chart
Priority 1 and 2 Subbasin Actions – 100 years
Fifteenmile Creek Winter Steelhead
Change in Performance Due to Scenario's Effect within Geographic Area

Geographic Area	Loss category		Gain category	
	Category/rank		Category/rank	
Fifteenmile Cr-4	C	1	B	9
Fivemile Cr-3	E	14	A	1
Fivemile Cr-4	E	14	A	2
Eightmile Cr-8	E	14	A	3
Eightmile Cr-6	E	14	A	4
Fifteenmile Cr-5	E	14	A	4
Fifteenmile Cr-3	C	3	C	16
Eightmile Cr-13	D	7	C	13
Fifteenmile Cr-9	E	14	A	6
Fivemile Cr-1	C	5	C	15
Fifteenmile Cr-8	E	14	B	7
Fifteenmile Cr-7	E	14	B	8
Eightmile Cr-1	C	2	C	21
Fifteenmile Cr-6	E	14	B	9
Eightmile Cr-4	C	4	C	21
Eightmile Cr-5	C	6	C	19
Ramsey Cr-1	E	14	C	11
Ramsey Cr-3	E	14	C	11
Fifteenmile Cr-11	E	14	C	13
Eightmile Cr-3	E	14	C	17
Eightmile Cr-10	E	14	C	18
Eightmile Cr-2	D	9	C	24
Eightmile Cr-7	E	14	C	20
Fivemile Cr-2	D	8	C	26
Dry Cr-1	E	10	C	25
Fifteenmile Cr-10	E	14	C	21
Dry Cr-2	E	11	C	27
Ramsey Cr-4	E	14	C	27
Fifteenmile Cr-12	E	14	D	29
Eightmile Cr-9	E	14	D	30
Fivemile Cr MF-1	E	14	D	31
Ramsey Cr-2	E	14	D	32
Fifteenmile Cr-1	E	12	D	35
Fifteenmile Cr-13	E	14	D	33
Fifteenmile Cr-14	E	14	D	34
Fifteenmile Cr-16	E	14	D	36
Eightmile Cr-12	E	14	D	37
Ramsey Cr-5	E	13	E	38
Cedar Cr	E	14	E	39
Fifteenmile Cr-15	E	14	E	39
Ramsey Cr-6	E	14	E	39
Fivemile Cr SF-1	E	14	E	42
Eightmile Cr-11	E	14	E	43
Eightmile Cr-14	E	14	E	43
Fifteenmile Cr-2	E	14	E	43
Fivemile Cr MF-2	E	14	E	43
Fivemile Cr MF-3	E	14	E	43
Ramsey Cr-7	E	14	E	43
Ramsey Cr-8	E	14	E	43



Scenario Profile Report – Change in Habitat Factors Summary

Priority 1 and 2 Subbasin Actions – 100 years

Fifteenmile Creek Winter Steelhead

Summary of Scenario Effects on Survival Factors and Overall Performance

Relative loss or gain by area			Change in attribute impact on survival due to scenario															
Geographic area	Relative loss	Relative gain	*Channel stability*	*Chemicals*	*Competition (w/ hatch)*	*Competition (other sp)*	*Flow*	*Food*	*Habitat diversity*	*Harassment/poaching*	*Obstructions*	*Oxygen*	*Pathogens*	*Predation*	*Sediment load*	*Temperature*	*Withdrawals*	*Key habitat quantity*
Fifteenmile Cr-1							○		∘			○	∘		∘	○		
Fifteenmile Cr-2																		
Fifteenmile Cr-3	•	∘	∘				○		○	∘		○	○		◯	◯		
Eightmile Cr-1	•	∘	∘		∘		◯	∘	○	∘			○		○	◯		
Fivemile Cr-1	•	∘	○		∘		○		○	∘			∘			◯		◯
Fivemile Cr-2		∘	○				○		◯	∘			○			◯		◯
Fivemile Cr-3		◯	○		∘		○	∘	○	○			○	∘		◯		◯
Fivemile Cr-4		◯	∘				∘		○	∘					○	∘		∘
Fivemile Cr SF-1							∘		∘									∘
Fivemile Cr MF-1			∘				∘		∘									○
Fivemile Cr MF-2																		
Fivemile Cr MF-3			∘															•
Eightmile Cr-2		∘	○		∘		◯	∘	○	∘			○		◯	◯		◯
Eightmile Cr-3		∘	○		∘		○	∘	◯	∘			○		◯	◯		
Eightmile Cr-4	•	∘	○				○		○	∘			∘		◯	◯		◯
Eightmile Cr-5	•	∘	∘		∘		○	∘	○	∘			∘		◯	◯		
Eightmile Cr-6		◯	○		∘		○	∘	○	∘		∘	○		◯	◯		
Eightmile Cr-7		∘	○				∘		∘	∘						∘		
Eightmile Cr-8		◯	○				∘		○						○			
Eightmile Cr-9			○				∘		∘						○			∘
Eightmile Cr-10		∘	∘				∘		∘						○			∘
Eightmile Cr-11																		
Eightmile Cr-12			∘				∘		∘						◯			∘
Eightmile Cr-13		∘									◯							
Eightmile Cr-14							∘		∘						◯			∘
Fifteenmile Cr-4	•	○	∘		∘		○	∘	○	∘		○	○		◯	◯		
Fifteenmile Cr-5		◯	∘		∘		○	∘	○	∘		○	∘		○	◯		∘
Fifteenmile Cr-6		○	∘		∘		○	∘	○	∘		∘	○		○	◯		∘
Dry Cr-1		∘	∘				○		○	∘			∘		○	◯		∘
Dry Cr-2		∘	∘				○		◯				○			◯		∘
Fifteenmile Cr-7		○	∘		∘		○	∘	○	∘			∘		○	◯		
Fifteenmile Cr-8		○	∘		∘		∘	∘	○	∘		∘	∘			◯		
Ramsey Cr-1		∘	∘				○		○	∘					○	◯		
Ramsey Cr-2			∘				∘		○	∘					◯	∘		○
Ramsey Cr-3		∘					∘		∘						○			○
Ramsey Cr-4		∘																•
Ramsey Cr-5											◯							
Ramsey Cr-6							∘		∘						○			•
Ramsey Cr-7																		
Ramsey Cr-8			○				∘		∘						○			∘
Fifteenmile Cr-9		◯	○		∘		∘	∘	○	∘		∘			○	◯		
Fifteenmile Cr-10		∘	○				∘		○						○	∘		
Fifteenmile Cr-11		∘	∘				∘		∘						◯	∘		
Fifteenmile Cr-12																		∘
Fifteenmile Cr-13																		
Cedar Cr			∘						∘									∘
Fifteenmile Cr-14																		∘
Fifteenmile Cr-15																		∘
Fifteenmile Cr-16																		∘

1/ Greatest absolute value of factor change (whether gain or loss) is shown for area (reaches may differ in gain or loss).

Key to amount of change in factor (corresponding Loss/Gain Category letter also shown)

A	B	C	D & E
◯ / ● High	○ / • Medium	∘ / · Low	Indirect or General

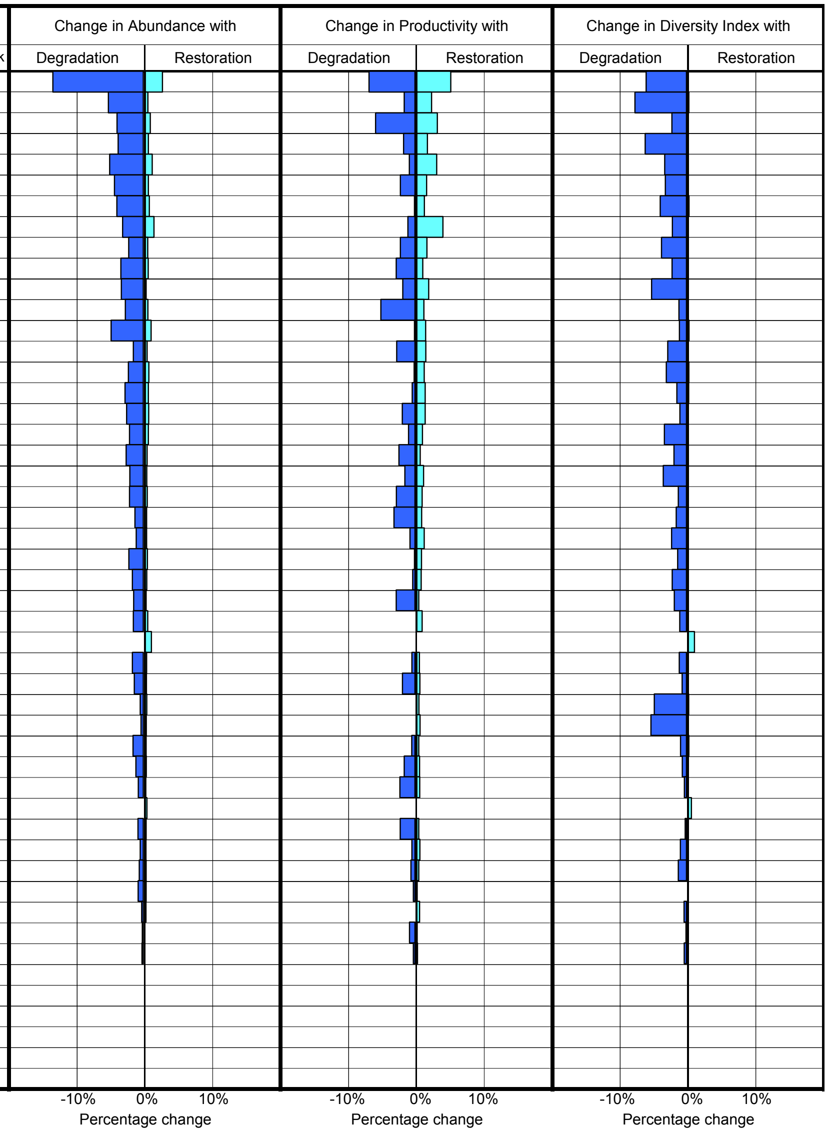
Scenario Diagnostic Report – Tornado Chart

Priority 1 and 2 Subbasin Actions – 100 years

Fifteenmile Creek Winter Steelhead

Relative Importance Of Geographic Areas For Protection and Restoration Measures After Scenario Implementation

Geographic Area	Protection benefit Category	Protection benefit rank	Restoration benefit Category	Restoration benefit rank
Eightmile Cr-8	A	1	A	1
Fifteenmile Cr-5	B	2	B	7
Fifteenmile Cr-9	B	3	A	6
Fivemile Cr-3	B	4	B	8
Ramsey Cr-4	B	8	A	4
Fivemile Cr-4	B	5	B	11
Fifteenmile Cr-4	B	12	A	5
Ramsey Cr-3	B	15	A	2
Fifteenmile Cr-7	B	8	B	13
Eightmile Cr-10	B	6	B	17
Eightmile Cr-6	B	6	B	19
Fifteenmile Cr-12	B	10	B	15
Fifteenmile Cr-3	C	23	A	2
Fifteenmile Cr-8	B	12	B	15
Fivemile Cr-1	C	21	B	9
Eightmile Cr-3	C	22	B	10
Fifteenmile Cr-13	C	20	B	12
Fivemile Cr MF-1	B	15	B	17
Eightmile Cr-14	B	10	C	25
Fifteenmile Cr-6	B	14	C	21
Fifteenmile Cr-14	C	17	C	22
Fifteenmile Cr-11	C	19	C	27
Ramsey Cr-1	C	24	C	24
Eightmile Cr-4	C	27	C	23
Eightmile Cr-5	C	24	C	26
Eightmile Cr-7	C	18	D	36
Fivemile Cr-2	D	36	B	19
Ramsey Cr-7	E	42	B	14
Eightmile Cr-2	C	28	D	30
Eightmile Cr-9	C	26	D	32
Dry Cr-1	C	30	D	29
Dry Cr-2	C	28	D	31
Eightmile Cr-1	D	33	D	32
Fifteenmile Cr-16	D	33	D	34
Fifteenmile Cr-10	C	31	D	37
Fivemile Cr MF-2	E	42	C	27
Fifteenmile Cr-15	C	31	D	40
Ramsey Cr-2	D	37	D	35
Cedar Cr	D	35	D	40
Fifteenmile Cr-1	D	39	D	39
Ramsey Cr-6	E	41	D	37
Eightmile Cr-12	D	38	E	43
Fivemile Cr SF-1	E	40	E	42
Eightmile Cr-11	E	42	E	44
Eightmile Cr-13	E	42	E	44
Fifteenmile Cr-2	E	42	E	44
Fivemile Cr MF-3	E	42	E	44
Ramsey Cr-5	E	42	E	44
Ramsey Cr-8	E	42	E	44



Scenario Diagnostic Report – Diagnostic Summary

Priority 1 and 2 Subbasin Actions – 100 years

Fifteenmile Creek Winter Steelhead

Protection and Restoration Strategic Priority Summary After Scenario Implementation

Geographic area priority			Attribute class priority for restoration															
Geographic area	Protection benefit	Restoration benefit	*Channel stability*	*Chemicals*	*Competition (w/ hatch)*	*Competition (other sp)*	*Flow*	*Food*	*Habitat diversity*	*Harassment/poaching*	*Obstructions*	*Oxygen*	*Pathogens*	*Predation*	*Sediment load*	*Temperature*	*Withdrawals*	*Key habitat quantity*
Fifteenmile Cr-1							•									•		
Fifteenmile Cr-2																		
Fifteenmile Cr-3	∘	◯					•		•							•		•
Eightmile Cr-1							•									•		•
Fivemile Cr-1	∘	○	•				•		•	•						●		●
Fivemile Cr-2		○	•				•		•							●	●	●
Fivemile Cr-3	○	○					•										●	●
Fivemile Cr-4	○	○							•									•
Fivemile Cr SF-1									•									•
Fivemile Cr MF-1	○	○	•						•									•
Fivemile Cr MF-2		∘									⬤							
Fivemile Cr MF-3			•						•									•
Eightmile Cr-2	∘		•				•									●		•
Eightmile Cr-3	∘	○	•				•		•							●		•
Eightmile Cr-4	∘	∘	•				•		•							•		•
Eightmile Cr-5	∘	∘					•		•	•						•		•
Eightmile Cr-6	○	○	•				•		•							•		•
Eightmile Cr-7	∘																	
Eightmile Cr-8	◯	◯																
Eightmile Cr-9	∘																	
Eightmile Cr-10	○	○																•
Eightmile Cr-11																		
Eightmile Cr-12																		•
Eightmile Cr-13																		
Eightmile Cr-14	○	∘																•
Fifteenmile Cr-4	○	◯					•		•	•						•		•
Fifteenmile Cr-5	○	○					•		•	•						•		•
Fifteenmile Cr-6	○	∘					•		•							•		•
Dry Cr-1	∘						•		•	•			•			●		•
Dry Cr-2	∘						•		•							●		•
Fifteenmile Cr-7	○	○					•		•							•		•
Fifteenmile Cr-8	○	○							•							●		•
Ramsey Cr-1	∘	∘	•				•		•	•						•		•
Ramsey Cr-2							•		•						●			•
Ramsey Cr-3	○	◯					•		•						•			●
Ramsey Cr-4	○	◯					•		•									
Ramsey Cr-5																		
Ramsey Cr-6							•		•						●			•
Ramsey Cr-7		○									⬤							
Ramsey Cr-8			●				•		•						●			•
Fifteenmile Cr-9	○	◯	•															•
Fifteenmile Cr-10	∘		•															•
Fifteenmile Cr-11	∘	∘	•															
Fifteenmile Cr-12	○	○																
Fifteenmile Cr-13	∘	○							•									•
Cedar Cr			•						•									•
Fifteenmile Cr-14	∘	∘																•
Fifteenmile Cr-15	∘																	•
Fifteenmile Cr-16																		•

1/ "Channel stability" applies to freshwater areas only.

Key to strategic priority (corresponding Benefit Category letter also shown)

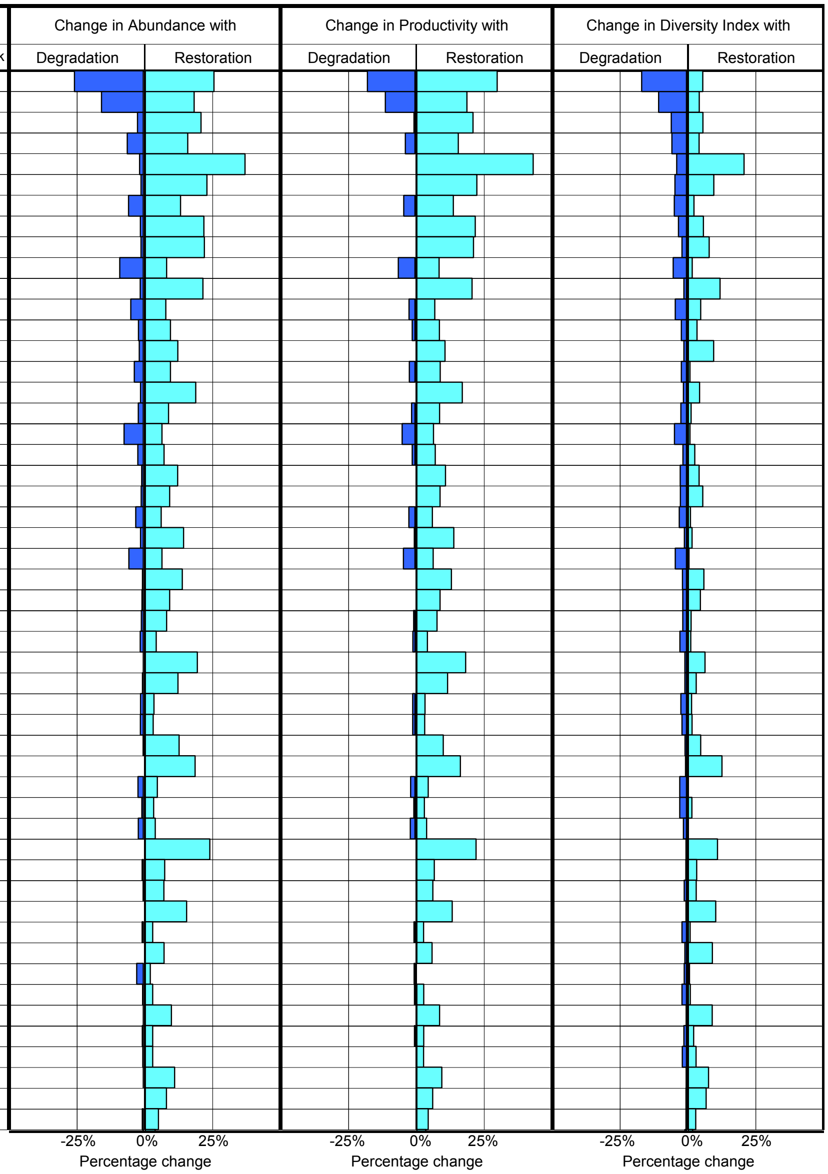
A	B	C	D & E
◯ / ⬤ High	○ / ● Medium	∘ / • Low	(blank) Indirect or General

Baseline Diagnostic Report – Tornado Chart

Deschutes Eastside Summer Steelhead

Relative Importance Of Geographic Areas For Protection and Restoration Measures - current condition

Geographic Area	Protection benefit Category	Protection benefit rank	Restoration benefit Category	Restoration benefit rank
L Deschutes MS-17	A	1	A	6
L Deschutes MS-16	A	2	A	13
Trout Cr-5	B	10	A	9
L Deschutes MS-18	B	5	B	16
Buck Hollow Cr-1	C	23	A	1
Buck Hollow Cr-3	C	26	A	3
Trout Cr-12	B	6	B	24
Thorn Hollow	C	25	A	8
Deep Cr-2 (Bakeoven)	D	30	A	5
L Deschutes MS-15	A	3	C	33
L Deschutes MS-6	D	33	A	4
L Deschutes MS-12	B	8	C	30
L Deschutes MS-14	C	14	C	28
L Deschutes MS-8	D	32	A	13
L Deschutes MS-13	B	10	C	37
Deep Cr-1 (Bakeoven)	D	36	A	12
Foley Cr-2	C	13	C	35
L Deschutes MS-19	A	4	C	45
Bakeoven Cr-1	C	17	C	33
Buck Hollow Cr-4	D	30	B	21
Ward Cr-1	D	29	B	22
Trout Cr-13	B	9	C	43
Deep Cr-3 (Bakeoven)	D	28	B	25
Trout Cr-14	B	7	C	47
Buck Hollow Cr-2	D	42	B	15
Little Trout Cr	D	38	B	25
Trout Cr-11	C	24	C	40
Dutchman Cr	C	15	D	50
Bakeoven Cr-4	E	57	A	10
Bakeoven Cr-3	E	47	B	22
Cartwright Cr	C	18	D	52
Foley Cr-1	C	19	D	53
Cottonwood Cr-1	E	54	B	19
Trout Cr-7	E	66	A	7
Potlid Cr	C	12	D	63
Board Hollow Cr	C	21	D	55
Trout Cr-15	C	16	D	64
Trout Cr-3	E	78	A	2
L Deschutes MS-5	E	51	C	32
Bakeoven Cr-2	E	49	C	36
Trout Cr-6	E	75	A	11
Big Log Cr-2	D	27	D	62
Tenmile Cr	E	61	C	28
L Deschutes MS-4	C	22	E	70
Auger Cr	D	33	D	60
Amity Cr	E	75	B	19
Beaver Cr (Trout)	D	37	D	57
Clover Cr	D	44	D	51
Trout Cr-8	E	78	B	17
Trout Cr-4	E	69	C	27
L Deschutes MS-7	E	55	C	42



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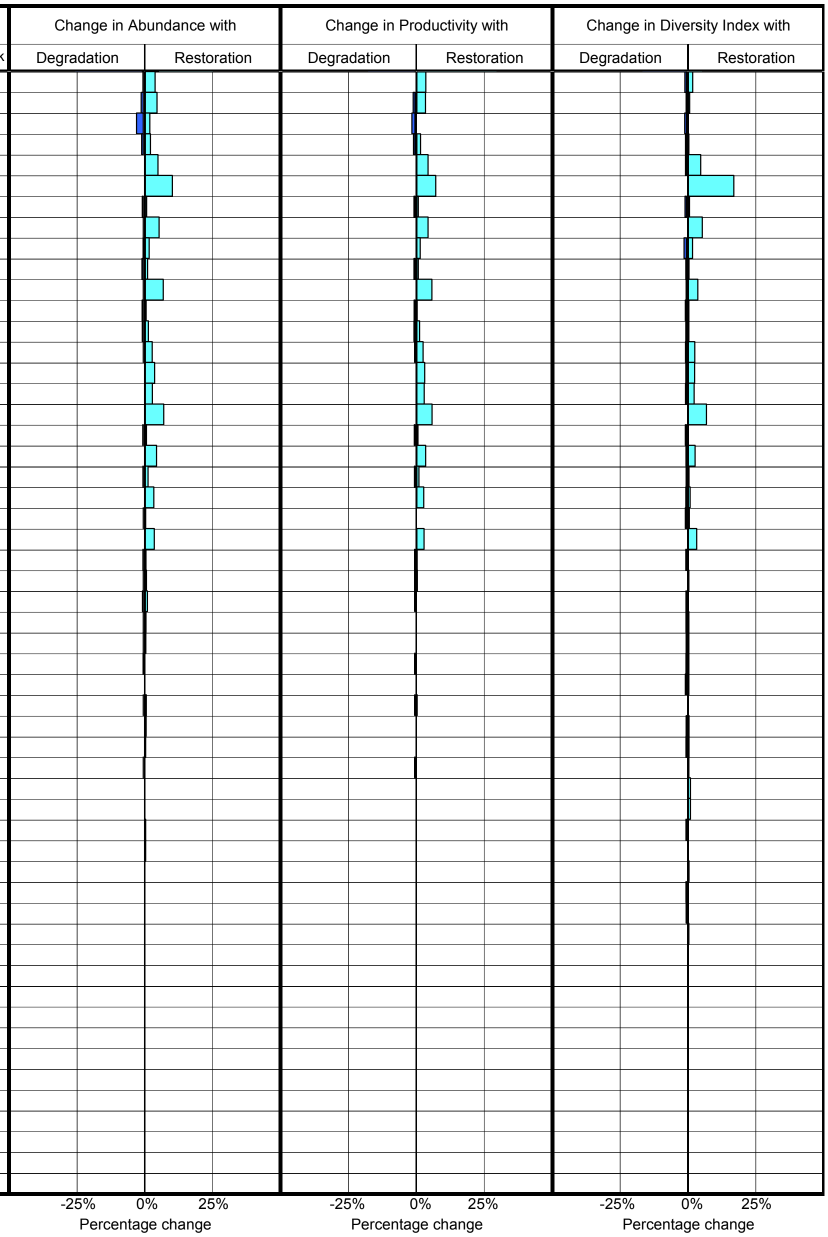
Deschutes Eastside Summer Steelhead - continued

Relative Importance Of Geographic Areas For Protection and Restoration Measures - current condition

Geographic Area	Protection benefit Category	Protection benefit rank	Restoration benefit Category	Restoration benefit rank
Maupin Trail Canyon	E	49	D	48
Nena Cr-1	D	42	D	55
L Deschutes MS-2	C	20	E	78
Wapinitia Cr-1	D	35	E	65
Opal Cr-2	E	62	C	40
Antelope Cr-4	E	87	B	17
Big Log Cr-1	D	38	E	67
Trout Cr-9	E	70	C	37
Big Whetstone Cr	E	48	D	60
Warm Springs MS-1	D	41	E	67
Antelope Cr-1	E	70	C	39
L Deschutes MS-11	D	40	E	73
Stag Canyon	D	44	E	69
Opal Cr-1	E	56	D	58
Trout Cr-1	E	70	D	49
Mud Springs Cr-1	E	66	D	54
Antelope Cr-2	E	90	C	31
Skookum Cr	E	46	E	75
Trout Cr-2	E	78	C	43
Eagle Cr	E	59	E	66
Cottonwood Cr-2	E	70	D	59
Hauser Canyon	E	60	E	72
Trout Cr-10	E	90	C	46
L Deschutes MS-1	E	51	E	87
Ferry Canyon	E	68	E	71
L Deschutes MS-3	E	53	E	86
Buck Hollow Cr-5	E	64	E	81
Finnegan Canyon	E	65	E	80
L Deschutes MS-9	E	58	E	87
Macken Canyon	E	62	E	83
Oak Canyon	E	70	E	78
Bakeoven Cr-5	E	84	E	74
Macks Canyon	E	78	E	81
Trout Cr-16	E	77	E	84
Hay Cr-1	E	89	E	76
Mud Springs Cr-2	E	90	E	76
Robin Cr	E	78	E	91
Fall Canyon	E	85	E	89
Jones Canyon	E	90	E	85
Tub Springs Canyon	E	78	E	97
L Deschutes MS-20	E	86	E	92
Booten Cr	E	90	E	90
Mud Springs Cr-3	E	87	E	95
Trail Hollow Cr	E	90	E	93
Hay Cr-2	E	90	E	94
Mud Springs Cr-4	E	90	E	96
Antelope Cr-3	E	90	E	97
Hay Cr-3	E	90	E	97
L Deschutes MS-10	E	90	E	97
Mud Springs Cr-5	E	90	E	97
Mud Springs Cr-6	E	90	E	97
Ochoco Gulch Cr	E	90	E	97
Sagebrush Cr	E	90	E	97
White R MS-1	E	90	E	97



Baseline Diagnostic Report – Diagnostic Summary

Deschutes Eastside Summer Steelhead
Protection and Restoration Strategic Priority Summary - current condition

Geographic area priority			Attribute class priority for restoration															
Geographic area	Protection benefit	Restoration benefit	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
L Deschutes MS-1					C				A					C				A
L Deschutes MS-2	C				C				B					C				A
Fall Canyon							C		C									B
L Deschutes MS-3					C				C					C				
L Deschutes MS-4	C				C		C		B					C				
Macks Canyon			C				B		B									B
L Deschutes MS-5		C			C		C		B					C	A	C		
Ferry Canyon							B		C						C			B
L Deschutes MS-6		A			C		C		B					C	A			
Jones Canyon			C				C		B									B
L Deschutes MS-7		C			C		C		B					C	A			
Oak Canyon			C				C		C									B
L Deschutes MS-8		A			C		C		B					C	A			
Buck Hollow Cr-1	C	A	C				B		B					B	B	A		B
Finnegan Canyon			C				B		C						C			B
Buck Hollow Cr-2		B	C				B		B					B	B	A		B
Hauser Canyon							B		B									C
Buck Hollow Cr-3	C	A	C				B		B				C	B		A		B
Macken Canyon							C		B									
Buck Hollow Cr-4		B	C				B		B					B		A		B
Thorn Hollow	C	A	C				B		B					B		A		B
Buck Hollow Cr-5							C		C					C		C		B
L Deschutes MS-9					C		C		C									C
L Deschutes MS-10																		
L Deschutes MS-11					C				C					C				C
White R MS-1							C		C					C				C
L Deschutes MS-12	B	C	C		C		C		B					C				
Bakeoven Cr-1	C	C	C				B		C					B		A		C
Trail Hollow Cr			C				C		B									B
Bakeoven Cr-2		C	C				B		B					B		A		B
Booten Cr			C				B		B							C		B
Bakeoven Cr-3		B	C				B		B					B		A		B
Robin Cr			C				C		B									B
Bakeoven Cr-4		A	C				B		B				C	B		A		B
Deep Cr-1 (Bakeoven)		A	C				B		B				C	C		A		C
Cottonwood Cr-1		B	C				B		B				C	C		A		B
Ochoco Gulch Cr							C		B							C		B
Cottonwood Cr-2			C				B		B					C		A		B
Deep Cr-2 (Bakeoven)		A	C				B		B				C	C		A		C
Maupin Trail Canyon			C				C		C				C	C		A		
Deep Cr-3 (Bakeoven)		B	C				C		C				C	C		A		B
Bakeoven Cr-5			C				C		B					C		C		A
L Deschutes MS-13	B	C	C		C		C		B	C			C	C		C		
Stag Canyon			C				B		B				C	C		C		
L Deschutes MS-14	C	C	C		C		C		B					C				C
Wapinitia Cr-1							C		C					C	C			B
L Deschutes MS-15	A	C			C		C		B					C				
Nena Cr-1			C				C		B					C		C		B
L Deschutes MS-16	A	A					C		B									
Eagle Cr			C				C		C					C		C		B
L Deschutes MS-17	A	A	C		C		C		B					C				
Skookum Cr							C		C							C		B
L Deschutes MS-18	B	B	C		C		C		B					C				
Warm Springs MS-1					C		C		B				C					
L Deschutes MS-19	A	C			C		C		B					C				
Trout Cr-1			C				B		B					C		A		C

1/ "Channel stability" applies to freshwater areas only.

Key to strategic priority (corresponding Benefit Category letter also shown)

A	B	C	D & E
High	Medium	Low	Indirect or General

Continued next page

Deschutes Eastside Summer Steelhead - continued
Protection and Restoration Strategic Priority Summary - current condition

Geographic area priority			Attribute class priority for restoration															
Geographic area	Protection benefit	Restoration benefit	*Channel stability*	*Chemicals*	*Competition (w/ hatch)*	*Competition (other sp)*	*Flow*	*Food*	*Habitat diversity*	*Harassment/poaching*	*Obstructions*	*Oxygen*	*Pathogens*	*Predation*	*Sediment load*	*Temperature*	*Withdrawals*	*Key habitat quantity*
Tenmile Cr		C	C				B		B					B		A		C
Trout Cr-2		C	C				B		B					B		A		B
Mud Springs Cr-1			B				C		C					C	B	A		
Mud Springs Cr-2											A							
Mud Springs Cr-3			B				C		B					C	B	A		
Sagebrush Cr			C				C		B									
Mud Springs Cr-4			C				C		B					C	B	A		
Mud Springs Cr-5																		
Mud Springs Cr-6			C				C		C					C	B	A		
Trout Cr-3		A	C				B		C				B	B	B	A		B
Hay Cr-1			C				B		A	C			B	B		A		A
Hay Cr-2											A							
Hay Cr-3			C				A		B	C			B	B		A		A
Trout Cr-4		C	C				A		C				B	B		A		A
Antelope Cr-1		C	C				B		C				B	B		A		B
Ward Cr-1		B	C				B		B					B		A		
Antelope Cr-2		C	C				B		B				B	B	C	A		
Antelope Cr-3																		
Antelope Cr-4		B	C				B		C				B	B	B	A		B
Trout Cr-5	B	A	C				B		C					B		A		B
Tub Springs Canyon							C		C							C		C
Trout Cr-6		A	C				B		C				B	B		A		B
Little Trout Cr		B	C				B		C					B	C	A		C
Trout Cr-7		A	C				A		C				B	B	C	A		B
Big Whetstone Cr			C				B		B					C		A		
Trout Cr-8		B	C				A		C				B	B	C	A		B
Clover Cr			C				B		C					C		A		
Trout Cr-9		C	C				B		C				B	B	C	A		B
Beaver Cr (Trout)			C				B		C					C		A		
Trout Cr-10		C	C				B		C				B	B	C	A		B
Amity Cr		B	C				B		C				B	B	C	A		C
Trout Cr-11	C	C	C				B		C					B	C	A		
Board Hollow Cr	C		C				B		C					C		B		C
Trout Cr-12	B	B	C				B		C					C		B		
Foley Cr-1	C		C				B		C					B		B		
Big Log Cr-1			C				B		C					C		B		
Dutchman Cr	C		C				B		B					C		B		
Big Log Cr-2			C				B		C					C		B		C
Foley Cr-2	C	C	C				B		C					B		B		
Trout Cr-13	B	C	C				B		C					C		B		
Cartwright Cr	C		C				B		B					C		B		
Trout Cr-14	B	C	C				B		C					C		C		
Opal Cr-1			C				B		C				C	C		A		
Auger Cr			C				B		C					C		B		
Opal Cr-2		C	C				B		C				C	C		A		
Trout Cr-15	C		C				B		C					C		C		C
Potlid Cr	C		C				B		C					C				C
Trout Cr-16							C		C									C
L Deschutes MS-20									B					C				

1/ "Channel stability" applies to freshwater areas only.

Key to strategic priority (corresponding Benefit Category letter also shown)

A	B	C	D & E
High	Medium	Low	Indirect or General

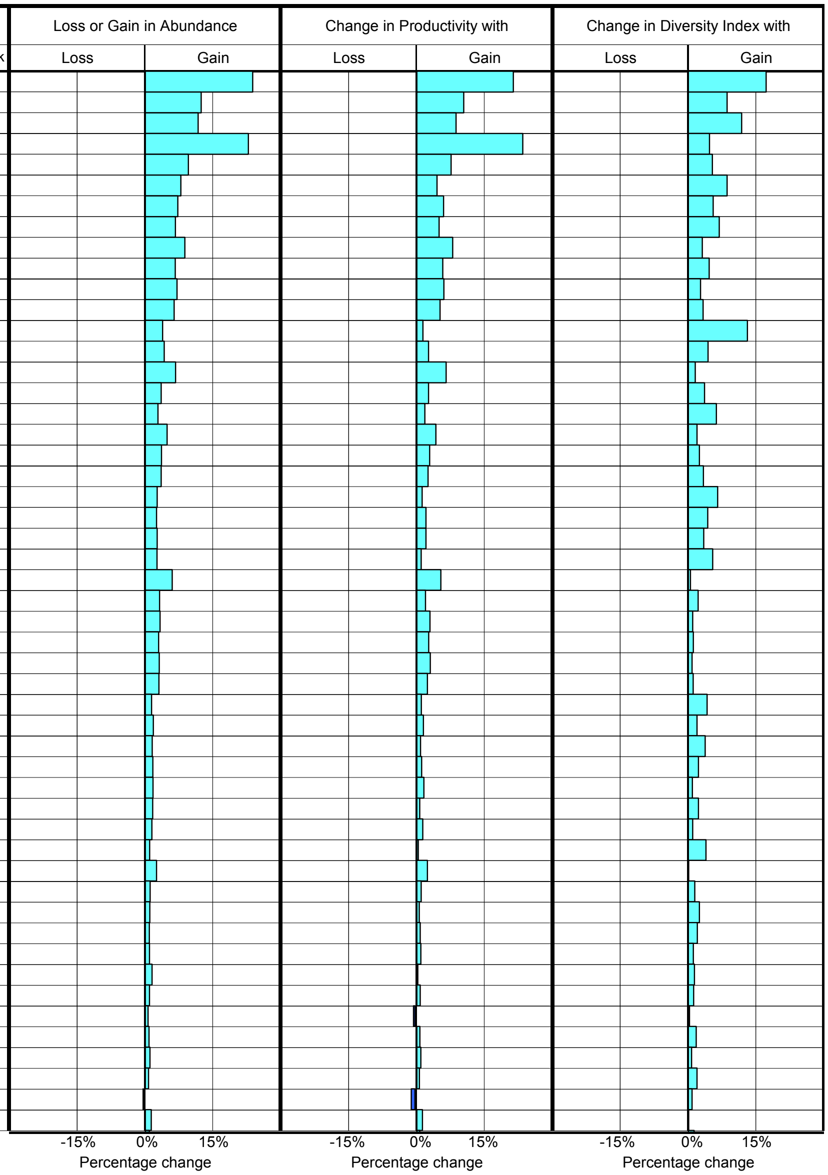
Scenario Profile Report – Tornado Chart

Priority 1 and 2 Subbasin Actions – 100 years

Deschutes Eastside Summer Steelhead

Change in Performance Due to Scenario's Effect within Geographic Area

Geographic Area	Loss category		Gain category	
	Category/rank		Category/rank	
Buck Hollow Cr-1	E	19	A	1
Buck Hollow Cr-3	E	19	A	2
Trout Cr-7	E	19	A	3
L Deschutes MS-17	E	19	A	4
Bakeoven Cr-4	E	19	A	5
Trout Cr-3	E	19	A	6
Buck Hollow Cr-2	E	19	A	7
Trout Cr-8	E	19	A	8
L Deschutes MS-18	E	19	A	9
Trout Cr-5	E	19	B	10
Bakeoven Cr-3	E	19	B	11
Buck Hollow Cr-4	E	19	B	12
Antelope Cr-4	E	19	B	13
Deep Cr-2 (Bakeoven)	E	19	B	14
Trout Cr-12	E	19	B	15
Thorn Hollow	E	19	B	16
Antelope Cr-2	E	19	B	17
Bakeoven Cr-1	E	19	B	17
Bakeoven Cr-2	E	19	B	17
Antelope Cr-1	E	19	B	20
Trout Cr-6	E	19	B	21
Ward Cr-1	E	19	B	22
Little Trout Cr	E	19	B	23
Trout Cr-4	E	19	B	24
L Deschutes MS-19	E	19	B	25
Deep Cr-1 (Bakeoven)	E	19	C	26
Trout Cr-11	E	19	C	27
Foley Cr-2	E	19	C	28
Trout Cr-13	E	19	C	29
Deep Cr-3 (Bakeoven)	E	19	C	30
Opal Cr-2	E	19	C	30
Trout Cr-1	E	19	C	32
Trout Cr-9	E	19	C	33
Trout Cr-2	E	19	C	34
Dutchman Cr	E	19	C	35
Cottonwood Cr-1	E	19	C	36
Foley Cr-1	E	19	C	37
Tenmile Cr	E	19	C	38
Trout Cr-14	E	19	C	39
Board Hollow Cr	E	19	D	40
Trout Cr-10	E	19	D	41
Opal Cr-1	E	19	D	42
Cartwright Cr	E	19	D	43
L Deschutes MS-6	E	19	D	44
Mud Springs Cr-1	E	19	D	44
L Deschutes MS-4	E	3	E	61
Beaver Cr (Trout)	E	19	D	46
Auger Cr	E	19	D	47
Clover Cr	E	19	D	48
Mud Springs Cr-2	C	1	E	66
Trout Cr-15	E	19	D	48



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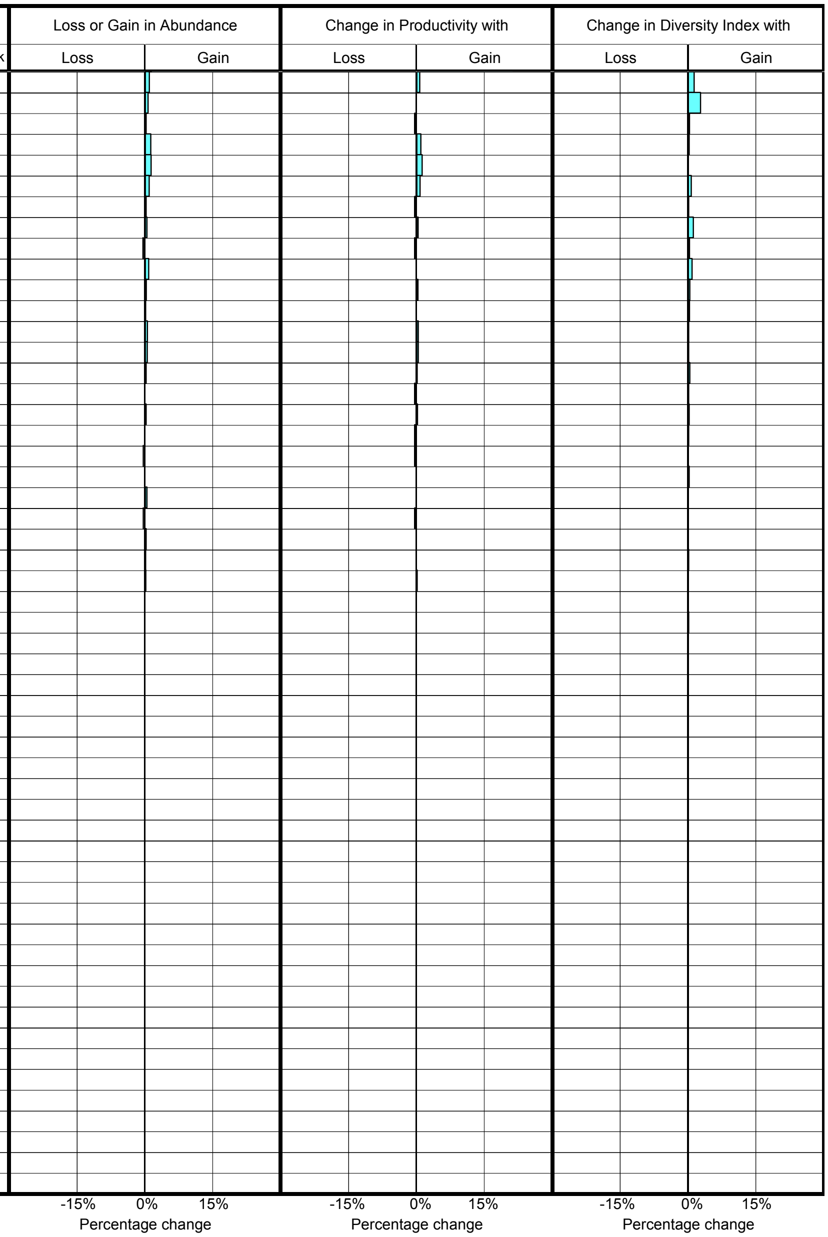
Deschutes Eastside Summer Steelhead - continued
Change in Performance Due to Scenario's Effect within Geographic Area

Geographic Area	Loss category		Gain category	
	Category/rank		Category/rank	
Maupin Trail Canyon	E	19	D	50
Amity Cr	E	19	D	51
L Deschutes MS-7	E	8	E	63
Nena Cr-1	E	19	D	52
Potlid Cr	E	19	D	53
Big Log Cr-2	E	19	E	54
Bakeoven Cr-5	E	10	E	64
Big Whetstone Cr	E	19	E	55
Hay Cr-1	E	2	E	72
L Deschutes MS-8	E	19	E	56
Big Log Cr-1	E	19	E	57
L Deschutes MS-5	E	12	E	64
Wapinitia Cr-1	E	19	E	58
Warm Springs MS-1	E	19	E	59
Cottonwood Cr-2	E	19	E	60
L Deschutes MS-20	E	6	E	73
Eagle Cr	E	19	E	62
Robin Cr	E	7	E	74
Booten Cr	E	3	E	80
Hauser Canyon	E	19	E	66
L Deschutes MS-3	E	15	E	70
Trail Hollow Cr	E	5	E	80
Buck Hollow Cr-5	E	13	E	74
Finnegan Canyon	E	19	E	68
Skookum Cr	E	19	E	69
L Deschutes MS-2	E	9	E	80
Trout Cr-16	E	19	E	70
Tub Springs Canyon	E	11	E	80
Ochoco Gulch Cr	E	13	E	80
Hay Cr-2	E	17	E	77
Macken Canyon	E	19	E	76
Mud Springs Cr-4	E	16	E	79
Mud Springs Cr-3	E	19	E	78
White R MS-1	E	17	E	80
Antelope Cr-3	E	19	E	80
Fall Canyon	E	19	E	80
Ferry Canyon	E	19	E	80
Hay Cr-3	E	19	E	80
Jones Canyon	E	19	E	80
L Deschutes MS-1	E	19	E	80
L Deschutes MS-10	E	19	E	80
L Deschutes MS-11	E	19	E	80
L Deschutes MS-12	E	19	E	80
L Deschutes MS-13	E	19	E	80
L Deschutes MS-14	E	19	E	80
L Deschutes MS-15	E	19	E	80
L Deschutes MS-16	E	19	E	80
L Deschutes MS-9	E	19	E	80
Macks Canyon	E	19	E	80
Mud Springs Cr-5	E	19	E	80
Mud Springs Cr-6	E	19	E	80
Oak Canyon	E	19	E	80
Sagebrush Cr	E	19	E	80
Stag Canyon	E	19	E	80



Scenario Profile Report – Change in Habitat Factors Summary

Priority 1 and 2 Subbasin Actions – 100 years

Deschutes Eastside Summer Steelhead

Summary of Scenario Effects on Survival Factors and Overall Performance

Relative loss or gain by area			Change in attribute impact on survival due to scenario															
Geographic area	Relative loss	Relative gain	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
L Deschutes MS-1																		
L Deschutes MS-2																		
Fall Canyon																		
L Deschutes MS-3									∘									
L Deschutes MS-4									∘									
Macks Canyon																		
L Deschutes MS-5									○									
Ferry Canyon																		
L Deschutes MS-6									○									
Jones Canyon																		
L Deschutes MS-7									○									
Oak Canyon																		
L Deschutes MS-8									○									
Buck Hollow Cr-1		◯	∘				○		○						○	◯		•
Finnegan Canyon							○		∘									∘
Buck Hollow Cr-2		◯	∘				○		○						○	◯		∘
Hauser Canyon							∘		∘									•
Buck Hollow Cr-3		◯	∘				○		○							◯		○
Macken Canyon									∘									•
Buck Hollow Cr-4		○	∘				○		∘							◯		○
Thorn Hollow		○					○		∘							○		∘
Buck Hollow Cr-5							∘		∘									○
L Deschutes MS-9																		
L Deschutes MS-10																		
L Deschutes MS-11																		
White R MS-1																		
L Deschutes MS-12																		
Bakeoven Cr-1		○	∘				○		∘							◯		•
Trail Hollow Cr									∘									○
Bakeoven Cr-2		○	∘				○		○							◯		○
Booten Cr							○		○							∘		○
Bakeoven Cr-3		○	∘				○		○							◯		∘
Robin Cr									∘									○
Bakeoven Cr-4		◯	∘				○		○							◯		∘
Deep Cr-1 (Bakeoven)		∘					∘		∘							◯		•
Cottonwood Cr-1		∘	∘				∘		∘							◯		○
Ochoco Gulch Cr									∘							∘		○
Cottonwood Cr-2			∘				∘		∘							◯		○
Deep Cr-2 (Bakeoven)		○					∘		∘							◯		•
Maupin Trail Canyon							∘		∘							◯		•
Deep Cr-3 (Bakeoven)		∘					∘		∘							◯		∘
Bakeoven Cr-5			∘				∘		∘							∘		◯
L Deschutes MS-13																		
Stag Canyon																		
L Deschutes MS-14																		
Wapinitia Cr-1									∘									∘
L Deschutes MS-15																		
Nena Cr-1									∘									∘
L Deschutes MS-16																		
Eagle Cr									∘									○
L Deschutes MS-17		◯	∘						○									
Skookum Cr									∘									∘
L Deschutes MS-18		◯	∘						○									
Warm Springs MS-1									∘									
L Deschutes MS-19		○							○									
Trout Cr-1		∘					∘		∘							◯		•

1/ Greatest absolute value of factor change (whether gain or loss) is shown for area (reaches may differ in gain or loss).

Key to amount of change in factor (corresponding Loss/Gain Category letter also shown)

A	B	C	D & E
◯ / ● High	○ / ● Medium	∘ / • Low	Indirect or General

Continued next page

Deschutes Eastside Summer Steelhead - continued
Summary of Scenario Effects on Survival Factors and Overall Performance

Relative loss or gain by area			Change in attribute impact on survival due to scenario															
Geographic area	Relative loss	Relative gain	*Channel stability*	*Chemicals*	*Competition (w/ hatch)*	*Competition (other sp)*	*Flow*	*Food*	*Habitat diversity*	*Harassment/poaching*	*Obstructions*	*Oxygen*	*Pathogens*	*Predation*	*Sediment load*	*Temperature*	*Withdrawals*	*Key habitat quantity*
Tenmile Cr		∘	∘				○		○							◯		•
Trout Cr-2		∘	∘				○		○							◯		○
Mud Springs Cr-1			○						∘						○	◯		•
Mud Springs Cr-2	•										◯							
Mud Springs Cr-3			○				∘		○						○	◯		•
Sagebrush Cr									○									•
Mud Springs Cr-4			∘						○						○	◯		•
Mud Springs Cr-5																		
Mud Springs Cr-6			∘						∘						○	◯		•
Trout Cr-3		◯	∘				○		∘				○	∘	○	◯		○
Hay Cr-1			∘				○		○	∘			○		●	◯		◯
Hay Cr-2											◯							
Hay Cr-3			∘				◯		○	∘			○	∘		◯		◯
Trout Cr-4		○	∘				◯		∘				○	∘		◯		◯
Antelope Cr-1		○	∘				○		∘				○	∘		◯		●
Ward Cr-1		○					○		∘							◯		•
Antelope Cr-2		○	∘				○		○				○	∘		◯		●
Antelope Cr-3																		
Antelope Cr-4		○	∘				○		∘				○	∘	○	◯		◯
Trout Cr-5		○					○									◯		○
Tub Springs Canyon							∘		∘							∘		•
Trout Cr-6		○					○		∘				∘			◯		○
Little Trout Cr		○	∘				○		∘							◯		•
Trout Cr-7		◯	∘				◯		∘				○	∘	∘	◯		◯
Big Whetstone Cr			∘				∘		∘							◯		•
Trout Cr-8		◯	∘				◯		∘				○	∘	∘	◯		◯
Clover Cr			∘				∘		∘							◯		•
Trout Cr-9		∘	∘				○		∘				∘			◯		○
Beaver Cr (Trout)			∘				∘		∘							◯		•
Trout Cr-10			∘				○		∘				∘		∘	◯		○
Amity Cr			∘				○		∘				∘			◯		•
Trout Cr-11		∘	∘				○		∘						∘	◯		•
Board Hollow Cr			∘				○		∘							○		•
Trout Cr-12		○	∘				∘		∘							◯		•
Foley Cr-1		∘	∘				○		∘							○		•
Big Log Cr-1			∘				○									○		●
Dutchman Cr		∘	∘				○		∘							○		●
Big Log Cr-2			∘				○		∘							◯		•
Foley Cr-2		∘	∘				○		∘							○		•
Trout Cr-13		∘	∘				∘									◯		●
Cartwright Cr			∘				∘		∘							○		•
Trout Cr-14		∘	∘				∘		∘									•
Opal Cr-1			∘				○		∘				∘			◯		•
Auger Cr							○		∘							◯		•
Opal Cr-2		∘	∘				○		∘				∘			◯		•
Trout Cr-15			∘				∘		∘							∘		∘
Potlid Cr							∘		∘									•
Trout Cr-16									∘									•
L Deschutes MS-20									○									

1/ Greatest absolute value of factor change (whether gain or loss) is shown for area (reaches may differ in gain or loss).

Key to amount of change in factor (corresponding Loss/Gain Category letter also shown)

A		B		C		D & E	
◯ / ⬤	High	○ / ●	Medium	∘ / •	Low	(blank)	Indirect or General

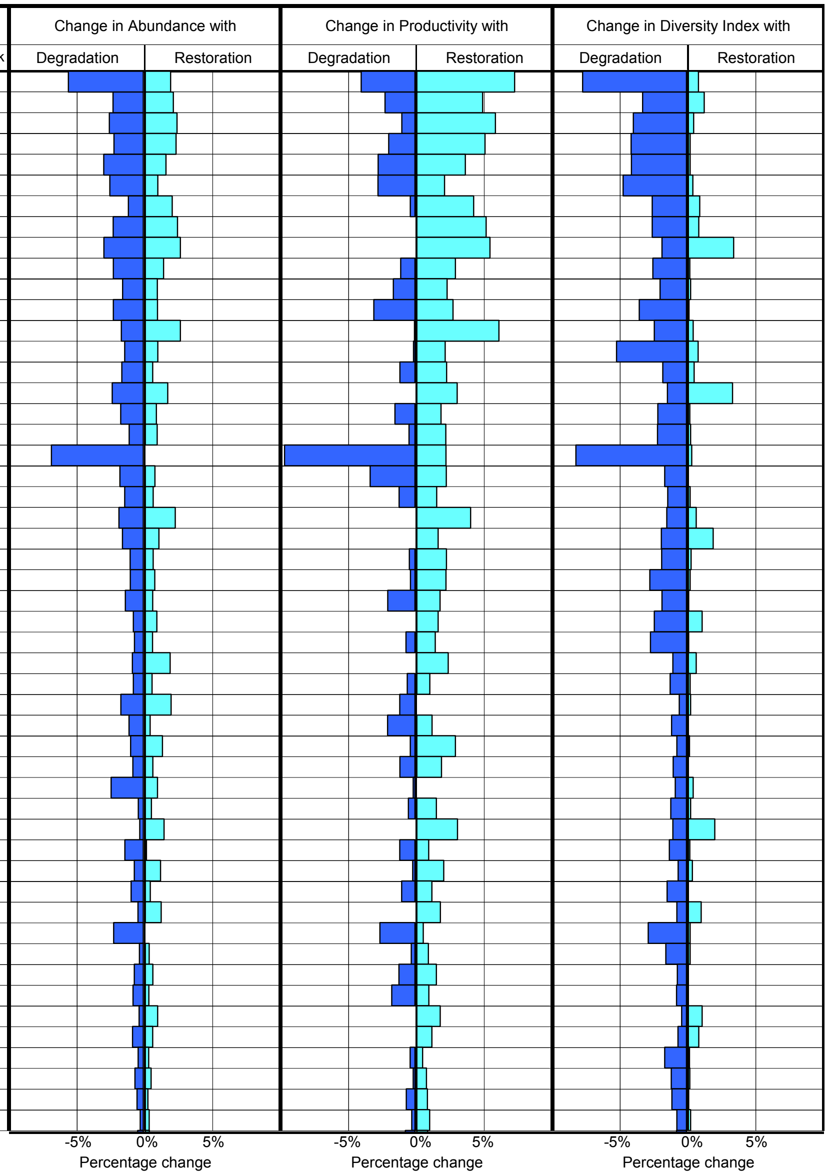
Scenario Diagnostic Report – Tornado Chart

Priority 1 and 2 Subbasin Actions – 100 years

Deschutes Eastside Summer Steelhead

Relative Importance Of Geographic Areas For Protection and Restoration Measures After Scenario Implementation

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
Buck Hollow Cr-1	A	2	A	5
L Deschutes MS-16	A	6	A	3
Trout Cr-3	A	9	A	6
Trout Cr-5	A	7	A	12
Buck Hollow Cr-3	A	3	B	17
L Deschutes MS-18	A	3	B	20
Trout Cr-6	B	19	A	6
Deep Cr-2 (Bakeoven)	B	26	A	2
L Deschutes MS-6	B	27	A	1
Bakeoven Cr-4	B	11	B	23
Buck Hollow Cr-2	B	13	B	21
Trout Cr-7	A	5	B	29
Thorn Hollow	B	31	A	4
Antelope Cr-4	B	22	B	15
L Deschutes MS-15	B	15	B	22
L Deschutes MS-8	B	34	A	6
Buck Hollow Cr-4	B	12	C	31
Trout Cr-4	B	19	B	24
L Deschutes MS-17	A	1	C	44
Trout Cr-12	A	10	C	35
Bakeoven Cr-3	B	16	C	30
Deep Cr-1 (Bakeoven)	B	38	A	10
L Deschutes MS-12	B	35	B	13
Little Trout Cr	B	24	B	24
Ward Cr-1	B	22	B	28
Trout Cr-8	B	14	C	38
Tenmile Cr	B	42	B	18
Antelope Cr-2	B	21	C	43
Cottonwood Cr-1	C	53	A	11
Bakeoven Cr-2	B	32	C	33
L Deschutes MS-2	B	28	C	37
Trout Cr-14	B	18	C	49
Deep Cr-3 (Bakeoven)	C	44	B	26
Foley Cr-2	B	30	C	42
L Deschutes MS-4	B	33	C	39
Trout Cr-9	B	40	C	32
Amity Cr	C	64	A	9
Bakeoven Cr-1	B	17	D	56
L Deschutes MS-13	C	55	B	18
Antelope Cr-1	B	25	C	49
L Deschutes MS-14	C	65	B	13
L Deschutes MS-19	A	7	D	72
Clover Cr	C	44	C	39
Trout Cr-11	B	36	C	47
Trout Cr-13	B	28	D	58
L Deschutes MS-5	D	72	B	16
L Deschutes MS-7	C	62	B	27
Trout Cr-1	B	36	D	57
Trout Cr-2	C	48	C	45
Dutchman Cr	B	38	D	58
Trout Cr-10	C	63	C	34



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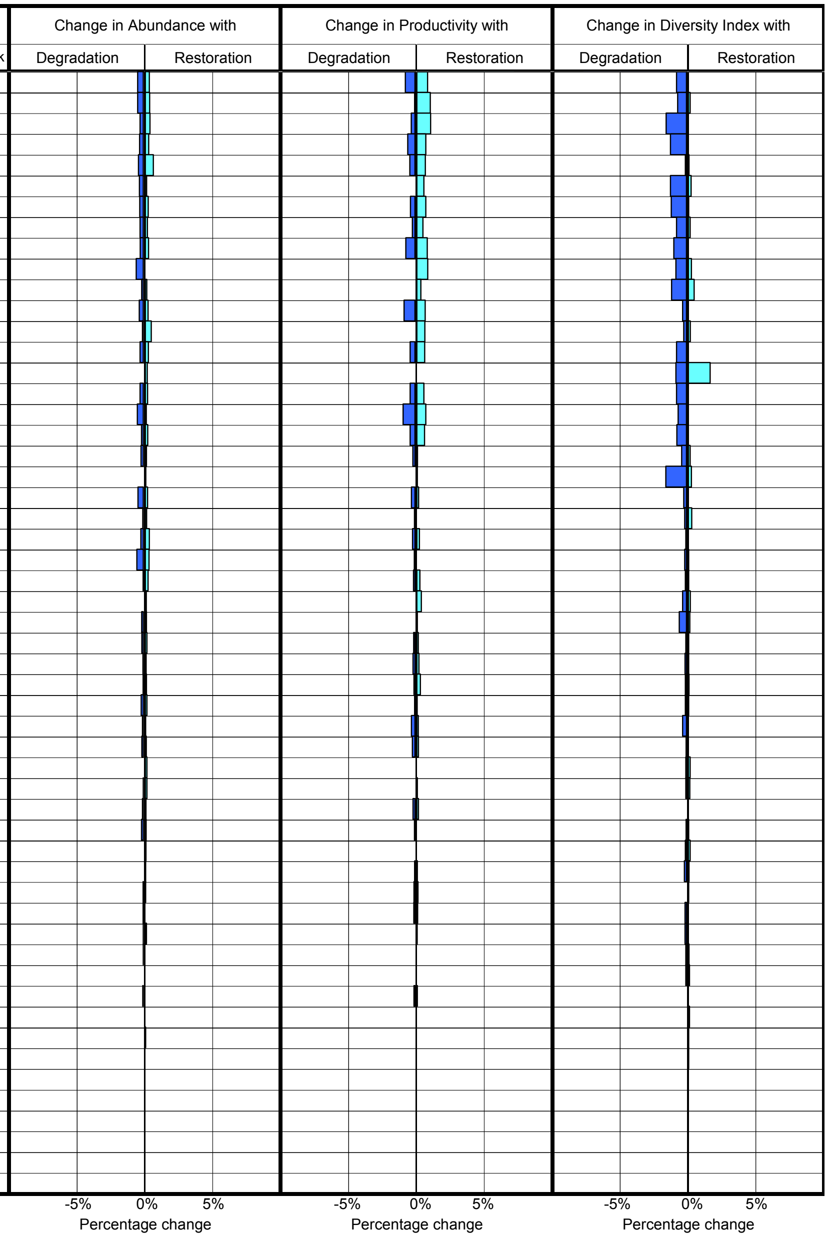
Deschutes Eastside Summer Steelhead

Relative Importance Of Geographic Areas For Protection and Restoration Measures After Scenario Implementation

Geographic Area	Protection benefit Category	Protection benefit rank	Restoration benefit Category	Restoration benefit rank
Potlid Cr	B	41	D	58
Maupin Trail Canyon	C	65	C	35
Opal Cr-2	C	47	D	53
Board Hollow Cr	B	42	D	64
Nena Cr-1	C	60	C	46
Mud Springs Cr-4	C	59	C	51
Beaver Cr (Trout)	C	50	D	61
Big Whetstone Cr	C	57	D	54
Cartwright Cr	C	49	D	63
Mud Springs Cr-1	C	57	D	55
Mud Springs Cr-6	C	68	C	48
Trout Cr-15	C	51	D	67
Cottonwood Cr-2	D	81	C	39
Big Log Cr-2	C	54	D	67
Hay Cr-3	D	75	C	51
Auger Cr	C	51	D	76
Foley Cr-1	C	46	D	81
Opal Cr-1	C	56	D	74
L Deschutes MS-11	C	69	D	66
Hay Cr-1	C	70	D	67
Warm Springs MS-1	C	60	E	82
L Deschutes MS-9	D	78	D	65
Wapinitia Cr-1	D	73	D	71
L Deschutes MS-3	C	67	D	79
Eagle Cr	D	81	D	67
Mud Springs Cr-3	D	87	D	62
L Deschutes MS-20	D	74	D	77
L Deschutes MS-1	D	78	D	79
Skookum Cr	D	76	E	85
Stag Canyon	D	84	D	77
Bakeoven Cr-5	D	78	E	84
Big Log Cr-1	D	71	E	92
Finnegan Canyon	D	77	E	86
Ferry Canyon	E	95	D	73
Oak Canyon	E	93	D	75
Hauser Canyon	D	84	E	89
Buck Hollow Cr-5	D	86	E	89
Macks Canyon	E	92	E	83
Booten Cr	D	88	E	88
Macken Canyon	D	91	E	86
Tub Springs Canyon	D	83	E	97
Robin Cr	D	89	E	94
Sagebrush Cr	E	94	E	92
Trail Hollow Cr	E	95	E	91
Trout Cr-16	D	90	E	99
Jones Canyon	E	97	E	95
Fall Canyon	E	97	E	96
Ochoco Gulch Cr	E	97	E	98
Antelope Cr-3	E	97	E	100
Hay Cr-2	E	97	E	100
L Deschutes MS-10	E	97	E	100
Mud Springs Cr-2	E	97	E	100
Mud Springs Cr-5	E	97	E	100
White R MS-1	E	97	E	100



Scenario Diagnostic Report – Diagnostic Summary
Priority 1 and 2 Subbasin Actions – 100 years
Deschutes Eastside Summer Steelhead
Protection and Restoration Strategic Priority Summary After Scenario Implementation

Geographic area priority			Attribute class priority for restoration															
Geographic area	Protection benefit	Restoration benefit	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
L Deschutes MS-1					•				⬤					•				⬤
L Deschutes MS-2	○	∘			•				●					•				⬤
Fall Canyon							•		•									●
L Deschutes MS-3	∘				•				•					•				
L Deschutes MS-4	○	∘			•				•					•				
Macks Canyon			•				●		●									●
L Deschutes MS-5		○			•				•					•	⬤			
Ferry Canyon							●		•						•			●
L Deschutes MS-6	○	◯			•				•					•	⬤			
Jones Canyon			•				•		●									●
L Deschutes MS-7	∘	○			•				•					•	⬤			
Oak Canyon			•				•		•									●
L Deschutes MS-8	○	◯			•				•					•	⬤			
Buck Hollow Cr-1	◯	◯					•							●	•	●		●
Finnegan Canyon							●		•									●
Buck Hollow Cr-2	○	○					•							●	•	●		●
Hauser Canyon							•		•									
Buck Hollow Cr-3	◯	○					•							●		•		●
Macken Canyon							•		•									
Buck Hollow Cr-4	○	∘					•							●		•		•
Thorn Hollow	○	◯					•		•					●		●		●
Buck Hollow Cr-5														•				•
L Deschutes MS-9					•		•		•									•
L Deschutes MS-10																		
L Deschutes MS-11	∘				•				•					•				•
White R MS-1									•					•				•
L Deschutes MS-12	○	○	•		•		•		●					•				
Bakeoven Cr-1	○						•							●		●		•
Trail Hollow Cr							•		•									●
Bakeoven Cr-2	○	∘					•							●		●		●
Booten Cr			•				•		●							•		●
Bakeoven Cr-3	○	∘					•							●		•		●
Robin Cr							•		•									●
Bakeoven Cr-4	○	○					•		•					●		●		●
Deep Cr-1 (Bakeoven)	○	◯					•		•					•		⬤		•
Cottonwood Cr-1	∘	◯					•		•					•		⬤		●
Ochoco Gulch Cr							•		•							•		●
Cottonwood Cr-2		∘					•		•					•		⬤		●
Deep Cr-2 (Bakeoven)	○	◯					•		•					•		⬤		•
Maupin Trail Canyon	∘	∘					•		•					•		●		•
Deep Cr-3 (Bakeoven)	∘	○					•		•					•		⬤		•
Bakeoven Cr-5									•					•				●
L Deschutes MS-13	∘	○	•		•		•		●	•			•	•		•		
Stag Canyon			•				●		●				•	•		•		
L Deschutes MS-14	∘	○	•		•		•		●					•				•
Wapinitia Cr-1							•		•					•				•
L Deschutes MS-15	○	○			•		•		●					•				
Nena Cr-1	∘	∘					•		•					•				●
L Deschutes MS-16	◯	◯					•		●									
Eagle Cr							•		•					•				●
L Deschutes MS-17	◯	∘			•				•					•				•
Skookum Cr							•		•									●
L Deschutes MS-18	◯	○			•				•					•				
Warm Springs MS-1	∘				•				•				•					
L Deschutes MS-19	◯				•				•					•				
Trout Cr-1	○						•		•					•		●		●

1/ "Channel stability" applies to freshwater areas only.

Key to strategic priority (corresponding Benefit Category letter also shown)

A	B	C	D & E
◯ / ⬤ High	○ / ● Medium	∘ / • Low	(blank) Indirect or General

Continued next page

Deschutes Eastside Summer Steelhead - continued
Protection and Restoration Strategic Priority Summary After Scenario Implementation

Geographic area priority			Attribute class priority for restoration															
Geographic area	Protection benefit	Restoration benefit	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Tenmile Cr	○	○					•		•					●		●		•
Trout Cr-2	∘	∘					•		•					●		●		•
Mud Springs Cr-1	∘		•											•	●	●		
Mud Springs Cr-2																		
Mud Springs Cr-3			•				•		•					•	●	●		•
Sagebrush Cr									•									
Mud Springs Cr-4	∘	∘	•						•					•	●	●		
Mud Springs Cr-5																		
Mud Springs Cr-6	∘	∘	•				•							•	●	●		
Trout Cr-3	◯	◯					•		•					●	•	●		•
Hay Cr-1	∘						•		●					●		●		⬤
Hay Cr-2																		
Hay Cr-3		∘					•		●					●		●		●
Trout Cr-4	○	○					•							●		●		●
Antelope Cr-1	○	∘					•							●		●		●
Ward Cr-1	○	○					•		•					●		●		
Antelope Cr-2	○	∘					•							●		●		•
Antelope Cr-3																		
Antelope Cr-4	○	○					•							●	•	●		●
Trout Cr-5	◯	◯					•							●		●		•
Tub Springs Canyon							•		•									•
Trout Cr-6	○	◯					•		•					●		⬤		•
Little Trout Cr	○	○					●							●		●		•
Trout Cr-7	◯	○					•							●		●		●
Big Whetstone Cr	∘						•		•					•		●		
Trout Cr-8	○	∘					•							●		●		•
Clover Cr	∘	∘					•		•					•		●		
Trout Cr-9	○	∘					•		•					●		⬤		●
Beaver Cr (Trout)	∘						•		•					•		●		
Trout Cr-10	∘	∘					•							●		⬤		●
Amity Cr	∘	◯					●		•				•	●		⬤		•
Trout Cr-11	○	∘					•		•					●		•		
Board Hollow Cr	○						•		•					•		●		•
Trout Cr-12	◯	∘					•		•					•		•		•
Foley Cr-1	∘		•				•		•					●		●		•
Big Log Cr-1							●		•					•		●		
Dutchman Cr	○						•		•					•		●		
Big Log Cr-2	∘						•		•					•		●		•
Foley Cr-2	○	∘					●							●		●		•
Trout Cr-13	○						•							•		•		
Cartwright Cr	∘						•		•					•		●		
Trout Cr-14	○	∘					•		•					•				
Opal Cr-1	∘		•				●		•					•		●		
Auger Cr	∘						•		•					•		•		
Opal Cr-2	∘		•				●		•					•		●		
Trout Cr-15	∘						•		•					•				•
Potlid Cr	○						•		•					•				•
Trout Cr-16							•		•									•
L Deschutes MS-20									•					•				

1/ "Channel stability" applies to freshwater areas only.

Key to strategic priority (corresponding Benefit Category letter also shown)

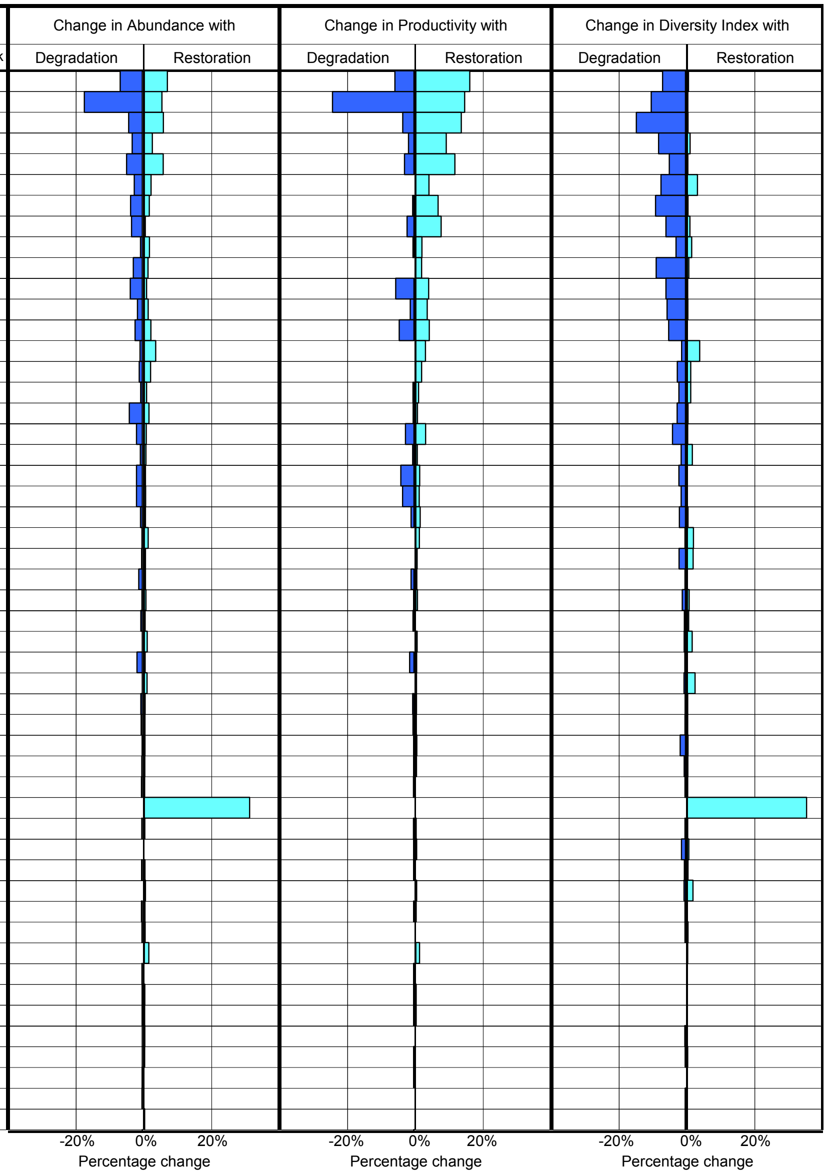
A	B	C	D & E
◯ / ⬤ High	○ / ● Medium	∘ / • Low	Indirect or General

Baseline Diagnostic Report – Tornado Chart

Deschutes Westside Summer Steelhead

Relative Importance Of Geographic Areas For Protection and Restoration Measures - current condition

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
Beaver Cr-1 (WS)	A	2	B	3
Shitike Cr-3	A	1	B	6
Boulder Cr (WS)	A	3	B	5
Warm Springs MS-7	B	6	B	4
Shitike Cr-2	B	5	B	7
L Deschutes MS-20	C	16	A	1
Warm Springs MS-9	B	8	B	10
Shitike Cr-1	B	7	B	13
Warm Springs MS-3	D	18	B	7
Badger Cr (WS)	C	15	B	12
Beaver Cr-2 (WS)	B	4	C	23
Mill Cr-2 (WS)	C	12	C	16
Beaver Cr-3 (WS)	B	8	C	21
Wapinitia Cr-1	D	27	A	2
L Deschutes MS-21	D	23	B	9
Warm Springs MS-1	D	19	B	14
Warm Springs MS-5	C	14	C	22
Warm Springs MS-8	B	11	C	26
L Deschutes MS-17	D	20	C	18
Beaver Cr-4 (WS)	B	10	D	30
Beaver Cr-5 (WS)	C	13	D	30
Warm Springs MS-6	C	16	C	27
Nena Cr-1	E	37	B	11
L Deschutes MS-18	D	29	C	20
L Deschutes MS-4	D	22	D	32
Warm Springs MS-4	D	32	C	23
L Deschutes MS-16	D	24	D	32
Eagle Cr	E	41	C	16
L Deschutes MS-2	D	20	D	38
Wapinitia Cr-2	E	40	C	18
L Deschutes MS-6	D	26	D	34
L Deschutes MS-8	D	25	D	37
Mill Cr-1 (WS)	D	35	D	29
Trout Cr-1	D	33	D	36
L Deschutes MS-11	D	28	D	42
Pelton Dam complex	E	56	B	14
L Deschutes MS-12	D	30	D	41
L Deschutes MS-19	D	36	D	35
L Deschutes MS-15	D	34	D	38
Skookum Cr	E	44	C	28
Bunchgrass Cr	D	30	D	43
L Deschutes MS-14	E	38	D	40
Warm Springs MS-2	E	56	C	25
L Deschutes MS-5	E	39	E	48
L Deschutes MS-1	E	43	E	45
L Deschutes MS-3	E	42	E	46
Stag Canyon	E	44	E	47
L Deschutes MS-13	E	49	D	43
L Deschutes MS-7	E	44	E	50
Buck Hollow Cr-1	E	44	E	54
Trout Cr-2	E	52	E	48



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Deschutes Westside Summer Steelhead - continued

Relative Importance Of Geographic Areas For Protection and Restoration Measures - current condition

Geographic Area	Protection benefit		Restoration benefit		Change in Abundance with		Change in Productivity with		Change in Diversity Index with	
	Category/rank		Category/rank		Degradation	Restoration	Degradation	Restoration	Degradation	Restoration
L Deschutes MS-9	E	50	E	52						
Bakeoven Cr-1	E	48	E	56						
Oak Canyon	E	53	E	52						
White R MS-1	E	54	E	51						
Paquet Gulch-1	E	51	E	57						
Jones Canyon	E	55	E	55						
Abbot Cr	E	56	E	58						
Candle Cr	E	56	E	58						
Canyon Cr-1 (Met)	E	56	E	58						
Crooked MS-1	E	56	E	58						
Ferry Canyon	E	56	E	58						
First Cr	E	56	E	58						
Fly Cr-1	E	56	E	58						
Indian Ford Cr	E	56	E	58						
Jack Cr-1	E	56	E	58						
Jack Cr-2	E	56	E	58						
Jefferson Cr	E	56	E	58						
L Deschutes MS-10	E	56	E	58						
Lake Cr MF-1	E	56	E	58						
Lake Cr MF-2	E	56	E	58						
Lake Cr SF	E	56	E	58						
Lake Cr-1	E	56	E	58						
M Deschutes MS-10	E	56	E	58						
M Deschutes MS-4	E	56	E	58						
M Deschutes MS-5	E	56	E	58						
M Deschutes MS-6	E	56	E	58						
M Deschutes MS-7	E	56	E	58						
M Deschutes MS-8	E	56	E	58						
M Deschutes MS-9	E	56	E	58						
Macks Canyon	E	56	E	58						
Metolius MS-1	E	56	E	58						
Metolius MS-10	E	56	E	58						
Metolius MS-11	E	56	E	58						
Metolius MS-12	E	56	E	58						
Metolius MS-13	E	56	E	58						
Metolius MS-14	E	56	E	58						
Metolius MS-2	E	56	E	58						
Metolius MS-3	E	56	E	58						
Metolius MS-4	E	56	E	58						
Metolius MS-5	E	56	E	58						
Metolius MS-6	E	56	E	58						
Metolius MS-7	E	56	E	58						
Metolius MS-8	E	56	E	58						
Metolius MS-9	E	56	E	58						
Snow Cr (Squaw)	E	56	E	58						
Spring Cr-1	E	56	E	58						
Spring Cr-1 (Met)	E	56	E	58						
Squaw Cr-1	E	56	E	58						
Squaw Cr-2	E	56	E	58						
Squaw Cr-3	E	56	E	58						
Squaw Cr-4	E	56	E	58						
Squaw Cr-5	E	56	E	58						
Squaw Cr-6	E	56	E	58						
Squaw Cr-7	E	56	E	58						
Squaw Cr-8	E	56	E	58						
Street Cr-1	E	56	E	58						
Street Cr-2	E	56	E	58						
Whitewater R	E	56	E	58						
					-20% 0%	20%	-20% 0%	20%	-20% 0%	20%
					Percentage change		Percentage change		Percentage change	

Baseline Diagnostic Report – Diagnostic Summary

Deschutes Westside Summer Steelhead
Protection and Restoration Strategic Priority Summary - current condition

Geographic area priority			Attribute class priority for restoration																
Geographic area	**Protection benefit**	**Restoration benefit**	*Channel stability*	*Chemicals*	*Competition (w/ hatch)*	*Competition (other sp)*	*Flow*	*Food*	*Habitat diversity*	*Harassment/poaching*	*Obstructions*	*Oxygen*	*Pathogens*	*Predation*	*Sediment load*	*Temperature*	*Withdrawals*	*Key habitat quantity*
L Deschutes MS-1									C					C				
L Deschutes MS-2					C				B					C				A
L Deschutes MS-3									C					C				
L Deschutes MS-4					C				B					C				
Macks Canyon							C		C									B
L Deschutes MS-5					C				B					C				
Ferry Canyon							C		C						C			B
L Deschutes MS-6					C				B					C				
Jones Canyon			C				C		B									B
L Deschutes MS-7					C				B					C				
Oak Canyon			C				C		C									B
L Deschutes MS-8					C				B					C				
Buck Hollow Cr-1			C				C		C					C				C
L Deschutes MS-9					C		C		C									C
L Deschutes MS-10																		
L Deschutes MS-11					C		C		C					C				C
White R MS-1					C		B		C					C		C		C
L Deschutes MS-12					C				B					C				
Bakeoven Cr-1							C		C					C				C
L Deschutes MS-13					C		C		B				C	C				
Stag Canyon			C				C		B					C		C		
L Deschutes MS-14			C		C		C		B					C				C
Wapinitia Cr-1		A	C				B		B					B	B	A		B
Paquet Gulch-1							B		C							B		B
Wapinitia Cr-2		C	C				B		C				C	C	C	A		B
L Deschutes MS-15					C				B									
Nena Cr-1		B	C				B		B				C	B		A		B
L Deschutes MS-16							C		B									
Eagle Cr		C	C				B		B				C	B		A		A
L Deschutes MS-17		C			C		C		B					C				
Skookum Cr		C	C				B		B				C	C		A		B
L Deschutes MS-18		C			C				B									
Warm Springs MS-1		B			C		C		B									
Warm Springs MS-2		C									C							
Warm Springs MS-3		B			C		C		C				C	C				
Beaver Cr-1 (WS)	A	B	C		C		C		C					C	B	C		B
Beaver Cr-2 (WS)	B	C					C		C							C		
Beaver Cr-3 (WS)	B	C					C		C						C	C		B
Beaver Cr-4 (WS)	B						C									C		B
Beaver Cr-5 (WS)	C						C									C		C
Warm Springs MS-4		C			C		C		B									C
Mill Cr-1 (WS)					C		C		C									C
Boulder Cr (WS)	A	B	C				B		C							C		C
Mill Cr-2 (WS)	C	C	C		C		B		C					C	B			C
Warm Springs MS-5	C	C							C									
Badger Cr (WS)	C	B					B		C							C		C
Warm Springs MS-6	C	C					C		C						B			C
Warm Springs MS-7	B	B					C		B						B			
Warm Springs MS-8	B	C					C		C						B			
Bunchgrass Cr									C									C
Warm Springs MS-9	B	B					C		C						B			
L Deschutes MS-19					C				B									
Trout Cr-1							C		B							C		C
Trout Cr-2							C		B					C		C		B
L Deschutes MS-20	C	A			C		C		B					C				
Shitike Cr-1	B	B	C		C		C	C	B						B	C		B

1/ "Channel stability" applies to freshwater areas only.

Key to strategic priority (corresponding Benefit Category letter also shown)

A	B	C	D & E
High	Medium	Low	Indirect or General

Continued next page

Deschutes Westside Summer Steelhead - continued
Protection and Restoration Strategic Priority Summary - current condition

Geographic area priority			Attribute class priority for restoration																	
Geographic area	Protection benefit	Restoration benefit	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Shitike Cr-2	○	○	•		•		•	•	●							•		•
Shitike Cr-3	◯	○			•											•		•
L Deschutes MS-21		○			•		•		●					•				•
Pelton Dam complex		○									⬤							
M Deschutes MS-4					•				⬤					•	⬤	•		●
Metolius MS-1									⬤					•	⬤	•		●
Fly Cr-1									⬤					•	⬤	•		●
Metolius MS-2					•				⬤					•	⬤	•		●
Spring Cr-1									⬤					●	⬤	•		●
Metolius MS-3					•				⬤					•	⬤	•		●
Street Cr-1									⬤					•	⬤	•		●
Street Cr-2							•		•						•			•
Metolius MS-4					•				⬤					•	⬤	•		●
Metolius MS-5					•									•				
Whitewater R																		
Metolius MS-6					•									•				
Jefferson Cr									•									
Metolius MS-7														•				●
Candle Cr									•									
Metolius MS-8					•				•					•				
Abbot Cr									•						●			
Metolius MS-9					●				•					•				•
Canyon Cr-1 (Met)									•									
Metolius MS-10					•				•					•				
Jack Cr-1									●									●
Jack Cr-2																		
Metolius MS-11					●				⬤					•				●
First Cr							•											•
Metolius MS-12					•			•	•					•				
Spring Cr-1 (Met)									●									
Metolius MS-13					•				•					•				•
Lake Cr MF-1			•		•				•					•	•	•		
Lake Cr SF					•									•		•		
Lake Cr MF-2					•				•					•		•		
Lake Cr-1					•				•					•		•		
Metolius MS-14					•				•					•				
M Deschutes MS-5					•				⬤				•	•		•		•
Crooked MS-1									⬤					•	⬤	•		●
M Deschutes MS-6					•				⬤					•	⬤	•		●
M Deschutes MS-7					•				•									
Squaw Cr-1									•									●
Squaw Cr-2			●				•		•				•	●	•	⬤		●
Indian Ford Cr			•				•		•						●	●		●
Squaw Cr-3			●				●	•	●				•	●	●	⬤		⬤
Squaw Cr-4											⬤							
Squaw Cr-5			•				•		•					●	●	•		●
Squaw Cr-6											⬤							
Squaw Cr-7			•						•					•				●
Snow Cr (Squaw)																		
Squaw Cr-8																		•
M Deschutes MS-8					•		•		•					•				•
M Deschutes MS-9																		
M Deschutes MS-10					•		•		•					•				●

1/ "Channel stability" applies to freshwater areas only.

Key to strategic priority (corresponding Benefit Category letter also shown)

A	B	C	D & E
◯ / ⬤ High	○ / ● Medium	◦ / • Low	(blank) Indirect or General

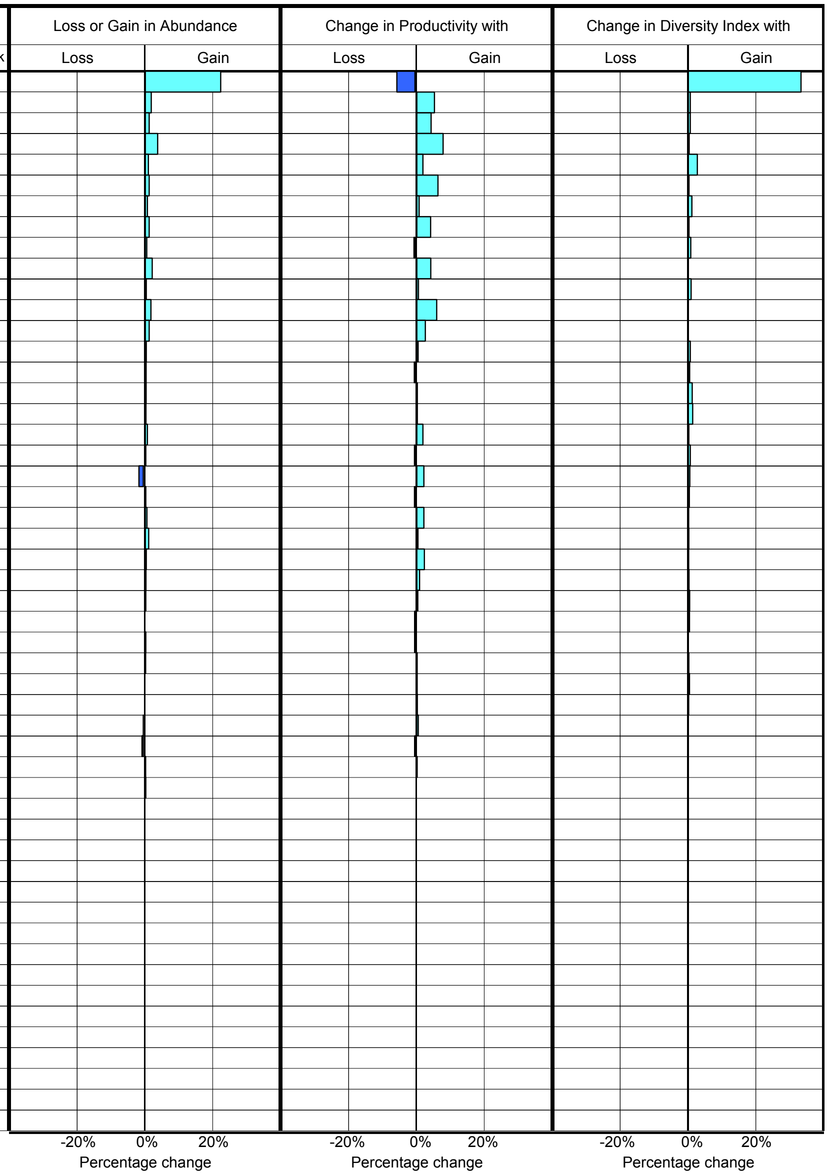
Scenario Profile Report – Tornado Chart

Priority 1 and 2 Subbasin Actions – 100 years

Deschutes Westside Summer Steelhead

Change in Performance Due to Scenario's Effect within Geographic Area

Geographic Area	Loss category		Gain category	
	Category/rank		Category/rank	
Pelton Dam complex	B	1	A	8
Warm Springs MS-7	E	15	A	1
Shitike Cr-1	E	15	A	2
Beaver Cr-1 (WS)	E	15	A	3
L Deschutes MS-20	E	15	A	4
Boulder Cr (WS)	E	15	A	5
Warm Springs MS-3	E	15	A	6
Warm Springs MS-9	E	15	A	7
Wapinitia Cr-1	E	2	C	21
Shitike Cr-2	E	15	A	9
L Deschutes MS-21	E	15	A	10
Shitike Cr-3	E	15	A	11
Beaver Cr-3 (WS)	E	15	B	12
Warm Springs MS-1	E	15	B	12
Nena Cr-1	E	4	E	24
L Deschutes MS-17	E	15	B	14
L Deschutes MS-18	E	15	B	14
Mill Cr-2 (WS)	E	15	B	14
Wapinitia Cr-2	E	5	E	25
Badger Cr (WS)	E	9	C	23
Eagle Cr	E	6	E	26
Warm Springs MS-8	E	15	B	17
Warm Springs MS-5	E	15	B	18
Beaver Cr-2 (WS)	E	15	B	19
Warm Springs MS-6	E	15	C	20
Warm Springs MS-4	E	15	C	21
Skookum Cr	E	7	E	32
Buck Hollow Cr-1	E	9	E	33
Mill Cr-1 (WS)	E	15	E	27
L Deschutes MS-19	E	15	E	28
Trout Cr-1	E	15	E	29
Beaver Cr-4 (WS)	E	11	E	34
Beaver Cr-5 (WS)	E	2	E	43
L Deschutes MS-4	E	15	E	30
Bunchgrass Cr	E	15	E	31
L Deschutes MS-6	E	15	E	34
Bakeoven Cr-1	E	11	E	39
White R MS-1	E	7	E	43
Trout Cr-2	E	15	E	36
L Deschutes MS-3	E	15	E	37
L Deschutes MS-8	E	15	E	38
L Deschutes MS-5	E	15	E	40
Paquet Gulch-1	E	13	E	42
L Deschutes MS-2	E	13	E	43
L Deschutes MS-7	E	15	E	41
Abbot Cr	E	15	E	43
Candle Cr	E	15	E	43
Canyon Cr-1 (Met)	E	15	E	43
Crooked MS-1	E	15	E	43
Ferry Canyon	E	15	E	43
First Cr	E	15	E	43



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Deschutes Westside Summer Steelhead - continued

Change in Performance Due to Scenario's Effect within Geographic Area

Geographic Area	Loss category		Gain category		Loss or Gain in Abundance		Change in Productivity with		Change in Diversity Index with	
	Category/rank		Category/rank		Loss	Gain	Loss	Gain	Loss	Gain
Fly Cr-1	E	15	E	43						
Indian Ford Cr	E	15	E	43						
Jack Cr-1	E	15	E	43						
Jack Cr-2	E	15	E	43						
Jefferson Cr	E	15	E	43						
Jones Canyon	E	15	E	43						
L Deschutes MS-1	E	15	E	43						
L Deschutes MS-10	E	15	E	43						
L Deschutes MS-11	E	15	E	43						
L Deschutes MS-12	E	15	E	43						
L Deschutes MS-13	E	15	E	43						
L Deschutes MS-14	E	15	E	43						
L Deschutes MS-15	E	15	E	43						
L Deschutes MS-16	E	15	E	43						
L Deschutes MS-9	E	15	E	43						
Lake Cr MF-1	E	15	E	43						
Lake Cr MF-2	E	15	E	43						
Lake Cr SF	E	15	E	43						
Lake Cr-1	E	15	E	43						
M Deschutes MS-10	E	15	E	43						
M Deschutes MS-4	E	15	E	43						
M Deschutes MS-5	E	15	E	43						
M Deschutes MS-6	E	15	E	43						
M Deschutes MS-7	E	15	E	43						
M Deschutes MS-8	E	15	E	43						
M Deschutes MS-9	E	15	E	43						
Macks Canyon	E	15	E	43						
Metolius MS-1	E	15	E	43						
Metolius MS-10	E	15	E	43						
Metolius MS-11	E	15	E	43						
Metolius MS-12	E	15	E	43						
Metolius MS-13	E	15	E	43						
Metolius MS-14	E	15	E	43						
Metolius MS-2	E	15	E	43						
Metolius MS-3	E	15	E	43						
Metolius MS-4	E	15	E	43						
Metolius MS-5	E	15	E	43						
Metolius MS-6	E	15	E	43						
Metolius MS-7	E	15	E	43						
Metolius MS-8	E	15	E	43						
Metolius MS-9	E	15	E	43						
Oak Canyon	E	15	E	43						
Snow Cr (Squaw)	E	15	E	43						
Spring Cr-1	E	15	E	43						
Spring Cr-1 (Met)	E	15	E	43						
Squaw Cr-1	E	15	E	43						
Squaw Cr-2	E	15	E	43						
Squaw Cr-3	E	15	E	43						
Squaw Cr-4	E	15	E	43						
Squaw Cr-5	E	15	E	43						
Squaw Cr-6	E	15	E	43						
Squaw Cr-7	E	15	E	43						
Squaw Cr-8	E	15	E	43						
Stag Canyon	E	15	E	43						
Street Cr-1	E	15	E	43						
Street Cr-2	E	15	E	43						
Warm Springs MS-2	E	15	E	43						
Whitewater R	E	15	E	43						

-20% 0% 20% Percentage change | -20% 0% 20% Percentage change | -20% 0% 20% Percentage change

Scenario Profile Report – Change in Habitat Factors Summary

Priority 1 and 2 Subbasin Actions – 100 years

Deschutes Westside Summer Steelhead

Summary of Scenario Effects on Survival Factors and Overall Performance

Relative loss or gain by area			Change in attribute impact on survival due to scenario															
Geographic area	**Relative loss**	**Relative gain**	*Channel stability*	*Chemicals*	*Competition (w/ hatch)*	*Competition (other sp)*	*Flow*	*Food*	*Habitat diversity*	*Harassment/poaching*	*Obstructions*	*Oxygen*	*Pathogens*	*Predation*	*Sediment load*	*Temperature*	*Withdrawals*	*Key habitat quantity*
L Deschutes MS-1																		
L Deschutes MS-2																		
L Deschutes MS-3																		
L Deschutes MS-4									◦									
Macks Canyon																		
L Deschutes MS-5									◦									
Ferry Canyon																		
L Deschutes MS-6									○									
Jones Canyon																		
L Deschutes MS-7									○									
Oak Canyon																		
L Deschutes MS-8									○									
Buck Hollow Cr-1			◦				◦		◦									•
L Deschutes MS-9																		
L Deschutes MS-10																		
L Deschutes MS-11																		
White R MS-1							○											•
L Deschutes MS-12																		
Bakeoven Cr-1									◦									•
L Deschutes MS-13																		
Stag Canyon																		
L Deschutes MS-14																		
Wapinitia Cr-1		◦					◦		◦						◦	◦		◦
Paquet Gulch-1							◦									◦		◦
Wapinitia Cr-2							◦		◦							◯		○
L Deschutes MS-15																		
Nena Cr-1			◦				◦		◦							◯		◦
L Deschutes MS-16																		
Eagle Cr			◦				◦		◦							◯		○
L Deschutes MS-17		○							○									
Skookum Cr							◦		◦							◯		◦
L Deschutes MS-18		○							○									
Warm Springs MS-1		○							◦									
Warm Springs MS-2																		
Warm Springs MS-3		◯					◦		◦									
Beaver Cr-1 (WS)		◯	◦				◦								○	◦		○
Beaver Cr-2 (WS)		○					◦		◦							◦		•
Beaver Cr-3 (WS)		○					◦											○
Beaver Cr-4 (WS)							◦									◦		●
Beaver Cr-5 (WS)							◦											●
Warm Springs MS-4		◦							◦									•
Mill Cr-1 (WS)							◦											◦
Boulder Cr (WS)		◯	◦				○		◦							◦		●
Mill Cr-2 (WS)		○	◦				◦		◦						○			◦
Warm Springs MS-5		○							◦									
Badger Cr (WS)		◦					◦		◦									●
Warm Springs MS-6		◦							◦						○			
Warm Springs MS-7		◯							◦						○			
Warm Springs MS-8		○							◦						○			
Bunchgrass Cr									◦									
Warm Springs MS-9		◯					◦		◦						○			•
L Deschutes MS-19									○									
Trout Cr-1									◦							◦		•
Trout Cr-2							◦		○							◦		○
L Deschutes MS-20		◯							○									
Shitike Cr-1		◯	◦				◦		◦						○	◦		•

1/ Greatest absolute value of factor change (whether gain or loss) is shown for area (reaches may differ in gain or loss).

Key to amount of change in factor (corresponding Loss/Gain Category letter also shown)

A		B		C		D & E	
◯ / ⬤	High	○ / ●	Medium	◦ / •	Low	(blank)	Indirect or General

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Deschutes Westside Summer Steelhead - continued
Summary of Scenario Effects on Survival Factors and Overall Performance

Relative loss or gain by area			Change in attribute impact on survival due to scenario																
Geographic area	Relative loss	Relative gain	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Shitike Cr-2		◯					∘		∘							∘		•
Shitike Cr-3		◯														∘		•
L Deschutes MS-21		◯							○									
Pelton Dam complex	●	◯									◯							
M Deschutes MS-4																		
Metolius MS-1																		
Fly Cr-1															◯			●
Metolius MS-2																		
Spring Cr-1															◯			●
Metolius MS-3																		
Street Cr-1															◯			●
Street Cr-2									∘									
Metolius MS-4																		
Metolius MS-5																		
Whitewater R																		•
Metolius MS-6																		
Jefferson Cr									∘									•
Metolius MS-7																		
Candle Cr									∘									
Metolius MS-8									∘									
Abbot Cr									∘						∘			∘
Metolius MS-9									∘									
Canyon Cr-1 (Met)									∘									
Metolius MS-10																		
Jack Cr-1									○									
Jack Cr-2																		
Metolius MS-11					∘				◯									
First Cr																		∘
Metolius MS-12									∘									
Spring Cr-1 (Met)									○									
Metolius MS-13																		
Lake Cr MF-1			∘						∘						∘	∘		•
Lake Cr SF																∘		∘
Lake Cr MF-2									∘							∘		•
Lake Cr-1									∘							∘		•
Metolius MS-14									∘									
M Deschutes MS-5																		
Crooked MS-1																		
M Deschutes MS-6																		
M Deschutes MS-7																		
Squaw Cr-1									∘									∘
Squaw Cr-2			○				∘		∘				∘	∘	∘	◯		◯
Indian Ford Cr							∘		∘						○	◯		○
Squaw Cr-3			○				○		○				∘	∘	○	◯		◯
Squaw Cr-4											◯							
Squaw Cr-5			∘				∘		∘						○	∘		◯
Squaw Cr-6											◯							
Squaw Cr-7									∘									◯
Snow Cr (Squaw)																		•
Squaw Cr-8																		∘
M Deschutes MS-8																		•
M Deschutes MS-9																		
M Deschutes MS-10																		

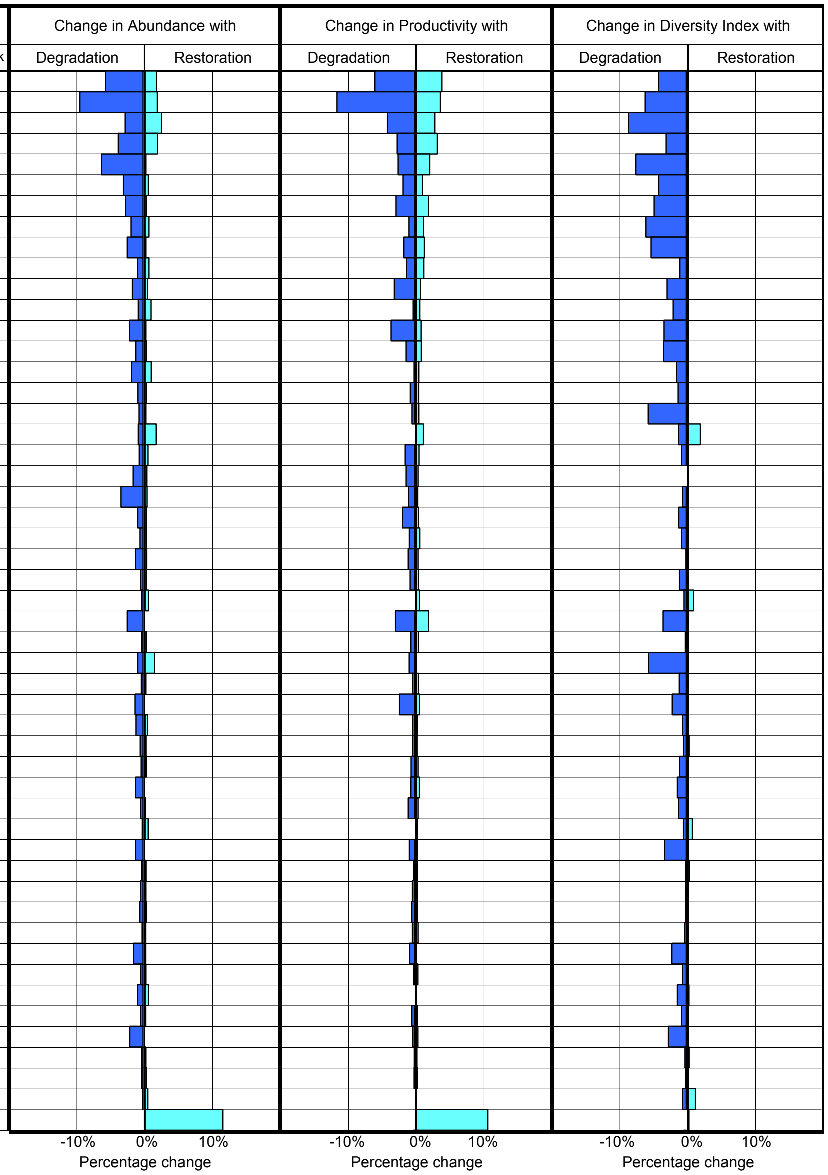
1/ Greatest absolute value of factor change (whether gain or loss) is shown for area (reaches may differ in gain or loss).

Key to amount of change in factor (corresponding Loss/Gain Category letter also shown)

A	B	C	D & E
◯ / ⬤ High	○ / ● Medium	∘ / • Low	Indirect or General

Scenario Diagnostic Report – Tornado Chart
Priority 1 and 2 Subbasin Actions – 100 years
Deschutes Westside Summer Steelhead
Relative Importance Of Geographic Areas For Protection and Restoration Measures After Scenario Implementation

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
Beaver Cr-1 (WS)	A	4	B	3
Shitike Cr-3	A	1	B	6
Boulder Cr (WS)	A	2	B	6
Shitike Cr-2	B	6	B	6
Squaw Cr-2	A	3	C	17
Squaw Cr-7	B	8	C	12
Warm Springs MS-7	A	5	C	15
L Deschutes MS-20	B	12	C	10
Warm Springs MS-9	B	10	C	16
Warm Springs MS-3	C	22	B	5
Beaver Cr-3 (WS)	B	11	D	19
L Deschutes MS-21	C	29	C	9
Beaver Cr-2 (WS)	B	8	D	31
Mill Cr-2 (WS)	B	14	D	25
M Deschutes MS-8	C	27	C	14
L Deschutes MS-17	C	24	D	20
Indian Ford Cr	B	20	D	26
Wapinitia Cr-1	C	45	B	2
Beaver Cr-5 (WS)	C	24	D	24
L Deschutes MS-2	C	32	C	17
Warm Springs MS-5	B	18	D	33
Beaver Cr-4 (WS)	B	18	D	35
Warm Springs MS-1	C	27	D	28
L Deschutes MS-4	C	33	D	23
Lake Cr MF-2	C	29	D	29
Nena Cr-1	D	55	B	4
Shitike Cr-1	B	6	D	54
Warm Springs MS-4	C	40	D	20
Badger Cr (WS)	B	15	D	47
L Deschutes MS-18	C	36	D	26
Warm Springs MS-8	B	13	D	51
Squaw Cr-1	C	31	D	38
L Deschutes MS-16	C	38	D	33
Lake Cr SF	C	33	D	39
Squaw Cr-3	C	22	D	52
Warm Springs MS-6	C	26	D	48
Eagle Cr	D	62	C	13
Snow Cr (Squaw)	B	16	D	60
L Deschutes MS-12	D	48	D	29
L Deschutes MS-8	C	42	D	36
L Deschutes MS-6	C	37	D	43
Mill Cr-1 (WS)	C	44	D	37
Squaw Cr-8	B	17	D	65
Lake Cr-1	C	40	D	44
M Deschutes MS-10	C	43	D	44
Squaw Cr-5	C	35	D	52
Abbot Cr	B	21	D	67
L Deschutes MS-15	D	50	D	40
M Deschutes MS-7	D	51	D	41
Wapinitia Cr-2	D	60	D	32
Pelton Dam complex	E	97	A	1



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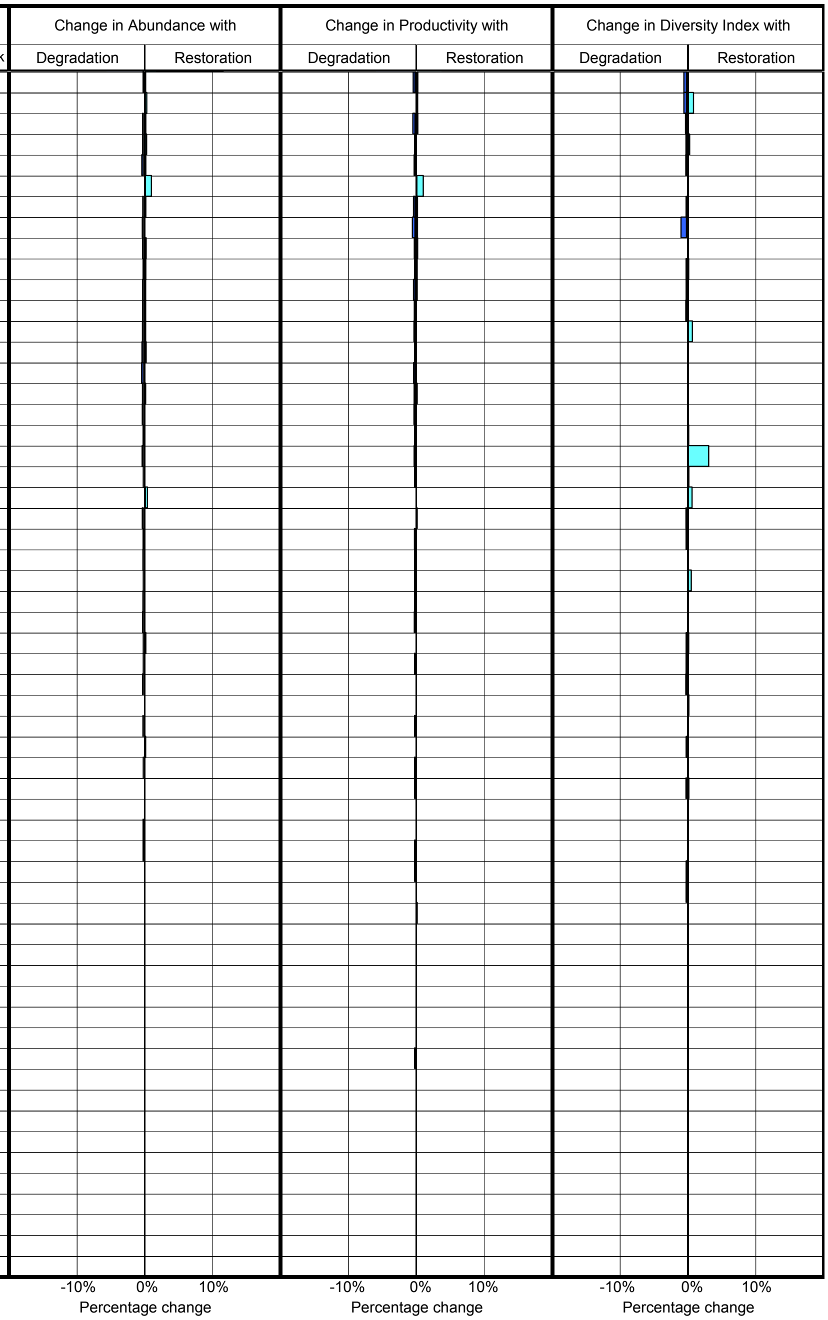
Deschutes Westside Summer Steelhead - continued

Relative Importance Of Geographic Areas For Protection and Restoration Measures After Scenario Implementation

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
L Deschutes MS-19	D	49	D	50
Skookum Cr	D	79	D	20
Metolius MS-6	D	47	D	56
L Deschutes MS-14	D	64	D	41
L Deschutes MS-11	D	46	D	61
Warm Springs MS-2	E	97	C	10
Metolius MS-9	D	54	D	58
Lake Cr MF-1	C	39	D	75
L Deschutes MS-1	D	65	D	54
L Deschutes MS-13	D	70	D	49
Trout Cr-1	D	58	D	62
L Deschutes MS-7	D	53	D	68
Metolius MS-1	D	58	D	64
Metolius MS-8	D	63	D	59
Bunchgrass Cr	D	52	D	71
L Deschutes MS-5	D	60	D	65
L Deschutes MS-3	D	56	D	70
L Deschutes MS-9	D	75	D	57
M Deschutes MS-6	D	56	D	77
M Deschutes MS-4	E	80	D	62
Crooked MS-1	E	97	D	46
Buck Hollow Cr-1	D	67	E	83
Metolius MS-5	D	68	E	82
Spring Cr-1 (Met)	D	74	D	77
M Deschutes MS-5	D	77	D	75
Metolius MS-14	D	72	E	80
Jefferson Cr	D	65	E	89
Stag Canyon	E	85	D	69
Metolius MS-12	D	71	E	85
Bakeoven Cr-1	D	68	E	89
Metolius MS-4	E	84	D	73
Candle Cr	D	73	E	85
Oak Canyon	E	86	D	72
Metolius MS-2	E	83	D	77
Metolius MS-11	D	77	E	85
Metolius MS-3	E	91	D	73
Trout Cr-2	E	81	E	85
First Cr	D	76	E	96
Metolius MS-10	E	81	E	93
White R MS-1	E	88	E	89
M Deschutes MS-9	E	97	E	81
Spring Cr-1	E	97	E	84
Metolius MS-7	E	87	E	95
Jones Canyon	E	94	E	92
Metolius MS-13	E	90	E	97
Paquet Gulch-1	E	92	E	98
Canyon Cr-1 (Met)	E	97	E	94
Whitewater R	E	88	E	103
Jack Cr-1	E	94	E	99
Jack Cr-2	E	93	E	100
Street Cr-1	E	96	E	101
Street Cr-2	E	97	E	102
Ferry Canyon	E	97	E	103
Fly Cr-1	E	97	E	103
L Deschutes MS-10	E	97	E	103
Macks Canyon	E	97	E	103
Squaw Cr-4	E	97	E	103
Squaw Cr-6	E	97	E	103



Scenario Diagnostic Report – Diagnostic Summary
Priority 1 and 2 Subbasin Actions – 100 years
Deschutes Westside Summer Steelhead
Protection and Restoration Strategic Priority Summary After Scenario Implementation

Geographic area priority			Attribute class priority for restoration															
Geographic area	**Protection benefit**	**Restoration benefit**	*Channel stability*	*Chemicals*	*Competition (w/ hatch)*	*Competition (other sp)*	*Flow*	*Food*	*Habitat diversity*	*Harassment/poaching*	*Obstructions*	*Oxygen*	*Pathogens*	*Predation*	*Sediment load*	*Temperature*	*Withdrawals*	*Key habitat quantity*
L Deschutes MS-1									•					•				
L Deschutes MS-2	∘	∘			•				●					•				⬤
L Deschutes MS-3														•				
L Deschutes MS-4	∘				•				•					•				
Macks Canyon							•		•									●
L Deschutes MS-5					•				•					•				
Ferry Canyon							•		•						•			●
L Deschutes MS-6	∘				•				•					•				
Jones Canyon			•				•		●									●
L Deschutes MS-7					•				•					•				
Oak Canyon			•				•		•									●
L Deschutes MS-8	∘				•				•					•				
Buck Hollow Cr-1														•				•
L Deschutes MS-9					•		•		•									•
L Deschutes MS-10																		
L Deschutes MS-11					•		•		•					•				•
White R MS-1					•		•		•					•		•		•
L Deschutes MS-12					•				●					•				
Bakeoven Cr-1														•				•
L Deschutes MS-13					•		•		●				•	•				
Stag Canyon			•				•		●					•		•		
L Deschutes MS-14			•		•		•		●					•				•
Wapinitia Cr-1	∘	○					•		•					●	●	⬤		●
Paquet Gulch-1							•		•							•		●
Wapinitia Cr-2							●		•					•		⬤		●
L Deschutes MS-15					•				●									
Nena Cr-1		○	•				●		•					●		⬤		●
L Deschutes MS-16	∘						•		●									
Eagle Cr		∘	•				●		•					●		⬤		●
L Deschutes MS-17	∘				•				•					•				•
Skookum Cr							•		•					•		⬤		●
L Deschutes MS-18	∘				•				•									
Warm Springs MS-1	∘				•				•									
Warm Springs MS-2		∘									•							
Warm Springs MS-3	∘	○			•		•		•					•				
Beaver Cr-1 (WS)	◯	○			•		•								•			•
Beaver Cr-2 (WS)	○																	
Beaver Cr-3 (WS)	○						•											•
Beaver Cr-4 (WS)	○						•											●
Beaver Cr-5 (WS)	∘						•											●
Warm Springs MS-4	∘				•				•									•
Mill Cr-1 (WS)	∘				•		•											
Boulder Cr (WS)	◯	○					•											●
Mill Cr-2 (WS)	○				•		•							•				•
Warm Springs MS-5	○																	
Badger Cr (WS)	○						•											●
Warm Springs MS-6	∘														•			•
Warm Springs MS-7	◯	∘							•						•			
Warm Springs MS-8	○														•			
Bunchgrass Cr																		•
Warm Springs MS-9	○	∘													•			
L Deschutes MS-19					•													
Trout Cr-1									•									•
Trout Cr-2									•					•				•
L Deschutes MS-20	○	∘			•				•					•				
Shitike Cr-1	○				•		•		•									●

1/ "Channel stability" applies to freshwater areas only.

Key to strategic priority (corresponding Benefit Category letter also shown)

A	B	C	D & E
◯ / ⬤ High	○ / ● Medium	∘ / • Low	(blank) Indirect or General

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Deschutes Westside Summer Steelhead - continued
Protection and Restoration Strategic Priority Summary After Scenario Implementation

Geographic area priority			Attribute class priority for restoration															
Geographic area	**Protection benefit**	**Restoration benefit**	*Channel stability*	*Chemicals*	*Competition (w/ hatch)*	*Competition (other sp)*	*Flow*	*Food*	*Habitat diversity*	*Harassment/poaching*	*Obstructions*	*Oxygen*	*Pathogens*	*Predation*	*Sediment load*	*Temperature*	*Withdrawals*	*Key habitat quantity*
Shitike Cr-2	○	○			•		•		•									
Shitike Cr-3	◯	○			•													
L Deschutes MS-21	∘	∘			•				•					•				•
Pelton Dam complex		◯									⬤							
M Deschutes MS-4					•				⬤					•	⬤	•		●
Metolius MS-1									⬤					•	⬤	•		●
Fly Cr-1									⬤					•	●			●
Metolius MS-2					•				⬤					•	⬤	•		●
Spring Cr-1									⬤					●	●	•		●
Metolius MS-3					•				⬤					•	⬤	•		●
Street Cr-1									⬤					•	●	•		●
Street Cr-2									•									•
Metolius MS-4					•				⬤					•	⬤	•		●
Metolius MS-5					•									•				
Whitewater R																		
Metolius MS-6					•									•				
Jefferson Cr																		•
Metolius MS-7														•				●
Candle Cr																		
Metolius MS-8					•				•					•				
Abbot Cr	○														•			
Metolius MS-9					•									•				•
Canyon Cr-1 (Met)																		
Metolius MS-10					•									•				
Jack Cr-1									•									●
Jack Cr-2																		
Metolius MS-11					•				⬤					•				●
First Cr																		•
Metolius MS-12					•				•					•				
Spring Cr-1 (Met)									•									
Metolius MS-13					•									•				•
Lake Cr MF-1	∘				•									•				
Lake Cr SF	∘				•									•				
Lake Cr MF-2	∘				•									•				
Lake Cr-1	∘				•				•					•				•
Metolius MS-14					•				•					•				
M Deschutes MS-5					•				⬤				•	•		•		•
Crooked MS-1									⬤					•	⬤	•		●
M Deschutes MS-6					•				⬤					•	⬤	•		●
M Deschutes MS-7					•				•									
Squaw Cr-1	∘								•									•
Squaw Cr-2	◯	∘												●				●
Indian Ford Cr	○						•								•	•		•
Squaw Cr-3	∘						•		•					●				●
Squaw Cr-4																		
Squaw Cr-5	∘													●				•
Squaw Cr-6																		
Squaw Cr-7	○	∘												•				•
Snow Cr (Squaw)	○																	•
Squaw Cr-8	○																	•
M Deschutes MS-8	∘	∘			•		•		•					•				•
M Deschutes MS-9																		
M Deschutes MS-10	∘				•		•		•					•				•

1/ "Channel stability" applies to freshwater areas only.

Key to strategic priority (corresponding Benefit Category letter also shown)

A	B	C	D & E
◯ / ⬤ High	○ / ● Medium	∘ / • Low	(blank) Indirect or General

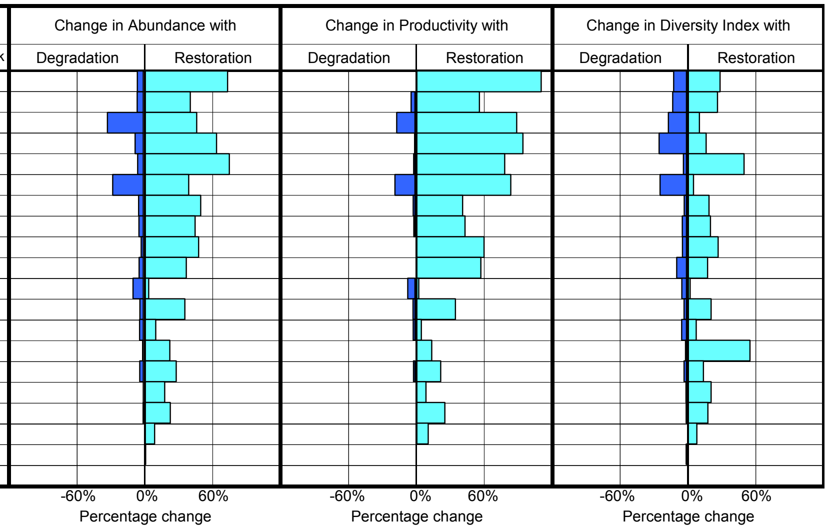
(Symbols in the table: ◯ = large open circle, ○ = medium open circle, ∘ = small open circle; ⬤ = large filled circle, ● = medium filled circle, • = small filled circle.)

Baseline Diagnostic Report – Tornado Chart

Lower John Day Summer Steelhead

Relative Importance Of Geographic Areas For Protection and Restoration Measures - current condition

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
Bridge Creek	B	6	A	1
Lower JDR Muddy Creek	B	3	A	5
Upper Middle JDR	A	2	A	6
Mountain Creek	B	5	A	4
Lower JDR Kahler Creek	C	8	A	2
Rock Creek	A	1	B	12
Lower JDR Scott Canyon	C	9	A	6
JDR Johnson Creek	C	9	B	8
Thirtymile Creek	D	14	A	3
Butte Creek	C	9	B	9
Lower JDR McDonald Ferry	B	4	D	18
Lower JDR Service Creek	D	12	B	10
Lower JDR Clarno	C	7	D	17
Upper Rock Creek	D	15	B	10
Lower JDR Ferry Canyon	D	13	C	15
Lower Rock Cr	E	16	C	14
Pine Hollow	E	17	C	13
Grass Valley Canyon	E	19	D	16
Lower NF JDR	E	18	E	19
Fields Creek	E	20	E	20



Baseline Diagnostic Report – Diagnostic Summary

Lower John Day Summer Steelhead
Protection and Restoration Strategic Priority Summary - current condition

Geographic area priority			Attribute class priority for restoration															
Geographic area	Protection benefit	Restoration benefit	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Bridge Creek	○	◯	•				•		●		⬤				⬤	●		⬤
Butte Creek	∘	○	•				•		●				•		⬤	●		⬤
Fields Creek									⬤						•			⬤
Grass Valley Canyon			•				●		•				•	•	⬤	●		●
JDR Johnson Creek	∘	○	•				●		●				•	•	●	●		●
Lower JDR Clarno	∘		•		•				●				•	•	•	●		●
Lower JDR Ferry Canyon		∘	•		•		●		●				•	•	●	●		●
Lower JDR Kahler Creek	∘	◯	•				●		●		⬤		•		●	●		⬤
Lower JDR McDonald Ferry	○				•				⬤					●	⬤	•		●
Lower JDR Muddy Creek	○	◯	•				●		●		⬤		•	•	⬤	●		●
Lower JDR Scott Canyon	∘	◯	•		•		●		●				•	•	⬤	●		●
Lower JDR Service Creek		○	•				●		●				•	•	●	●		⬤
Lower NF JDR									•							●		●
Lower Rock Cr		∘	•				●		●		⬤				⬤	•		●
Mountain Creek	○	◯	●				•		●				•		●	●		●
Pine Hollow		∘	•				●		●	•			•		⬤	●		⬤
Rock Creek	◯	○	●				•		•		●				●	•		●
Thirtymile Creek		◯	•				●		●		⬤		•	•	⬤	⬤		⬤
Upper Middle JDR	◯	◯	•				•		●				•		●	●		●
Upper Rock Creek		○	•				●		●						⬤	●		⬤

1/ "Channel stability" applies to freshwater areas only.

Key to strategic priority (corresponding Benefit Category letter also shown)

A	B	C	D & E
◯ / ⬤ High	○ / ● Medium	∘ / • Low	(blank) Indirect or General

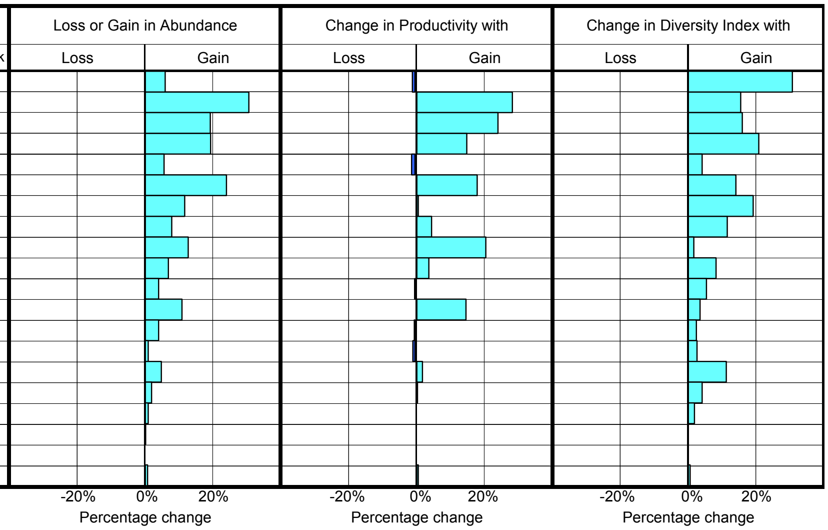
Scenario Profile Report – Tornado Chart

Priority 1 and 2 Subbasin Actions – 100 years

Lower John Day Summer Steelhead

Change in Performance Due to Scenario's Effect within Geographic Area

Geographic Area	Loss category		Gain category	
	Category/rank		Category/rank	
Upper Rock Creek	D	2	B	7
Bridge Creek	E	9	A	1
Butte Creek	E	9	A	2
Thirtymile Creek	E	9	A	2
Lower JDR Scott Canyon	D	1	C	12
Mountain Creek	E	9	A	4
Lower Rock Cr	E	9	B	5
Lower JDR Kahler Creek	E	9	B	6
Rock Creek	E	9	B	8
JDR Johnson Creek	E	9	B	9
Lower JDR Muddy Creek	E	5	C	13
Upper Middle JDR	E	9	B	9
Lower JDR Ferry Canyon	E	4	C	15
Lower JDR Service Creek	D	3	D	16
Pine Hollow	E	9	C	11
Grass Valley Canyon	E	9	C	14
Lower JDR Clarno	E	7	D	17
Lower NF JDR	E	6	E	19
Fields Creek	E	7	E	20
Lower JDR McDonald Ferry	E	9	D	18



Scenario Profile Report – Change in Habitat Factors Summary

Priority 1 and 2 Subbasin Actions – 100 years

Lower John Day Summer Steelhead
Summary of Scenario Effects on Survival Factors and Overall Performance

Relative loss or gain by area			Change in attribute impact on survival due to scenario															
Geographic area	Relative loss	Relative gain	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Bridge Creek		A	C				C		C						A	B		B
Butte Creek		A	C				C		B						A	A		B
Fields Creek									B									B
Grass Valley Canyon		C	C				B		C						A	B		B
JDR Johnson Creek		B	C				C		C				C		C	B		C
Lower JDR Clarno									C				C			C		C
Lower JDR Ferry Canyon		C					C		C				C		B	B		B
Lower JDR Kahler Creek		B	C				C		B				C		B	B		C
Lower JDR McDonald Ferry									C						A	C		
Lower JDR Muddy Creek		C					C		B				C		B	B		B
Lower JDR Scott Canyon		C	C				C		C				C		B	B		B
Lower JDR Service Creek							C		C						C	C		C
Lower NF JDR									C							B		C
Lower Rock Cr		B	C				B		B		A				A	B		A
Mountain Creek		A	A				C		C						B	B		B
Pine Hollow		C	C				B		C	C			C		A	A		A
Rock Creek		B	B						C		B				B	C		B
Thirtymile Creek		A	C				C		B		A		C		A	A		B
Upper Middle JDR		B	C				C		C						C	C		C
Upper Rock Creek		B					B		C						A	B		A

1/ Greatest absolute value of factor change (whether gain or loss) is shown for area (reaches may differ in gain or loss).

Key to amount of change in factor (corresponding Loss/Gain Category letter also shown)

A	B	C	D & E
High	Medium	Low	Indirect or General

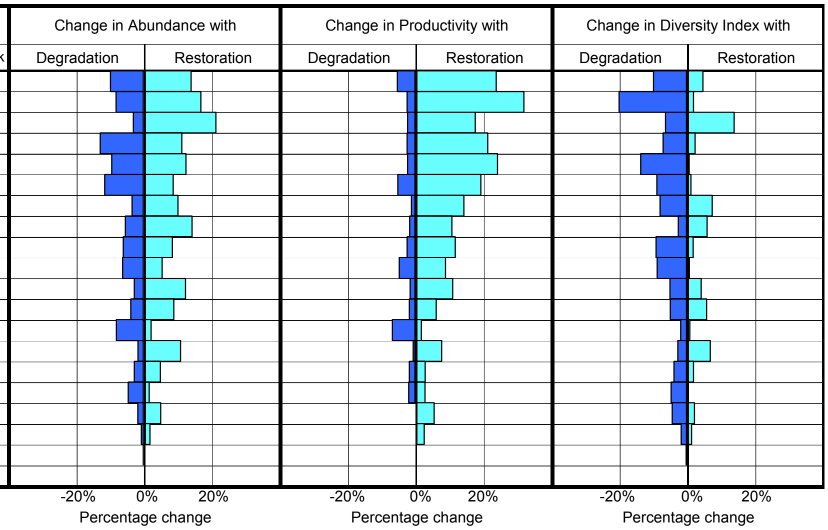
Scenario Diagnostic Report – Tornado Chart

Priority 1 and 2 Subbasin Actions – 100 years

Lower John Day Summer Steelhead

Relative Importance Of Geographic Areas For Protection and Restoration Measures After Scenario Implementation

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
Bridge Creek	A	1	A	2
Upper Rock Creek	A	3	A	2
Lower JDR Kahler Creek	C	9	A	1
Upper Middle JDR	A	4	B	6
Mountain Creek	A	4	B	9
Rock Creek	A	2	B	11
Lower JDR Muddy Creek	C	11	B	5
Lower JDR Scott Canyon	C	13	B	4
Thirtymile Creek	B	7	B	12
Butte Creek	B	6	C	14
JDR Johnson Creek	C	14	B	7
Lower JDR Ferry Canyon	C	11	B	10
Lower JDR McDonald Ferry	B	8	D	17
Lower JDR Service Creek	D	17	B	8
Lower JDR Clarno	C	14	C	14
Lower Rock Cr	C	10	D	18
Pine Hollow	D	16	C	13
Grass Valley Canyon	D	18	D	16
Lower NF JDR	E	19	E	19
Fields Creek	E	20	E	20



Scenario Diagnostic Report – Diagnostic Summary
Priority 1 and 2 Subbasin Actions – 100 years

Lower John Day Summer Steelhead
Protection and Restoration Strategic Priority Summary After Scenario Implementation

Geographic area priority			Attribute class priority for restoration															
Geographic area	**Protection benefit**	**Restoration benefit**	*Channel stability*	*Chemicals*	*Competition (w/ hatch)*	*Competition (other sp)*	*Flow*	*Food*	*Habitat diversity*	*Harassment/poaching*	*Obstructions*	*Oxygen*	*Pathogens*	*Predation*	*Sediment load*	*Temperature*	*Withdrawals*	*Key habitat quantity*
Bridge Creek	◯	◯	•				•		•		⬤				●	•		⬤
Butte Creek	○	∘					•		•						●	•		⬤
Fields Creek									●									●
Grass Valley Canyon							•		•					•	●	●		●
JDR Johnson Creek	∘	○	•				•		•					•	•	●		●
Lower JDR Clarno	∘	∘			•				●				•	•	•	•		●
Lower JDR Ferry Canyon	∘	○			•		•		●				•	•	●	●		●
Lower JDR Kahler Creek	∘	◯	•				•		●		⬤				●	●		⬤
Lower JDR McDonald Ferry	○				•				⬤					●	•			●
Lower JDR Muddy Creek	∘	○					•		●		⬤		•	•	●	●		●
Lower JDR Scott Canyon	∘	○			•		●		•				•	•	●	●		●
Lower JDR Service Creek		○	•				•		●				•	•	●	●		●
Lower NF JDR									•							•		•
Lower Rock Cr	∘						•											●
Mountain Creek	◯	○	•				•		•						●	•		●
Pine Hollow		∘					•		•						●	●		⬤
Rock Creek	◯	○	•				•		•						●	•		●
Thirtymile Creek	○	○					•		•						●	•		⬤
Upper Middle JDR	◯	○	•				•		•						●	●		●
Upper Rock Creek	◯	◯					•		•						●	•		●

1/ "Channel stability" applies to freshwater areas only.

Key to strategic priority (corresponding Benefit Category letter also shown)

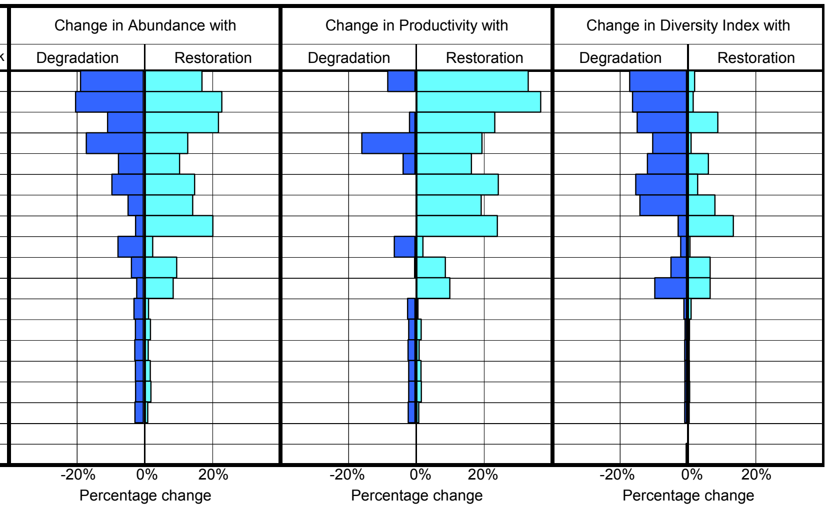
A	B	C	D & E
◯ / ⬤ High	○ / ● Medium	∘ / • Low	(blank) Indirect or General

Baseline Diagnostic Report – Tornado Chart

NF John Day Summer Steelhead

Relative Importance Of Geographic Areas For Protection and Restoration Measures - current condition

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
NF JDR Big Creek	A	1	A	4
Upper NF JDR	A	3	A	3
NF JDR Potamus Creek	B	5	A	2
Desolation Creek	A	2	C	8
Upper Camas Creek	B	4	C	7
Granite Creek	B	7	B	5
Wall Creek	B	8	B	6
Cottonwood Creek	D	16	A	1
Lower JDR McDonald Ferry	B	6	D	11
Lower NF JDR	C	10	C	8
Lower Camas Creek	C	13	C	8
Lower JDR Kahler Creek	C	9	D	14
Lower JDR Scott Canyon	C	13	D	13
Lower JDR Service Creek	C	10	D	16
Lower JDR Clarno	C	13	D	15
Lower JDR Ferry Canyon	D	17	D	12
Lower JDR Muddy Creek	C	12	D	17
JDR Johnson Creek	E	18	E	18
Lower MF JDR	E	18	E	18



Baseline Diagnostic Report – Diagnostic Summary

NF John Day Summer Steelhead
Protection and Restoration Strategic Priority Summary - current condition

Geographic area priority			Attribute class priority for restoration															
Geographic area	Protection benefit	Restoration benefit	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Cottonwood Creek		A	B				B		B				C		A	A		A
Desolation Creek	A	C	C												B	C		B
Granite Creek	B	B	C				C		C						B			B
JDR Johnson Creek									C					C	C			B
Lower Camas Creek	C	C	C				C		B						B	C		B
Lower JDR Clarno	C								C					C				B
Lower JDR Ferry Canyon									C					C				B
Lower JDR Kahler Creek	C						C		B							C		B
Lower JDR McDonald Ferry	B								C					B				
Lower JDR Muddy Creek	C								B					C				B
Lower JDR Scott Canyon	C								C					C				B
Lower JDR Service Creek	C						C		B						C	C		B
Lower MF JDR									B							B		C
Lower NF JDR	C	C	C				C		B				C		B	B		B
NF JDR Big Creek	A	A	B						C		B				C	C		B
NF JDR Potamus Creek	B	A	C				C		B						B	C		B
Upper Camas Creek	B	C	C				C		C						B	C		B
Upper NF JDR	A	A	B						C						B	C		B
Wall Creek	B	B					B		C						B	B		B

1/ "Channel stability" applies to freshwater areas only.

Key to strategic priority (corresponding Benefit Category letter also shown)

A	B	C	D & E
High	Medium	Low	Indirect or General

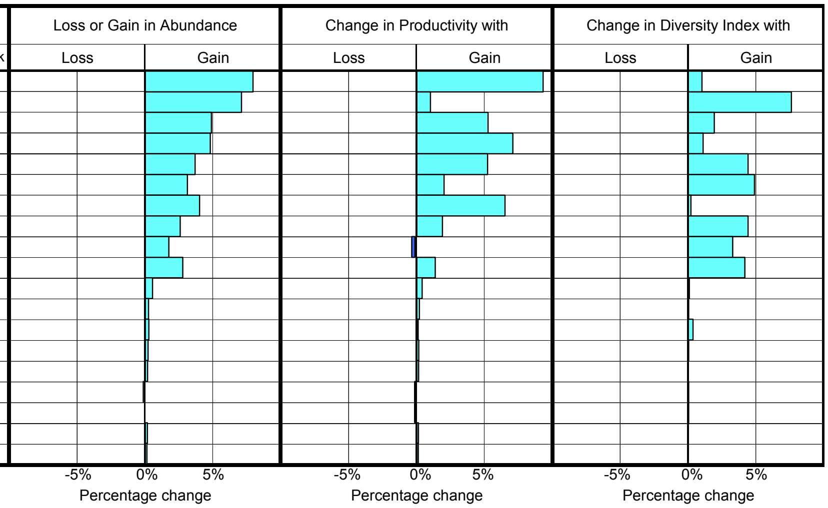
Scenario Profile Report – Tornado Chart

Priority 1 and 2 Subbasin Actions – 100 years

NF John Day Summer Steelhead

Change in Performance Due to Scenario's Effect within Geographic Area

Geographic Area	Loss category		Gain category	
	Category/rank		Category/rank	
Upper NF JDR	E	4	A	1
Cottonwood Creek	E	4	A	2
Granite Creek	E	4	B	3
NF JDR Big Creek	E	4	B	3
Upper Camas Creek	E	4	B	3
Wall Creek	E	4	B	6
Desolation Creek	E	4	B	7
Lower Camas Creek	E	4	B	7
Lower NF JDR	E	1	C	10
NF JDR Potamus Creek	E	4	B	9
Lower JDR McDonald Ferry	E	4	C	10
Lower JDR Scott Canyon	E	4	D	12
Lower JDR Kahler Creek	E	4	D	13
Lower JDR Service Creek	E	4	D	14
Lower JDR Ferry Canyon	E	4	D	15
Lower MF JDR	E	1	E	18
JDR Johnson Creek	E	3	E	17
Lower JDR Clarno	E	4	D	16
Lower JDR Muddy Creek	E	4	E	18



Scenario Profile Report – Change in Habitat Factors Summary
Priority 1 and 2 Subbasin Actions – 100 years

NF John Day Summer Steelhead
Summary of Scenario Effects on Survival Factors and Overall Performance

Relative loss or gain by area			Change in attribute impact on survival due to scenario															
Geographic area	**Relative loss**	**Relative gain**	*Channel stability*	*Chemicals*	*Competition (w/ hatch)*	*Competition (other sp)*	*Flow*	*Food*	*Habitat diversity*	*Harassment/poaching*	*Obstructions*	*Oxygen*	*Pathogens*	*Predation*	*Sediment load*	*Temperature*	*Withdrawals*	*Key habitat quantity*
Cottonwood Creek		◯	○				∘		∘				∘		◯	◯		◯
Desolation Creek		○	∘												∘			∘
Granite Creek		○	∘						∘						○			∘
JDR Johnson Creek									∘						∘			∘
Lower Camas Creek		○	∘				∘		∘						∘	∘		○
Lower JDR Clarno																		∘
Lower JDR Ferry Canyon																		
Lower JDR Kahler Creek							∘		○							∘		∘
Lower JDR McDonald Ferry		∘																
Lower JDR Muddy Creek									∘									∘
Lower JDR Scott Canyon																		∘
Lower JDR Service Creek									∘									∘
Lower MF JDR									∘							○		
Lower NF JDR		∘	∘						∘						∘	○		∘
NF JDR Big Creek		○	∘													∘		∘
NF JDR Potamus Creek		○							∘						∘	∘		
Upper Camas Creek		○	∘				∘		∘						○	∘		∘
Upper NF JDR		◯	○												∘	∘		
Wall Creek		○					∘		∘						○	○		∘

1/ Greatest absolute value of factor change (whether gain or loss) is shown for area (reaches may differ in gain or loss).

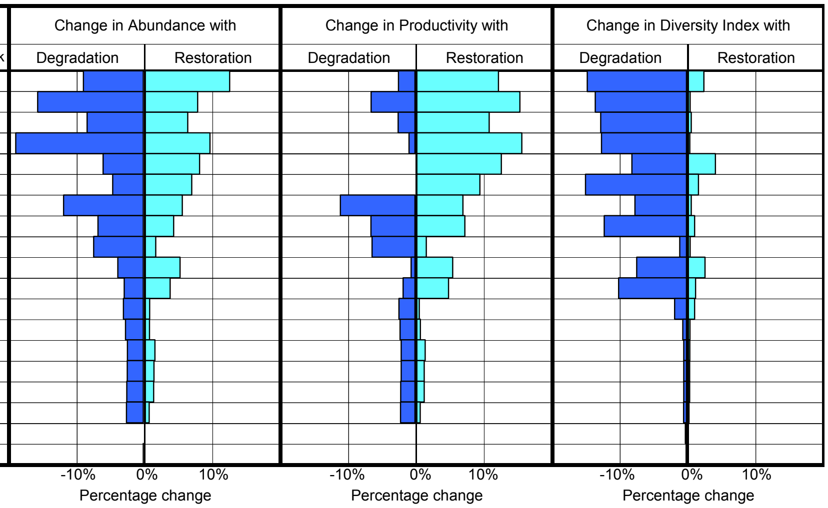
Key to amount of change in factor (corresponding Loss/Gain Category letter also shown)

A	B	C	D & E
◯ / ● High	○ / • Medium	∘ / · Low	(blank) Indirect or General

Scenario Diagnostic Report – Tornado Chart
Priority 1 and 2 Subbasin Actions – 100 years

NF John Day Summer Steelhead
Relative Importance Of Geographic Areas For Protection and Restoration Measures After Scenario Implementation

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
NF JDR Potamus Creek	A	2	A	2
NF JDR Big Creek	A	1	A	4
Granite Creek	A	4	B	6
Upper NF JDR	A	6	A	4
Cottonwood Creek	B	10	A	1
Wall Creek	B	8	A	3
Desolation Creek	A	3	B	9
Upper Camas Creek	A	5	B	8
Lower JDR McDonald Ferry	B	7	D	11
Lower NF JDR	C	13	B	6
Lower Camas Creek	B	10	C	10
Lower JDR Kahler Creek	B	9	D	12
Lower JDR Service Creek	C	12	D	15
Lower JDR Ferry Canyon	C	17	D	12
Lower JDR Clarno	C	16	D	14
Lower JDR Scott Canyon	C	15	D	15
Lower JDR Muddy Creek	C	14	E	17
Lower MF JDR	D	18	E	18
JDR Johnson Creek	D	18	E	19



Scenario Diagnostic Report – Diagnostic Summary
Priority 1 and 2 Subbasin Actions – 100 years

NF John Day Summer Steelhead
Protection and Restoration Strategic Priority Summary After Scenario Implementation

Geographic area priority			Attribute class priority for restoration																
Geographic area	**Protection benefit**	**Restoration benefit**	*Channel stability*	*Chemicals*	*Competition (w/ hatch)*	*Competition (other sp)*	*Flow*	*Food*	*Habitat diversity*	*Harassment/poaching*	*Obstructions*	*Oxygen*	*Pathogens*	*Predation*	*Sediment load*	*Temperature*	*Withdrawals*	*Key habitat quantity*
Cottonwood Creek	○	◯	•				•		•						●	●		⬤
Desolation Creek	◯	○													•			●
Granite Creek	◯	○	•				•		•						●			●
JDR Johnson Creek														•				•
Lower Camas Creek	○	∘	•				•		•						•	•		●
Lower JDR Clarno	∘													•				●
Lower JDR Ferry Canyon	∘								•					•				●
Lower JDR Kahler Creek	○						•		●									•
Lower JDR McDonald Ferry	○													●				
Lower JDR Muddy Creek	∘								•					•				●
Lower JDR Scott Canyon	∘													•				•
Lower JDR Service Creek	∘								•						•			●
Lower MF JDR									•							•		•
Lower NF JDR	∘	○	•				•		●						●	●		●
NF JDR Big Creek	◯	◯	•						•		●				•	•		●
NF JDR Potamus Creek	◯	◯					•		•						•	•		●
Upper Camas Creek	◯	○	•				•		•						•	•		●
Upper NF JDR	◯	◯	●												●			●
Wall Creek	○	◯					•		•						•	●		●

1/ "Channel stability" applies to freshwater areas only.

Key to strategic priority (corresponding Benefit Category letter also shown)

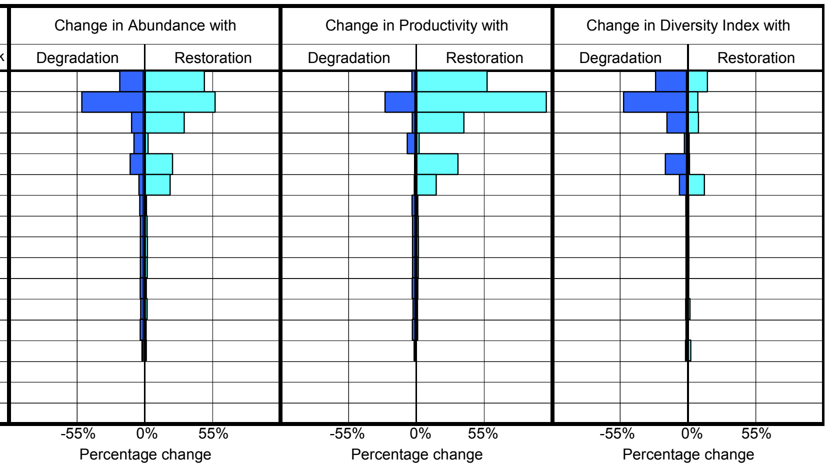
A	B	C	D & E
◯ / ⬤ High	○ / ● Medium	∘ / • Low	Indirect or General

Baseline Diagnostic Report – Tornado Chart

MF John Day Summer Steelhead

Relative Importance Of Geographic Areas For Protection and Restoration Measures - current condition

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
Big Creek	B	2	A	1
Camp Creek	A	1	A	2
Long Creek	C	3	B	3
Lower JDR McDonald Ferry	C	3	C	6
Upper MF JDR	C	5	B	5
Lower MF JDR	D	7	B	4
Lower JDR Kahler Creek	C	5	D	12
Lower JDR Clarno	D	10	D	9
Lower JDR Ferry Canyon	D	12	C	7
Lower JDR Scott Canyon	D	11	C	8
Lower JDR Service Creek	D	8	D	13
Lower NF JDR	D	12	D	9
Lower JDR Muddy Creek	D	9	D	14
NF JDR Potamus Creek	D	14	D	11
Cottonwood Creek	E	15	E	15
Wall Creek	E	15	E	15
JDR Johnson Creek	E	15	E	17



Baseline Diagnostic Report – Diagnostic Summary

MF John Day Summer Steelhead
Protection and Restoration Strategic Priority Summary - current condition

Geographic area priority			Attribute class priority for restoration															
Geographic area	Protection benefit	Restoration benefit	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Big Creek	○	◯	•				•		•						●	•		●
Camp Creek	◯	◯	•				•		•						●	•		●
Cottonwood Creek			•				•		•									●
JDR Johnson Creek									•					•	•			●
Long Creek	∘	○	•				●		●						●	•		⬤
Lower JDR Clarno									•					•				●
Lower JDR Ferry Canyon		∘							•					•				●
Lower JDR Kahler Creek	∘						•		⬤							•		●
Lower JDR McDonald Ferry	∘	∘							•					●				
Lower JDR Muddy Creek									•					•				●
Lower JDR Scott Canyon		∘							•					•				●
Lower JDR Service Creek									•					•				●
Lower MF JDR		○	•				•		●						●	●		●
Lower NF JDR									•							●		●
NF JDR Potamus Creek									●							●		•
Upper MF JDR	∘	○	•				•		•						●			●
Wall Creek							•		•									●

1/ "Channel stability" applies to freshwater areas only.

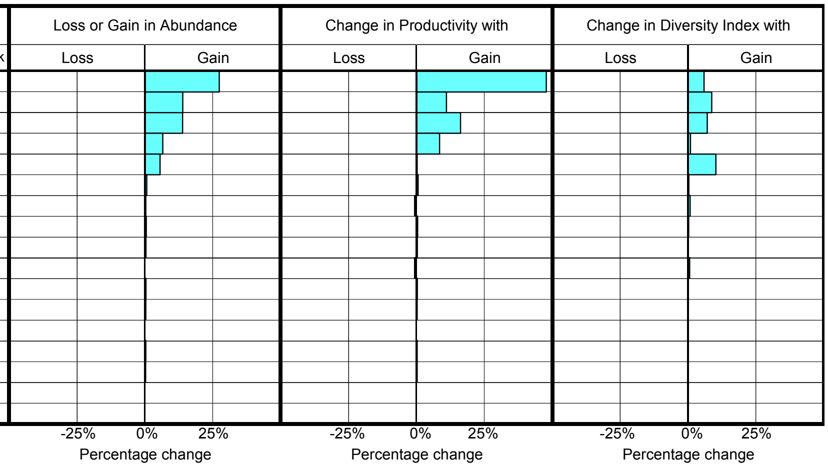
Key to strategic priority (corresponding Benefit Category letter also shown)

A		B		C		D & E	
◯ / ⬤	High	○ / ●	Medium	∘ / •	Low	(blank)	Indirect or General

Scenario Profile Report – Tornado Chart
Priority 1 and 2 Subbasin Actions – 100 years

MF John Day Summer Steelhead
Change in Performance Due to Scenario's Effect within Geographic Area

Geographic Area	Loss category		Gain category	
	Category/rank		Category/rank	
Camp Creek	E	6	A	1
Big Creek	E	6	B	2
Long Creek	E	6	B	3
Upper MF JDR	E	6	C	4
Lower MF JDR	E	6	C	5
Lower JDR McDonald Ferry	E	6	D	6
Lower NF JDR	E	2	E	10
Lower JDR Kahler Creek	E	6	D	7
Lower JDR Scott Canyon	E	6	D	8
NF JDR Potamus Creek	E	1	E	13
Lower JDR Service Creek	E	6	E	9
Lower JDR Ferry Canyon	E	6	E	11
Cottonwood Creek	E	3	E	15
Lower JDR Clarno	E	6	E	12
Lower JDR Muddy Creek	E	6	E	14
Wall Creek	E	4	E	16
JDR Johnson Creek	E	4	E	17



Scenario Profile Report – Change in Habitat Factors Summary
Priority 1 and 2 Subbasin Actions – 100 years

MF John Day Summer Steelhead
Summary of Scenario Effects on Survival Factors and Overall Performance

Relative loss or gain by area			Change in attribute impact on survival due to scenario																	
Geographic area	Relative loss	Relative gain	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Big Creek		B	C						C						C	C		C
Camp Creek		A	C						C						B	C		C
Cottonwood Creek			C				C		C									B
JDR Johnson Creek									C						C			C
Long Creek		B	C				B		C						B	C		B
Lower JDR Clarno																		C
Lower JDR Ferry Canyon																		
Lower JDR Kahler Creek							C		B							C		C
Lower JDR McDonald Ferry																		
Lower JDR Muddy Creek																		C
Lower JDR Scott Canyon																		C
Lower JDR Service Creek																		C
Lower MF JDR		C	C				C		B						B	B		C
Lower NF JDR									C							C		C
NF JDR Potamus Creek									C							C		
Upper MF JDR		C	C				C		C						B			C
Wall Creek									C									C

1/ Greatest absolute value of factor change (whether gain or loss) is shown for area (reaches may differ in gain or loss).

Key to amount of change in factor (corresponding Loss/Gain Category letter also shown)

A	High
B	Medium
C	Low
D & E	Indirect or General

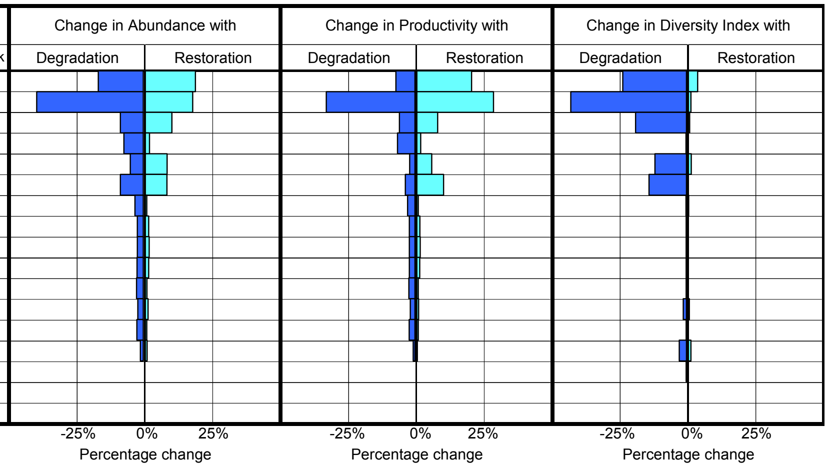
Scenario Diagnostic Report – Tornado Chart

Priority 1 and 2 Subbasin Actions – 100 years

MF John Day Summer Steelhead

Relative Importance Of Geographic Areas For Protection and Restoration Measures After Scenario Implementation

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
Big Creek	B	2	A	1
Camp Creek	A	1	A	2
Long Creek	B	3	B	4
Lower JDR McDonald Ferry	C	5	B	5
Lower MF JDR	C	7	B	3
Upper MF JDR	B	4	B	6
Lower JDR Kahler Creek	C	6	D	12
Lower JDR Clarno	D	11	C	8
Lower JDR Ferry Canyon	D	13	B	6
Lower JDR Scott Canyon	D	10	C	11
Lower JDR Service Creek	D	8	D	13
Lower NF JDR	D	12	C	9
Lower JDR Muddy Creek	D	9	D	14
NF JDR Potamus Creek	D	13	C	10
Cottonwood Creek	E	15	E	15
Wall Creek	E	16	E	16
JDR Johnson Creek	E	16	E	17



Scenario Diagnostic Report – Diagnostic Summary
Priority 1 and 2 Subbasin Actions – 100 years

MF John Day Summer Steelhead
Protection and Restoration Strategic Priority Summary After Scenario Implementation

Geographic area priority			Attribute class priority for restoration															
Geographic area	**Protection benefit**	**Restoration benefit**	*Channel stability*	*Chemicals*	*Competition (w/ hatch)*	*Competition (other sp)*	*Flow*	*Food*	*Habitat diversity*	*Harassment/poaching*	*Obstructions*	*Oxygen*	*Pathogens*	*Predation*	*Sediment load*	*Temperature*	*Withdrawals*	*Key habitat quantity*
Big Creek	B	A	C						C						C	C		B
Camp Creek	A	A					C		C						C	C		B
Cottonwood Creek																		C
JDR Johnson Creek														C				C
Long Creek	B	B					C		C						C	C		A
Lower JDR Clarno		C												C				B
Lower JDR Ferry Canyon		B							C					C				B
Lower JDR Kahler Creek	C								B									C
Lower JDR McDonald Ferry	C	B												B				
Lower JDR Muddy Creek														C				B
Lower JDR Scott Canyon		C												C				C
Lower JDR Service Creek									C					C				B
Lower MF JDR	C	B					C		C						B	C		B
Lower NF JDR		C							C									B
NF JDR Potamus Creek		C							B							C		C
Upper MF JDR	B	B	C				C		C						B			B
Wall Creek							C		C									C

1/ "Channel stability" applies to freshwater areas only.

Key to strategic priority (corresponding Benefit Category letter also shown)

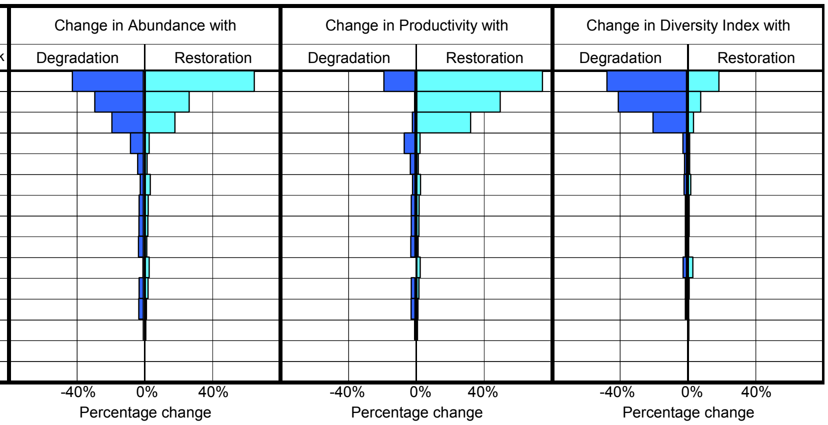
A	B	C	D & E
○ / ● High	○ / ● Medium	○ / ● Low	Indirect or General

Baseline Diagnostic Report – Tornado Chart

SF John Day Summer Steelhead

Relative Importance Of Geographic Areas For Protection and Restoration Measures - current condition

Geographic Area	Protection benefit Category	Protection benefit rank	Restoration benefit Category	Restoration benefit rank
Lower SF JDR	A	1	A	1
Murderers Creek	B	3	B	2
Middle SF JDR	B	3	C	3
Lower JDR McDonald Ferry	B	2	D	6
Lower JDR Kahler Creek	B	3	D	10
JDR Johnson Creek	C	10	D	4
Lower JDR Ferry Canyon	C	9	D	7
Lower JDR Clarno	C	8	D	9
Lower JDR Service Creek	C	6	D	11
Upper Middle JDR	D	12	D	5
Lower JDR Scott Canyon	C	10	D	8
Lower JDR Muddy Creek	C	7	D	12
Fields Creek	E	13	D	12
Rock Creek	E	14	E	14
Lower NF JDR	E	15	E	14



Baseline Diagnostic Report – Diagnostic Summary

SF John Day Summer Steelhead
Protection and Restoration Strategic Priority Summary - current condition

Geographic area priority			Attribute class priority for restoration																
Geographic area	**Protection benefit**	**Restoration benefit**	*Channel stability*	*Chemicals*	*Competition (w/ hatch)*	*Competition (other sp)*	*Flow*	*Food*	*Habitat diversity*	*Harassment/poaching*	*Obstructions*	*Oxygen*	*Pathogens*	*Predation*	*Sediment load*	*Temperature*	*Withdrawals*	*Key habitat quantity*
Fields Creek									•					•	•			⬤
JDR Johnson Creek	◦						•		●						•	•		●
Lower JDR Clarno	◦								•					•				●
Lower JDR Ferry Canyon	◦								•					•				●
Lower JDR Kahler Creek	○								●							•		●
Lower JDR McDonald Ferry	○								•					●				
Lower JDR Muddy Creek	◦								•					•				●
Lower JDR Scott Canyon	◦								•					•				●
Lower JDR Service Creek	◦								•					•				●
Lower NF JDR									•							●		●
Lower SF JDR	◯	◯	•				•		•						●	●		●
Middle SF JDR	○	◦	•				•		•						●	•		●
Murderers Creek	○	○	•				•		•						●	•		●
Rock Creek									•							•		●
Upper Middle JDR							•		●							•		●

1/ "Channel stability" applies to freshwater areas only.

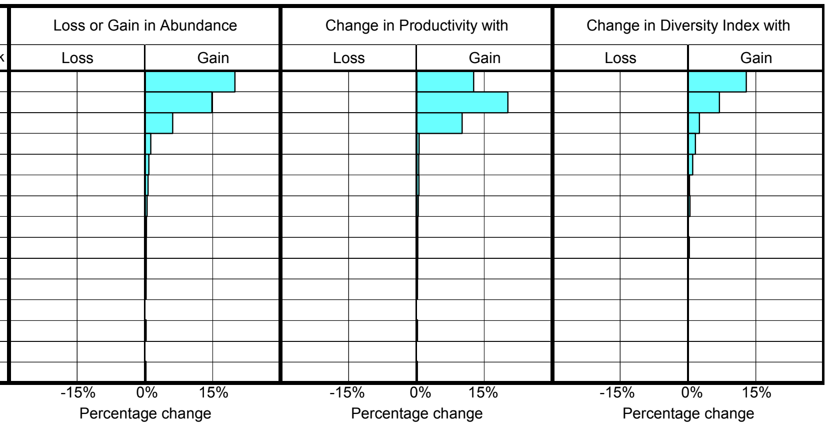
Key to strategic priority (corresponding Benefit Category letter also shown)

A		B		C		D & E	
◯ / ⬤	High	○ / ●	Medium	◦ / •	Low	(blank)	Indirect or General

Scenario Profile Report – Tornado Chart
Priority 1 and 2 Subbasin Actions – 100 years

SF John Day Summer Steelhead
Change in Performance Due to Scenario's Effect within Geographic Area

Geographic Area	Loss category		Gain category	
	Category/rank		Category/rank	
Lower SF JDR	E	3	A	1
Murderers Creek	E	3	A	2
Middle SF JDR	E	3	B	3
Upper Middle JDR	E	3	C	4
JDR Johnson Creek	E	3	C	5
Lower JDR McDonald Ferry	E	3	D	6
Lower JDR Kahler Creek	E	3	D	7
Lower JDR Scott Canyon	E	3	D	8
Fields Creek	E	3	D	9
Lower JDR Service Creek	E	3	D	10
Lower JDR Ferry Canyon	E	3	D	11
Lower NF JDR	E	1	E	13
Lower JDR Clarno	E	3	D	12
Rock Creek	E	1	E	15
Lower JDR Muddy Creek	E	3	E	14



Scenario Profile Report – Change in Habitat Factors Summary
Priority 1 and 2 Subbasin Actions – 100 years

SF John Day Summer Steelhead
Summary of Scenario Effects on Survival Factors and Overall Performance

Relative loss or gain by area			Change in attribute impact on survival due to scenario																
Geographic area	Relative loss	Relative gain	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Fields Creek									○ C						○ C			○ B
JDR Johnson Creek		○ C							○ C						○ C	○ C		○ C
Lower JDR Clarno																		○ C
Lower JDR Ferry Canyon																		
Lower JDR Kahler Creek									○ B							○ C		○ C
Lower JDR McDonald Ferry																		
Lower JDR Muddy Creek																		○ C
Lower JDR Scott Canyon																		○ C
Lower JDR Service Creek																		○ C
Lower NF JDR									○ C							○ B		○ C
Lower SF JDR		○ A					○ C		○ C						○ B	○ B		○ C
Middle SF JDR		○ B	○ C						○ C						○ B	○ C		○ C
Murderers Creek		○ A	○ C						○ C						○ B	○ C		○ C
Rock Creek									○ C							○ C		○ C
Upper Middle JDR		○ C							○ C									○ C

1/ Greatest absolute value of factor change (whether gain or loss) is shown for area (reaches may differ in gain or loss).

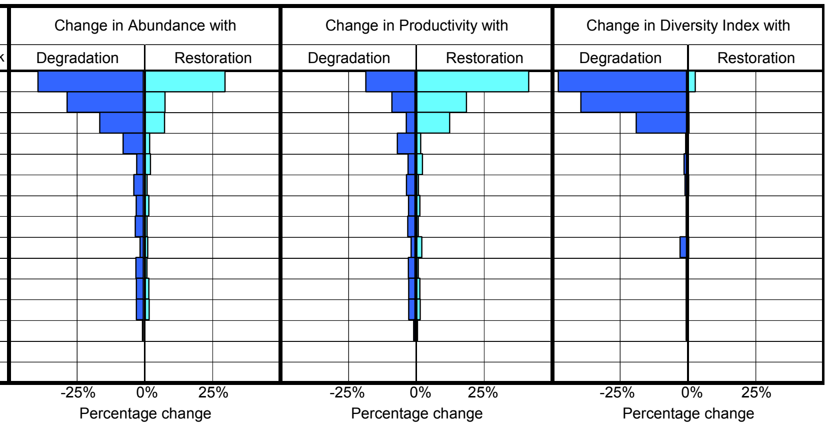
Key to amount of change in factor (corresponding Loss/Gain Category letter also shown)

A	B	C	D & E
○ / ● High	○ / ● Medium	○ / ● Low	Indirect or General

Scenario Diagnostic Report – Tornado Chart
Priority 1 and 2 Subbasin Actions – 100 years

SF John Day Summer Steelhead
Relative Importance Of Geographic Areas For Protection and Restoration Measures After Scenario Implementation

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
Lower SF JDR	A	1	A	1
Murderers Creek	A	2	B	2
Middle SF JDR	B	3	B	3
Lower JDR McDonald Ferry	C	4	C	5
JDR Johnson Creek	C	7	C	4
Lower JDR Kahler Creek	C	5	C	9
Lower JDR Scott Canyon	C	9	C	7
Lower JDR Service Creek	C	6	D	11
Upper Middle JDR	C	11	C	6
Lower JDR Muddy Creek	C	7	D	12
Lower JDR Clarno	C	10	C	10
Lower JDR Ferry Canyon	C	12	C	8
Fields Creek	D	13	E	13
Rock Creek	E	14	E	14
Lower NF JDR	E	15	E	15



Scenario Diagnostic Report – Diagnostic Summary
Priority 1 and 2 Subbasin Actions – 100 years

SF John Day Summer Steelhead
Protection and Restoration Strategic Priority Summary After Scenario Implementation

Geographic area priority			Attribute class priority for restoration																
Geographic area	**Protection benefit**	**Restoration benefit**	*Channel stability*	*Chemicals*	*Competition (w/ hatch)*	*Competition (other sp)*	*Flow*	*Food*	*Habitat diversity*	*Harassment/poaching*	*Obstructions*	*Oxygen*	*Pathogens*	*Predation*	*Sediment load*	*Temperature*	*Withdrawals*	*Key habitat quantity*
Fields Creek									•					•				●
JDR Johnson Creek	∘	∘							•									•
Lower JDR Clarno	∘	∘												•				●
Lower JDR Ferry Canyon	∘	∘							•					•				●
Lower JDR Kahler Creek	∘	∘							●									•
Lower JDR McDonald Ferry	∘	∘												●				
Lower JDR Muddy Creek	∘													•				●
Lower JDR Scott Canyon	∘	∘												•				•
Lower JDR Service Creek	∘								•					•				●
Lower NF JDR									•							•		●
Lower SF JDR	◯	◯					•		•						●	•		●
Middle SF JDR	○	○					•		•						●	•		●
Murderers Creek	◯	○							•						●	•		●
Rock Creek									•									●
Upper Middle JDR	∘	∘					•		•									●

1/ "Channel stability" applies to freshwater areas only.

Key to strategic priority (corresponding Benefit Category letter also shown)

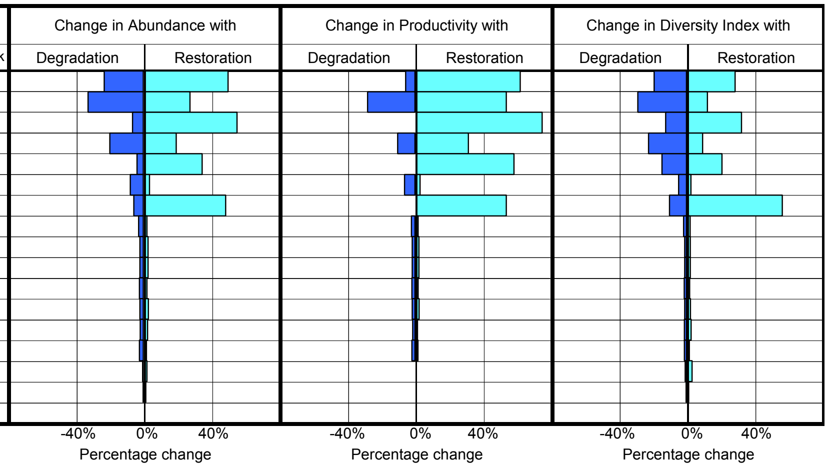
A	B	C	D & E
◯ / ● High	○ / ● Medium	∘ / • Low	(blank) Indirect or General

Baseline Diagnostic Report – Tornado Chart

Upper John Day Summer Steelhead

Relative Importance Of Geographic Areas For Protection and Restoration Measures - current condition

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
Strawberry Creek	B	3	A	2
Upper JDR	A	1	B	5
Fields Creek	C	6	A	1
Canyon Creek	B	2	C	6
Beech Creek	C	7	B	4
Lower JDR McDonald Ferry	C	4	D	7
Laycock Creek	C	9	A	3
Lower JDR Kahler Creek	C	5	D	13
Lower JDR Clarno	D	11	D	10
Lower JDR Scott Canyon	D	12	D	9
Lower JDR Service Creek	C	7	D	14
Lower JDR Ferry Canyon	D	14	D	8
JDR Johnson Creek	D	13	D	11
Lower JDR Muddy Creek	D	10	D	15
Upper Middle JDR	E	15	D	12
Lower SF JDR	E	16	E	16
Rock Creek	E	17	E	17



Baseline Diagnostic Report – Diagnostic Summary

Upper John Day Summer Steelhead
Protection and Restoration Strategic Priority Summary - current condition

Geographic area priority			Attribute class priority for restoration															
Geographic area	Protection benefit	Restoration benefit	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Beech Creek	C	B	C				B		B		A				A	B		B
Canyon Creek	B	C	C				C		C						C	C		B
Fields Creek	C	A	C				C		B						B	C		A
JDR Johnson Creek									B						C	C		B
Laycock Creek	C	A	C				C		B		A				B	C		B
Lower JDR Clarno									C					C				B
Lower JDR Ferry Canyon									C					C				B
Lower JDR Kahler Creek	C								B					C		C		B
Lower JDR McDonald Ferry	C								C					B				
Lower JDR Muddy Creek									C					C				B
Lower JDR Scott Canyon									C					C				B
Lower JDR Service Creek	C								C					C				B
Lower SF JDR									C						C			B
Rock Creek							C		C							C		B
Strawberry Creek	B	A	C				C		B		A				B	B		B
Upper JDR	A	B					C		C		A				B	C		B
Upper Middle JDR							C		B							C		B

1/ "Channel stability" applies to freshwater areas only.

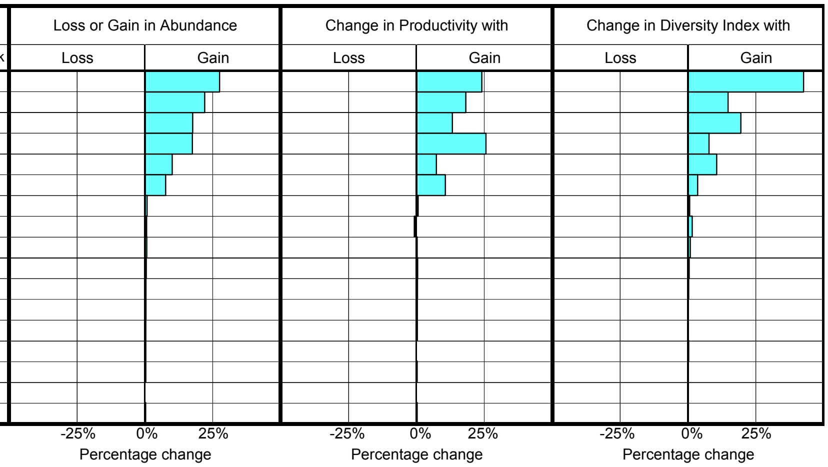
Key to strategic priority (corresponding Benefit Category letter also shown)

A	B	C	D & E
High	Medium	Low	Indirect or General

Scenario Profile Report – Tornado Chart
Priority 1 and 2 Subbasin Actions – 100 years

Upper John Day Summer Steelhead
Change in Performance Due to Scenario's Effect within Geographic Area

Geographic Area	Loss category		Gain category	
	Category/rank		Category/rank	
Laycock Creek	E	4	A	1
Strawberry Creek	E	4	B	2
Beech Creek	E	4	B	3
Upper JDR	E	4	B	4
Fields Creek	E	4	C	5
Canyon Creek	E	4	C	6
Lower JDR McDonald Ferry	E	4	D	7
Upper Middle JDR	E	1	D	10
JDR Johnson Creek	E	4	D	8
Lower JDR Kahler Creek	E	4	D	8
Lower JDR Scott Canyon	E	4	D	10
Lower JDR Service Creek	E	4	E	12
Lower JDR Ferry Canyon	E	4	E	13
Lower SF JDR	E	2	E	15
Lower JDR Clarno	E	4	E	14
Rock Creek	E	2	E	17
Lower JDR Muddy Creek	E	4	E	16



Scenario Profile Report – Change in Habitat Factors Summary

Priority 1 and 2 Subbasin Actions – 100 years

Upper John Day Summer Steelhead
Summary of Scenario Effects on Survival Factors and Overall Performance

Relative loss or gain by area			Change in attribute impact on survival due to scenario																
Geographic area	Relative loss	Relative gain	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Beech Creek		○	∘				∘		∘		◯				○	○		○
Canyon Creek		∘	∘				∘		∘						∘	∘		∘
Fields Creek		∘	∘				∘		○						○	∘		○
JDR Johnson Creek									∘						∘	∘		∘
Laycock Creek		◯	∘				∘		∘		◯				○	∘		○
Lower JDR Clarno																		∘
Lower JDR Ferry Canyon																		
Lower JDR Kahler Creek									○							∘		∘
Lower JDR McDonald Ferry																		
Lower JDR Muddy Creek																		∘
Lower JDR Scott Canyon																		∘
Lower JDR Service Creek																		∘
Lower SF JDR															∘			∘
Rock Creek									∘							∘		∘
Strawberry Creek		○	∘				∘		○		◯				○	○		○
Upper JDR		○							∘		◯				○	∘		∘
Upper Middle JDR									∘									∘

1/ Greatest absolute value of factor change (whether gain or loss) is shown for area (reaches may differ in gain or loss).

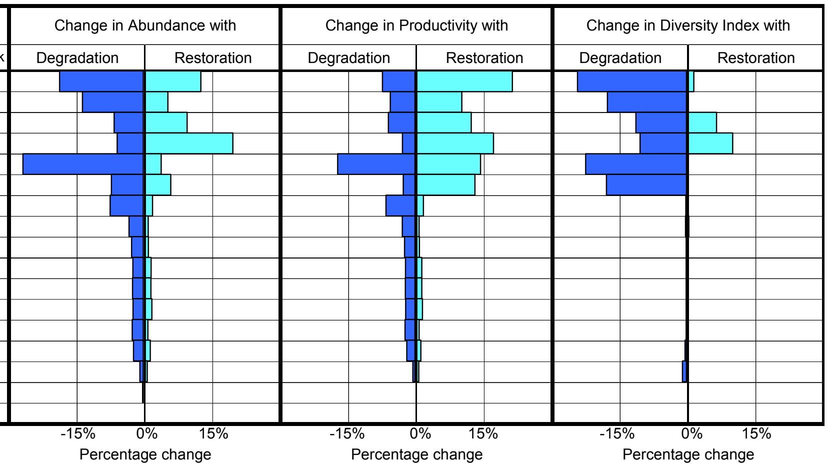
Key to amount of change in factor (corresponding Loss/Gain Category letter also shown)

A	B	C	D & E
◯ / ● High	○ / • Medium	∘ / • Low	Indirect or General

Scenario Diagnostic Report – Tornado Chart
Priority 1 and 2 Subbasin Actions – 100 years

Upper John Day Summer Steelhead
Relative Importance Of Geographic Areas For Protection and Restoration Measures After Scenario Implementation

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
Strawberry Creek	B	2	A	2
Canyon Creek	B	3	B	4
Laycock Creek	B	4	B	3
Fields Creek	C	7	A	1
Upper JDR	A	1	B	7
Beech Creek	B	5	B	5
Lower JDR McDonald Ferry	C	6	B	5
Lower JDR Kahler Creek	C	8	C	12
Lower JDR Service Creek	C	9	C	11
Lower JDR Clarno	C	12	C	9
Lower JDR Scott Canyon	C	11	C	10
Lower JDR Ferry Canyon	C	14	C	8
Lower JDR Muddy Creek	C	10	C	14
JDR Johnson Creek	C	13	C	13
Upper Middle JDR	C	14	C	15
Lower SF JDR	D	16	D	16
Rock Creek	D	17	D	17



Scenario Diagnostic Report – Diagnostic Summary
Priority 1 and 2 Subbasin Actions – 100 years

Upper John Day Summer Steelhead
Protection and Restoration Strategic Priority Summary After Scenario Implementation

Geographic area priority			Attribute class priority for restoration																
Geographic area	Protection benefit	Restoration benefit	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Beech Creek	○	○	•				•		•						●	•		●
Canyon Creek	○	○	•						•									●
Fields Creek	∘	◯	•				•		•						●			⬤
JDR Johnson Creek	∘	∘							•									•
Laycock Creek	○	○					•		•						•			●
Lower JDR Clarno	∘	∘												•				●
Lower JDR Ferry Canyon	∘	∘							•					•				●
Lower JDR Kahler Creek	∘	∘							●									●
Lower JDR McDonald Ferry	∘	○												●				
Lower JDR Muddy Creek	∘	∘												•				●
Lower JDR Scott Canyon	∘	∘												•				•
Lower JDR Service Creek	∘	∘							•					•				●
Lower SF JDR																		●
Rock Creek									•									●
Strawberry Creek	○	◯	•				•		•						●	•		●
Upper JDR	◯	○							•						●			●
Upper Middle JDR	∘	∘					•		•									●

Key to strategic priority (corresponding Benefit Category letter also shown)

A	B	C	D & E
◯ / ⬤ High	○ / ● Medium	∘ / • Low	Indirect or General

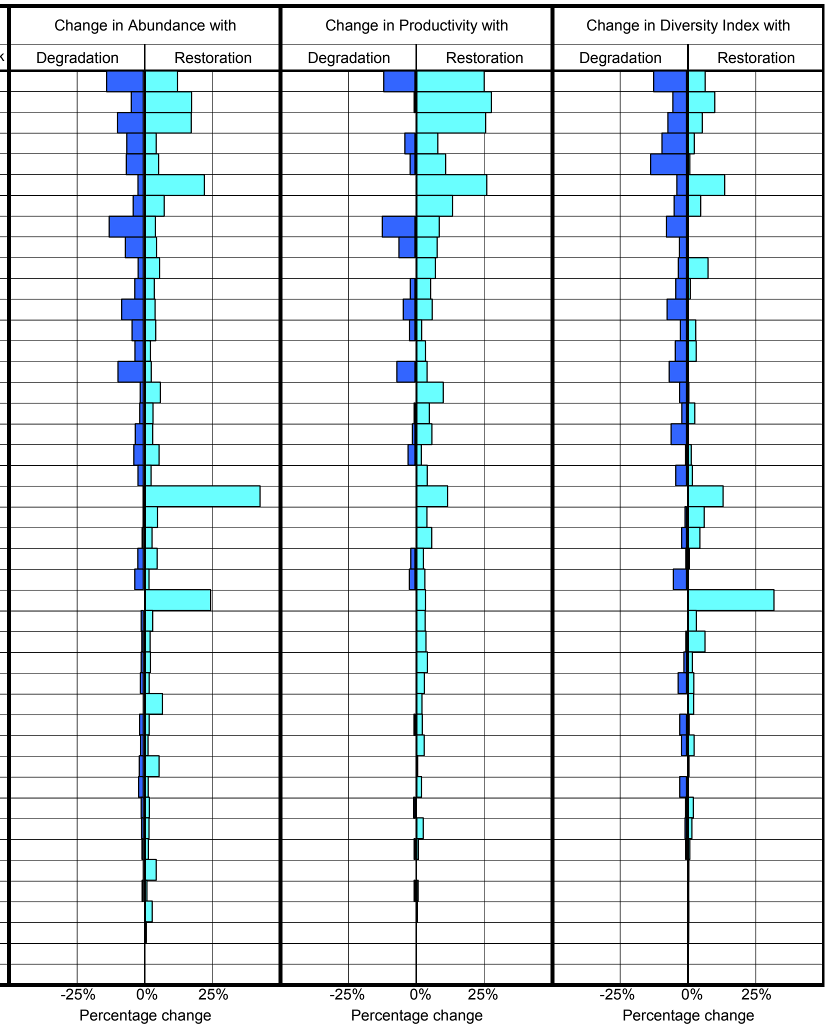
1/ "Channel stability" applies to freshwater areas only.

Baseline Diagnostic Report – Tornado Chart

Umatilla Summer Steelhead

Relative Importance Of Geographic Areas For Protection and Restoration Measures - current condition

Geographic Area	Protection benefit Category	Protection benefit rank	Restoration benefit Category	Restoration benefit rank
GA40	A	1	B	4
GA28	C	10	A	2
GA33	B	8	B	5
GA35	B	5	C	10
GA19	B	6	C	11
GA12	C	18	A	1
GA36	C	14	B	6
GA42	A	2	C	22
GA43	B	7	C	18
GA15	C	19	B	7
GA18	C	12	C	18
GA46	B	4	C	26
GA9	C	13	C	20
GA14	C	15	C	20
GA44	B	3	D	32
GA20	D	24	C	12
GA17	D	25	C	14
GA45	C	11	C	28
GA2	C	16	C	24
GA34	C	17	C	23
GA5	E	37	A	3
GA13	E	33	C	9
GA32	D	30	C	13
GA1	D	21	C	26
GA37	C	9	D	38
GA21	E	42	B	7
GA27	E	33	C	16
GA29	E	33	C	16
GA31	D	28	C	24
GA38	D	23	C	29
GA4	E	38	C	15
GA16	D	20	D	35
GA39	D	26	D	31
GA6	D	29	C	29
GA41	D	21	D	40
GA25	D	27	D	35
GA30	D	30	D	34
GA11	E	32	D	39
GA8	E	39	D	33
GA3	E	36	E	41
GA7	E	41	D	37
GA26	E	40	E	42
GA22	E	42	E	43
GA24	E	42	E	43



Baseline Diagnostic Report – Diagnostic Summary

Umatilla Summer Steelhead
Protection and Restoration Strategic Priority Summary - current condition

Geographic area priority			Attribute class priority for restoration																
Geographic area	Protection benefit	Restoration benefit	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
GA1		C	C		C		C		C					C	A	B		C
GA2	C	C	C		C		C		C				C	C	A	C		
GA3			C				B		B						A			B
GA4		C	B				B		B	C					A	A		B
GA5		A	B				B		B	C	A		C		A	A		B
GA6		C	C				B		B	C					A			B
GA7			B				C		C				C		A	A		B
GA8			B				C		C				C		A	A		B
GA9	C	C	C		C		C		B					C	B	C		
GA11			C		C		C		C					C	C	C		
GA12	C	A	B				C		C		B		C		B	A		B
GA13		C	A				B		B	C	B		C		B	A		B
GA14	C	C	B				C		C						B	B		B
GA15	C	B	B				C		C		B				B	B		B
GA16			B				C		C							C		B
GA17		C	B				C		C	C					B	A		B
GA18	C	C	B				C		C						B	C		B
GA19	B	C	C				C		C							C		B
GA20		C	C				C		C	B				C	B	C		A
GA21		B	B				C		B		A		B	C	B	A		B
GA22			B				C		C				C			B		B
GA24			B				C		C							B		B
GA25			C		C		C		C					C	A	C		
GA26			C				C		C						A	B		C
GA27		C	B				B		C						A	A		C
GA28	C	A	B		C		C		C				C	C	B	A		C
GA29		C	C				C		C				C		A	A		B
GA30			B				C	C	C							A		B
GA31		C	B				C	C							B	A		B
GA32		C	B				C	C	C						B	A		B
GA33	B	B	B		C		C	C	C					C		A		B
GA34	C	C	B		C		C		C					C	C			C
GA35	B	C	C		C		C		C		A			C		C		C
GA36	C	B	B		C		C		C					C		A		B
GA37	C		C		C		C		C					C				B
GA38		C	B		C		C		B					C	A			B
GA39			C		C		C				C			C	A			B
GA40	A	B	B				C		C							A		C
GA41			B				C	C	C									B
GA42	A	C	B															
GA43	B	C	B				C	C	C									
GA44	B		C				C											
GA45	C	C	B				C	C	C									B
GA46	B	C	B				C		C									

1/ "Channel stability" applies to freshwater areas only.

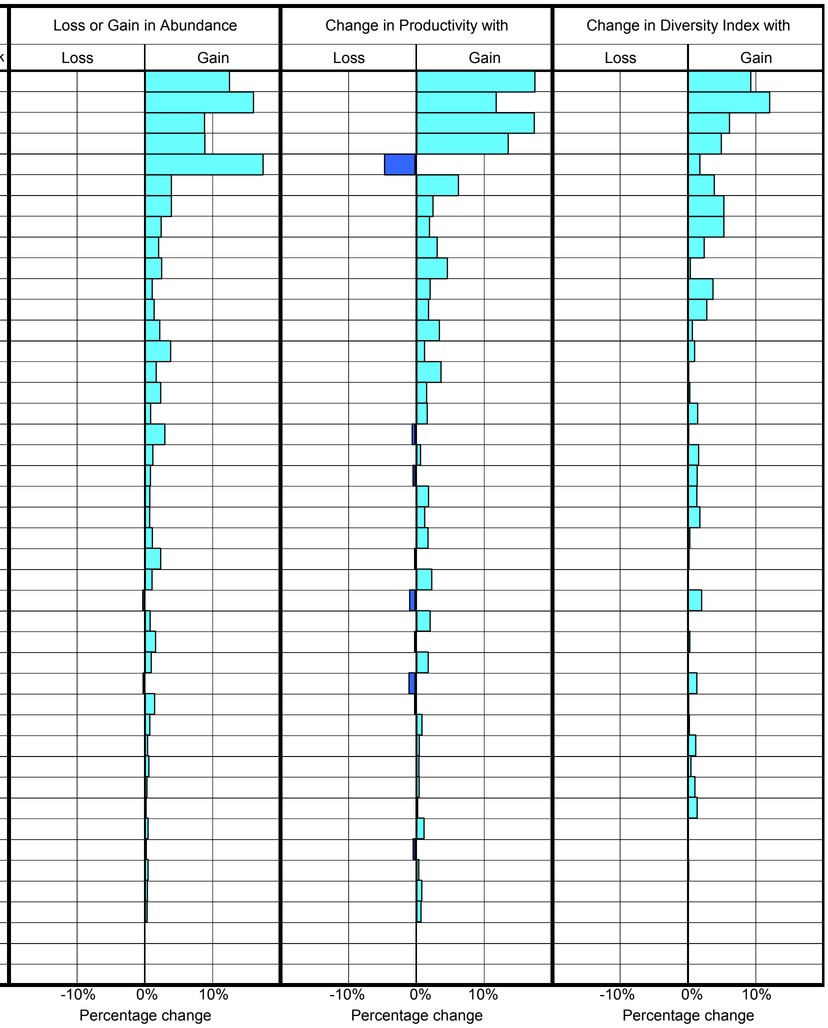
Key to strategic priority (corresponding Benefit Category letter also shown)

A	B	C	D & E
High	Medium	Low	Indirect or General

Scenario Profile Report – Tornado Chart
Priority 1 and 2 Subbasin Actions – 100 years

Umatilla Summer Steelhead
Change in Performance Due to Scenario's Effect within Geographic Area

Geographic Area	Loss category		Gain category	
	Category/rank		Category/rank	
GA28	E	10	A	1
GA12	E	10	A	2
GA40	E	10	A	3
GA33	E	10	A	4
GA5	C	1	B	13
GA36	E	10	B	5
GA13	E	10	B	6
GA15	E	10	B	7
GA17	E	10	B	8
GA19	E	10	B	9
GA32	E	10	B	10
GA14	E	10	B	11
GA18	E	10	B	12
GA2	E	10	B	14
GA43	E	10	B	15
GA1	E	10	C	16
GA31	E	10	C	16
GA4	E	4	C	23
GA9	E	10	C	18
GA27	E	5	C	24
GA35	E	10	C	19
GA38	E	10	C	20
GA20	E	10	C	21
GA8	E	7	C	24
GA45	E	10	C	22
GA29	C	1	C	32
GA42	E	10	C	24
GA6	E	8	C	27
GA46	E	10	C	27
GA25	C	1	D	37
GA7	E	9	C	29
GA16	E	10	C	29
GA30	E	10	C	29
GA11	E	10	D	33
GA34	E	10	D	34
GA39	E	10	D	34
GA44	E	10	D	36
GA26	E	6	D	41
GA3	E	10	D	38
GA37	E	10	D	38
GA41	E	10	D	40
GA21	E	10	E	42
GA22	E	10	E	42
GA24	E	10	E	42



Scenario Profile Report – Change in Habitat Factors Summary

Priority 1 and 2 Subbasin Actions – 100 years

Umatilla Summer Steelhead
Summary of Scenario Effects on Survival Factors and Overall Performance

Relative loss or gain by area			Change in attribute impact on survival due to scenario															
Geographic area	Relative loss	Relative gain	*Channel stability*	*Chemicals*	*Competition (w/ hatch)*	*Competition (other sp)*	*Flow*	*Food*	*Habitat diversity*	*Harassment/poaching*	*Obstructions*	*Oxygen*	*Pathogens*	*Predation*	*Sediment load*	*Temperature*	*Withdrawals*	*Key habitat quantity*
GA1		○C													○A	○C		○B
GA2		○B							○C		○C		○C		○A	○C		●B
GA3							○C		○B						○A			○C
GA4		○C	○C				○C		○B	○C					○A	○A		○A
GA5	●C	○B	○B				○C		○B	○C	○A		○C		○A	○A		○A
GA6		○C	○C				○C		○C						○A			○A
GA7		○C	○C										○C		○A	○A		○B
GA8		○C	○B				○C		○C						○A	○A		○C
GA9		○C							○B						○A			●B
GA11																○C		●B
GA12		○A	○B				○C		○C		○A		○C		○B	○A		○A
GA13		○B	○A				○B		○B	○C	○A		○C		○B	○A		○A
GA14		○B	○C				○C		○C						○C	○B		○B
GA15		○B	○B				○C		○C		○B				○A	○A		○A
GA16		○C	○C				○C											○B
GA17		○B	○A				○C		○C	○C					○B	○A		○A
GA18		○B	○B				○C		○C						○C	○C		○A
GA19		○B	○C				○C		○C									○B
GA20		○C	○C						○C	○C					○B			○A
GA21			○C				○C		○A				○B		○A	○A		○C
GA22			○B				○C		○C							○B		○B
GA24			○C				○C		○C							○A		○B
GA25	●C						○C		○C						○A	○C		●B
GA26							○C		○C						○A	○C		●C
GA27		○C	○B				○C		○C						○A	○A		●C
GA28		○A	○B				○C		○C				○B	○C	○B	○A		●B
GA29	●C	○C					○C		○C						○A	○A		○C
GA30		○C	○B				○C		○C							○A		○A
GA31		○C	○B				○C								○B	○A		○A
GA32		○B	○B				○C		○C						○B	○A		○C
GA33		○A	○B				○C		○C							○A		○B
GA34			○C												○C			○C
GA35		○C	○C						○C							○B		●C
GA36		○B	○B				○C		○C							○A		○B
GA37			○C															○B
GA38		○C	○B				○C		○A						○A			○B
GA39															○B			○A
GA40		○A	○B				○C		○C							○A		●C
GA41			○C						○C									●C
GA42		○C	○C															○C
GA43		○B	○B				○C		○C									●C
GA44			○C															
GA45		○C	○B						○C									○C
GA46		○C	○C													●C		

1/ Greatest absolute value of factor change (whether gain or loss) is shown for area (reaches may differ in gain or loss).

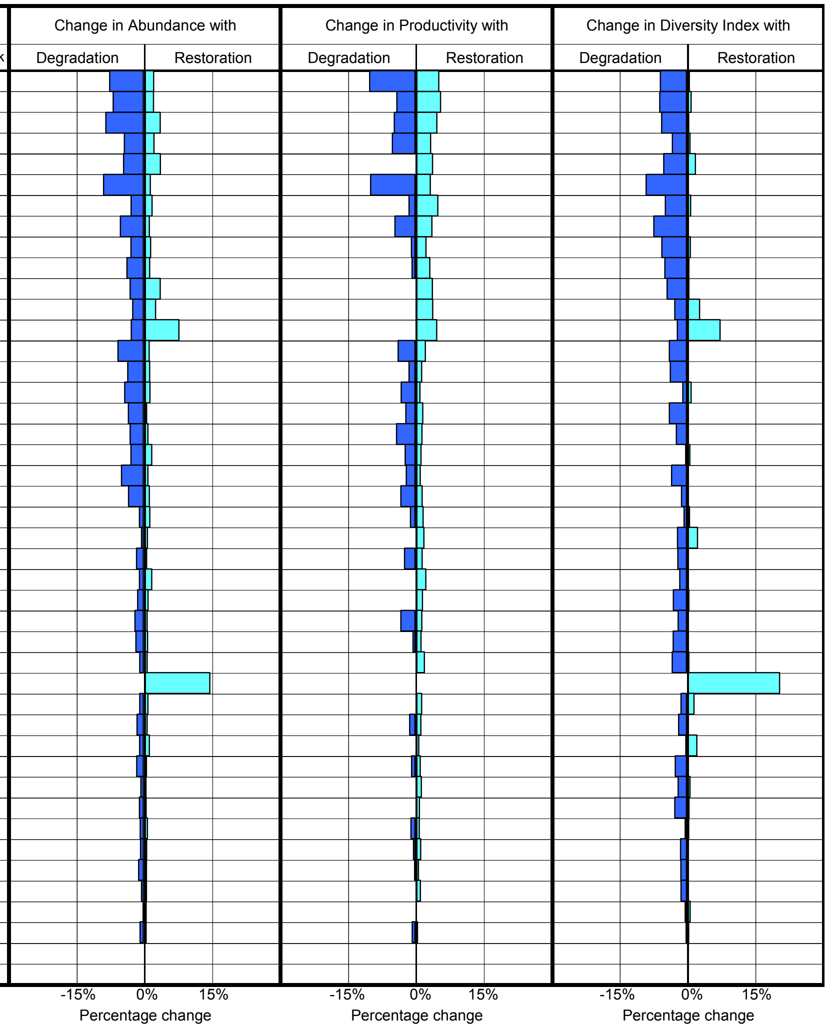
Key to amount of change in factor (corresponding Loss/Gain Category letter also shown)

A	B	C	D & E
○ / ● High	○ / ● Medium	○ / ● Low	Indirect or General

Scenario Diagnostic Report – Tornado Chart
Priority 1 and 2 Subbasin Actions – 100 years

Umatilla Summer Steelhead
Relative Importance Of Geographic Areas For Protection and Restoration Measures After Scenario Implementation

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
GA28	A	2	B	6
GA12	A	5	B	4
GA33	A	3	B	9
GA9	A	7	B	7
GA8	B	12	B	3
GA40	A	1	B	15
GA15	B	15	B	5
GA19	A	4	B	18
GA35	B	13	B	10
GA36	B	11	B	12
GA6	B	16	B	8
GA7	C	23	B	2
GA5	C	25	A	1
GA42	A	6	C	23
GA46	B	10	C	25
GA2	B	17	C	20
GA14	B	9	C	29
GA18	B	13	C	27
GA1	C	24	B	17
GA44	B	8	C	33
GA43	B	18	C	25
GA25	D	30	B	14
GA29	D	33	B	12
GA13	C	20	C	28
GA20	D	32	B	16
GA34	C	27	C	21
GA17	C	19	C	32
GA45	C	21	C	30
GA32	C	28	C	24
GA21	E	42	B	11
GA27	D	35	C	19
GA16	C	26	C	34
GA4	D	38	C	22
GA37	C	22	C	40
GA39	D	34	C	30
GA38	C	29	C	37
GA11	D	35	C	35
GA31	D	35	C	36
GA41	D	31	D	42
GA30	D	38	C	39
GA26	E	41	C	38
GA3	D	38	D	41
GA22	E	42	E	43
GA24	E	42	E	43



Scenario Diagnostic Report – Diagnostic Summary

Priority 1 and 2 Subbasin Actions – 100 years

Umatilla Summer Steelhead
Protection and Restoration Strategic Priority Summary After Scenario Implementation

Geographic area priority			Attribute class priority for restoration															
Geographic area	Protection benefit	Restoration benefit	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
GA1	∘	○	•		•									•	•	•		
GA2	○	∘	•		•				•					•	•			
GA3							•		●						●			•
GA4		∘	•				•		●	•					⬤	⬤		●
GA5	∘	◯	●				•		●	•			•		●	⬤		●
GA6	○	○	•				•		•	•					●			●
GA7	∘	○	●				•						•		●	⬤		•
GA8	○	○	●				•		•						●	●		•
GA9	◯	○			•				•					•				
GA11		∘			•									•				
GA12	◯	○					•								•	⬤		•
GA13	∘	∘	•													●		
GA14	○	∘	•				•								•	•		•
GA15	○	○	•				•		•						•	●		●
GA16	∘	∘	•				•											●
GA17	∘	∘														●		•
GA18	○	∘	•				•		•						•	•		•
GA19	◯	○					•		•									•
GA20		○	•				•		•	•				•	•	•		●
GA21		○	•				•		●		⬤		•		●	⬤		●
GA22			●				•		•							●		●
GA24			●				•		•							●		●
GA25		○			•		•		•					•	•	•		
GA26		∘					•		•						●	•		
GA27		∘	●				•		•						●	⬤		•
GA28	◯	○			•									•		●		
GA29		○	•				•		•						⬤	●		•
GA30		∘	•				•	•	•							●		•
GA31		∘	•													●		•
GA32	∘	∘	•				•									●		•
GA33	◯	○	•		•									•		•		●
GA34	∘	∘	•		•		•		•					•				•
GA35	○	○			•						⬤			•		•		•
GA36	○	○	•		•									•		●		•
GA37	∘	∘	•		•		•							•				●
GA38	∘	∘	•		•									•	●			●
GA39		∘	•		•						•			•	●			●
GA40	◯	○														●		
GA41			•				•		•									●
GA42	◯	∘	•															•
GA43	○	∘						•										
GA44	○	∘																
GA45	∘	∘					•	•										•
GA46	○	∘																

Key to strategic priority (corresponding Benefit Category letter also shown)

A	B	C	D & E
◯ / ⬤ High	○ / ● Medium	∘ / • Low	(blank) Indirect or General

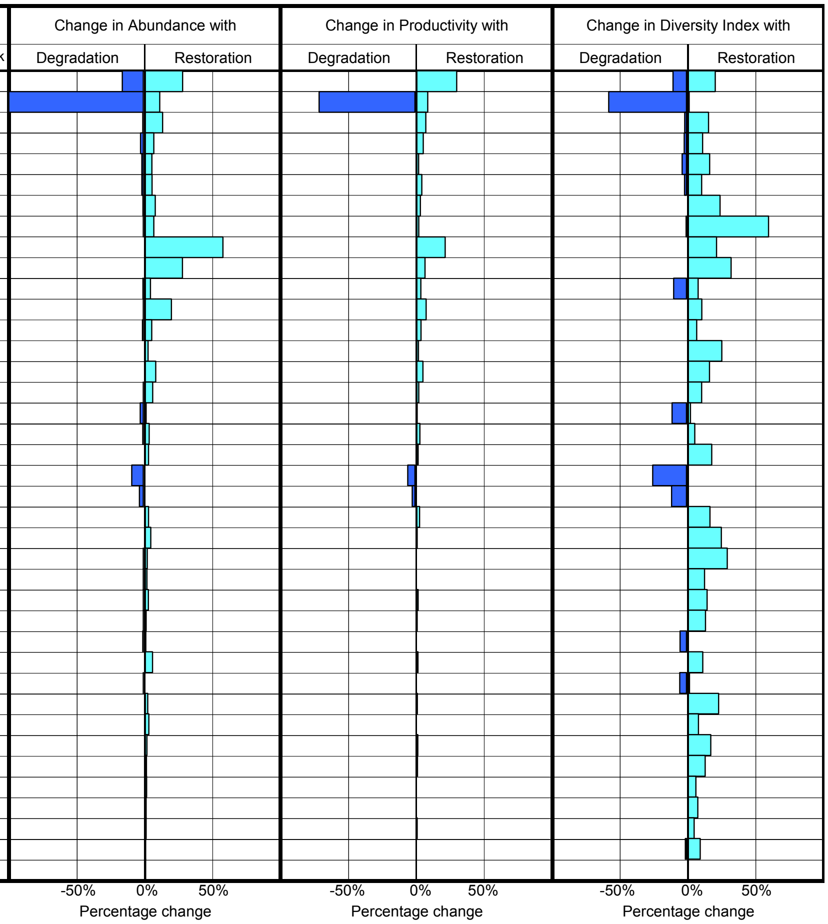
1/ "Channel stability" applies to freshwater areas only.

Baseline Diagnostic Report – Tornado Chart

Walla Walla Summer Steelhead

Relative Importance Of Geographic Areas For Protection and Restoration Measures - current condition

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
SF Walla Walla, mouth to Elbow Creek	B	4	A	3
SF Walla Walla, Elbow to access limit	A	1	B	11
NF Walla Walla, mouth to L. Meadows Ca	D	11	B	4
Walla Walla, Little Walla Walla Diversion	C	6	B	9
Mill Cr, Blue Cr to Walla Walla water intak	C	7	B	10
Walla Walla, E Little Walla Walla to Tuma	C	8	B	11
Cottonwood Cr Drainage (including NF, S	E	15	B	5
Pine Cr mainstem (plus Swartz)	E	17	B	5
Lower Walla Walla (mouth to Touche)	E	28	A	1
Mill Cr, Gose Street to Bennington Dam	E	28	A	1
NF Walla Walla, L. Meadows to access li	C	9	C	20
Walla Walla, Touche to Dry (plus Mud Cr	E	21	B	8
Walla Walla, Tumalum Bridge to Nursery	E	13	C	19
E Little Walla Walla Drainage (plus Unna	E	24	B	11
Walla Walla, Mill to E L. Walla Walla (plus	E	28	B	7
Mill Cr, mouth to start of Corps Project at	E	20	C	16
Mill Cr, Walla Walla water intake to acces	C	5	D	34
Walla Walla, Nursery Br to Little Walla W	E	14	C	25
Garrison Cr Drainage (plus Bryant)	E	25	C	16
Upper SF Walla Walla tribs (excluding Sk	B	2	E	39
Skiphorton & Reser Creek Drainages	B	3	E	39
Yellowhawk mainstem (mouth to source)	E	28	C	14
Dry Cr [Pine] Drainage	E	28	C	15
Lower Dry Cr (mouth to Sapolil)	E	19	C	24
Dry Cr Tribs (Mud[Dixie], Mud[Dry], NF D	E	16	C	28
Upper Dry Cr (Sapolil to forks)	E	22	C	22
Lower Mill Cr Tribs (Doan & Cold)	E	18	C	27
Lower SF Walla Walla Tribs (Flume Cany	C	9	E	36
Walla Walla, Dry to Mill	E	28	C	18
Upper Mill Tribs (NF, Low, Broken, Parad	D	12	E	37
Yellowhawk Tribs (Lassater, Russell, Res	E	28	C	21
Mill Cr, Bennington Dam to Blue Cr (plusT	E	23	C	28
W Little Walla Walla Drainage (plus Wals	E	28	C	23
Stone Cr Drainage	E	28	C	26
Blue Cr Drainage (including L. Blue)	E	28	D	30
Couse Creek Drainage	E	28	D	30
Birch Creek Drainage	E	27	D	33
Middle Mill Cr Tribs (Henry Canyon, Webl	E	25	D	35
Lower Touche (mouth to Coppei)	E	28	E	38



Baseline Diagnostic Report – Diagnostic Summary

Walla Walla Summer Steelhead
Protection and Restoration Strategic Priority Summary - current condition

Geographic area priority			Attribute class priority for restoration															
Geographic area	Protection benefit	Restoration benefit	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Lower Walla Walla (mouth to Touche)		A	B	C	B		B	C	A				B	B	A	B	C	C
Lower Touche (mouth to Coppei)			C		C		C		C					C	A	C	C	B
Walla Walla, Touche to Dry (plus Mud Cr)		B	C				B	C	A				B	C	A	B		B
Pine Cr mainstem (plus Swartz)		B	C				B		B		C		C		B	C		B
Dry Cr [Pine] Drainage		C	C		C		B	C	B	C			C		B	B		B
Lower Dry Cr (mouth to Sapolil)		C	C		C		B		B		B		C		A	B	C	C
Upper Dry Cr (Sapolil to forks)		C	C		C		C		C		B				A	B		C
Dry Cr Tribs (Mud[Dixie], Mud[Dry], NF Dry & SF D		C	B		C		B		B	C	A				A	B		C
Walla Walla, Dry to Mill		C	C		C		B		B	C			C	B	B	A	B	
W Little Walla Walla Drainage (plus Walsh)		C	C				B		B				C		A	A		B
Mill Cr, mouth to start of Corps Project at Gose St		C	C		C		B		B	C			C		A	B	C	B
Lower Mill Cr Tribs (Doan & Cold)		C	B				B		B	C	A				A	B	C	B
Mill Cr, Gose Street to Bennington Dam		A	C		C		B	C	B	C	A		C		A	B		B
Mill Cr, Bennington Dam to Blue Cr (plusTitus)		C	C		C		B		B		A		C		A	B	C	B
Blue Cr Drainage (including L. Blue)			B				B		B				C		A	A		B
Mill Cr, Blue Cr to Walla Walla water intake	C	B	C				C		C						B	C		B
Middle Mill Cr Tribs (Henry Canyon, Webb &Tiger)			B				C		C									C
Mill Cr, Walla Walla water intake to access limit	C																	C
Upper Mill Tribs (NF, Low, Broken, Paradise)															C			B
Walla Walla, Mill to E L. Walla Walla (plus MacAvo		B	B				B		B	C			C		B	B		C
Garrison Cr Drainage (plus Bryant)		C	C		C		B	C	B	C	A		C		A	B		B
Stone Cr Drainage		C	B		C		B	C	B	B	A		C		A	B		B
E Little Walla Walla Drainage (plus Unnamed Sprin		B	C		C		B	C	B	C	C				A	C		B
Walla Walla, E Little Walla Walla to Tumalum Bridg	C	B	B				B		C	C					B	B		
Yellowhawk mainstem (mouth to source)		C	C		C		C		B	C			C		B	B		
Yellowhawk Tribs (Lassater, Russell, Reser & Cald		C	B				B		B	C	A				A	B		B
Cottonwood Cr Drainage (including NF, SF & MF)		B	B				B		B				C		B	B		B
Birch Creek Drainage			C				B	C	A	C	C		C		A	B		B
Walla Walla, Tumalum Bridge to Nursery Bridge		C	A				B	C	B	B					C	C		B
Walla Walla, Nursery Br to Little Walla Walla Divers		C	B				B	C	B	C					C			B
Walla Walla, Little Walla Walla Diversion to forks	C	B	C				C		B	C					C			B
Couse Creek Drainage			B				B		B	C		B	C		B	B		B
NF Walla Walla, mouth to L. Meadows Canyon Cr (		B	B				B		B						B	B		B
NF Walla Walla, L. Meadows to access limit (plus B	C	C	B				C		C						C			
SF Walla Walla, mouth to Elbow Creek	B	A	C				B		B						B	B		B
Lower SF Walla Walla Tribs (Flume Canyon, Elbow	C		B												B			B
SF Walla Walla, Elbow to access limit	A	B																
Upper SF Walla Walla tribs (excluding Skiphorton &	B																	
Skiphorton & Reser Creek Drainages	B																	

1/ "Channel stability" applies to freshwater areas only.

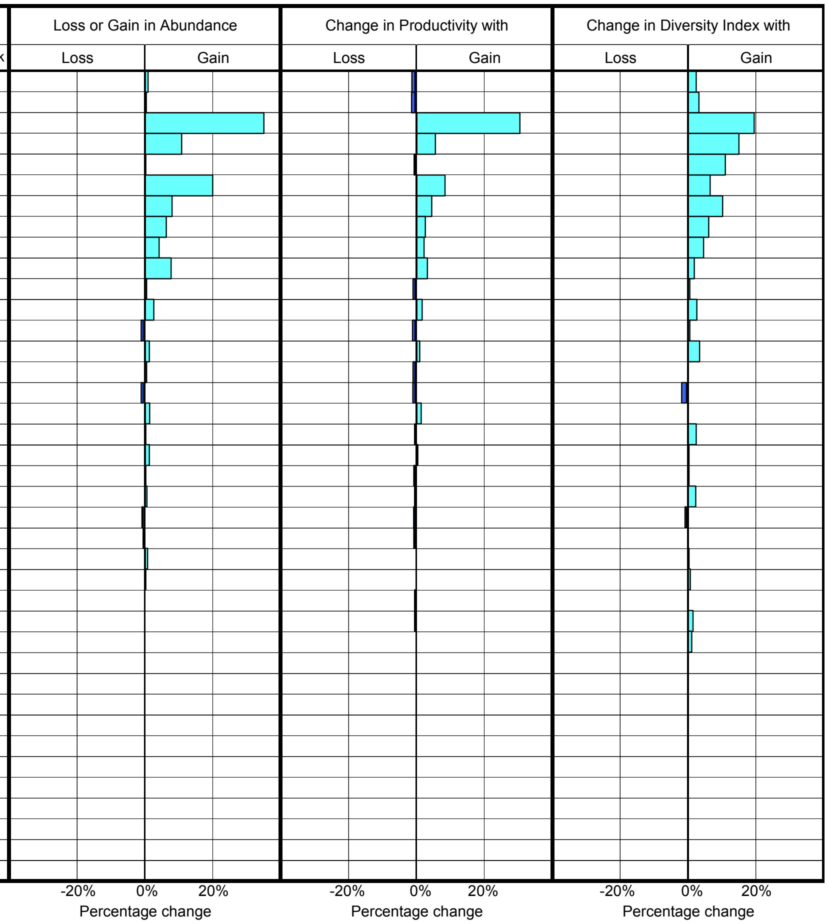
Key to strategic priority (corresponding Benefit Category letter also shown)

A	B	C	D & E
High	Medium	Low	Indirect or General

Scenario Profile Report – Tornado Chart
Priority 1 and 2 Subbasin Actions – 100 years

Walla Walla Summer Steelhead
Change in Performance Due to Scenario's Effect within Geographic Area

Geographic Area	Loss category		Gain category	
	Category/rank		Category/rank	
Cottonwood Cr Drainage (including NF, S	E	4	C	10
Pine Cr mainstem (plus Swartz)	E	3	D	14
SF Walla Walla, mouth to Elbow Creek	E	17	A	1
NF Walla Walla, mouth to L. Meadows Ca	E	17	B	2
E Little Walla Walla Drainage (plus Unnar	E	10	C	10
Lower Walla Walla (mouth to Touche)	E	17	B	3
Walla Walla, Little Walla Walla Diversion	E	17	B	4
Walla Walla, Tumalum Bridge to Nursery	E	17	B	5
Walla Walla, Nursery Br to Little Walla W	E	17	C	6
Walla Walla, Touche to Dry (plus Mud Cr	E	17	C	7
Dry Cr [Pine] Drainage	E	7	D	18
Walla Walla, E Little Walla Walla to Tuma	E	17	C	8
Couse Creek Drainage	C	1	E	25
NF Walla Walla, L. Meadows to access li	E	17	C	9
Mill Cr, mouth to start of Corps Project at	E	6	D	21
Upper SF Walla Walla tribs (excluding Sk	C	1	E	27
SF Walla Walla, Elbow to access limit	E	17	D	12
W Little Walla Walla Drainage (plus Wals	E	13	D	16
Walla Walla, Mill to E L. Walla Walla (plu	E	17	D	12
Mill Cr, Bennington Dam to Blue Cr (plusT	E	9	D	21
Mill Cr, Blue Cr to Walla Walla water intak	E	15	D	15
Skiphorton & Reser Creek Drainages	E	4	E	27
Mill Cr, Gose Street to Bennington Dam	E	7	E	27
Walla Walla, Dry to Mill	E	17	D	17
Lower SF Walla Walla Tribs (Flume Cany	E	17	D	19
Birch Creek Drainage	E	11	E	26
Middle Mill Cr Tribs (Henry Canyon, Webl	E	14	D	23
Upper Mill Tribs (NF, Low, Broken, Parad	E	17	D	20
Mill Cr, Walla Walla water intake to acces	E	17	E	24
Yellowhawk mainstem (mouth to source)	E	15	E	27
Blue Cr Drainage (including L. Blue)	E	17	E	27
Dry Cr Tribs (Mud[Dixie], Mud[Dry], NF D	E	17	E	27
Garrison Cr Drainage (plus Bryant)	E	17	E	27
Lower Dry Cr (mouth to Sapolil)	E	17	E	27
Lower Mill Cr Tribs (Doan & Cold)	E	17	E	27
Lower Touche (mouth to Coppei)	E	17	E	27
Stone Cr Drainage	E	17	E	27
Upper Dry Cr (Sapolil to forks)	E	17	E	27
Yellowhawk Tribs (Lassater, Russell, Res	E	17	E	27



Scenario Profile Report – Change in Habitat Factors Summary
Priority 1 and 2 Subbasin Actions – 100 years

Walla Walla Summer Steelhead
Summary of Scenario Effects on Survival Factors and Overall Performance

Relative loss or gain by area			Change in attribute impact on survival due to scenario															
Geographic area	Relative loss	Relative gain	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Lower Walla Walla (mouth to Touche)		○					∘						∘		◯	∘		•
Lower Touche (mouth to Coppei)																		
Walla Walla, Touche to Dry (plus Mud Cr)		∘					∘						∘		◯	∘		∘
Pine Cr mainstem (plus Swartz)			∘				∘		∘		○				○	∘		○
Dry Cr [Pine] Drainage			∘				∘		∘				∘		∘	○		◯
Lower Dry Cr (mouth to Sapolil)																		
Upper Dry Cr (Sapolil to forks)																		
Dry Cr Tribs (Mud[Dixie], Mud[Dry], NF Dry & SF D																		
Walla Walla, Dry to Mill							∘						∘		∘	∘		•
W Little Walla Walla Drainage (plus Walsh)							∘		∘						◯	○		○
Mill Cr, mouth to start of Corps Project at Gose St							∘								○			∘
Lower Mill Cr Tribs (Doan & Cold)																		
Mill Cr, Gose Street to Bennington Dam							∘								◯			○
Mill Cr, Bennington Dam to Blue Cr (plusTitus)															∘	∘		∘
Blue Cr Drainage (including L. Blue)																		
Mill Cr, Blue Cr to Walla Walla water intake															∘	∘		∘
Middle Mill Cr Tribs (Henry Canyon, Webb &Tiger)			∘															
Mill Cr, Walla Walla water intake to access limit																		
Upper Mill Tribs (NF, Low, Broken, Paradise)															∘			
Walla Walla, Mill to E L. Walla Walla (plus MacAvo							∘								○	○		•
Garrison Cr Drainage (plus Bryant)																		
Stone Cr Drainage																		
E Little Walla Walla Drainage (plus Unnamed Sprin		∘	∘				○		○						◯	∘		◯
Walla Walla, E Little Walla Walla to Tumalum Bridg		∘	∘				∘		∘						○	○		●
Yellowhawk mainstem (mouth to source)																		
Yellowhawk Tribs (Lassater, Russell, Reser & Cald																		
Cottonwood Cr Drainage (including NF, SF & MF)		∘	∘				∘		∘						○	○		◯
Birch Creek Drainage			∘				∘		○		∘		∘		○	∘		◯
Walla Walla, Tumalum Bridge to Nursery Bridge		○	◯				○		◯	○					∘	∘		●
Walla Walla, Nursery Br to Little Walla Walla Divers		∘	○				○		◯	○					∘			●
Walla Walla, Little Walla Walla Diversion to forks		○	∘				∘		○	∘					∘			●
Couse Creek Drainage	•		∘				∘		∘			◯	∘		∘	◯		◯
NF Walla Walla, mouth to L. Meadows Canyon Cr (		○	○				∘		○						○	○		○
NF Walla Walla, L. Meadows to access limit (plus E		∘	∘						∘						∘			
SF Walla Walla, mouth to Elbow Creek		◯	∘				○		○						○	○		○
Lower SF Walla Walla Tribs (Flume Canyon, Elbow			○												○	•		◯
SF Walla Walla, Elbow to access limit																		
Upper SF Walla Walla tribs (excluding Skiphorton &	•																	
Skiphorton & Reser Creek Drainages																•		

1/ Greatest absolute value of factor change (whether gain or loss) is shown for area (reaches may differ in gain or loss).

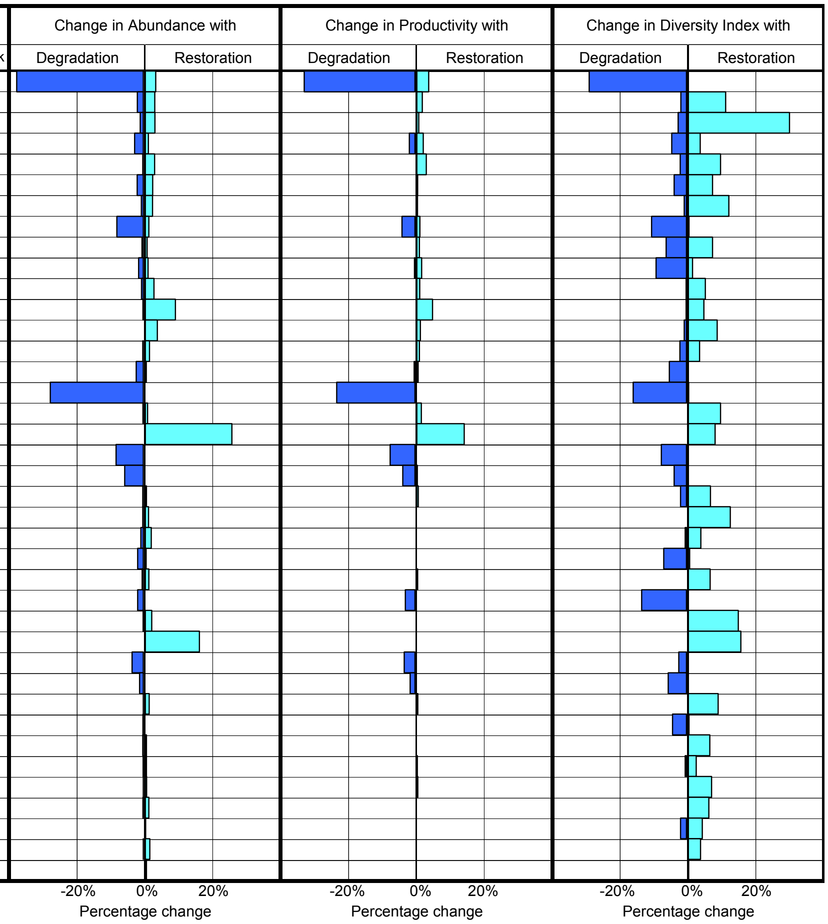
Key to amount of change in factor (corresponding Loss/Gain Category letter also shown)

A	B	C	D & E
◯ / ● High	○ / ● Medium	∘ / • Low	Indirect or General

Scenario Diagnostic Report – Tornado Chart
Priority 1 and 2 Subbasin Actions – 100 years

Walla Walla Summer Steelhead
Relative Importance Of Geographic Areas For Protection and Restoration Measures After Scenario Implementation

Geographic Area	Protection benefit		Restoration benefit	
	Category/rank		Category/rank	
SF Walla Walla, Elbow to access limit	A	1	B	11
Cottonwood Cr Drainage (including NF, S	D	16	B	2
Pine Cr mainstem (plus Swartz)	C	15	B	4
Walla Walla, E Little Walla Walla to Tuma	C	7	C	16
Walla Walla, Mill to E L. Walla Walla (plus	D	21	B	2
Mill Cr, Blue Cr to Walla Walla water intak	C	13	B	11
Dry Cr [Pine] Drainage	D	18	B	8
NF Walla Walla, mouth to L. Meadows Ca	C	3	D	23
E Little Walla Walla Drainage (plus Unnar	C	14	C	15
NF Walla Walla, L. Meadows to access li	C	10	C	20
Mill Cr, mouth to start of Corps Project at	D	23	B	10
Walla Walla, Touche to Dry (plus Mud Cr	E	29	B	6
Walla Walla, Dry to Mill	E	31	B	5
Couse Creek Drainage	D	19	C	18
Lower SF Walla Walla Tribs (Flume Cany	C	8	D	30
SF Walla Walla, mouth to Elbow Creek	B	2	E	36
Yellowhawk mainstem (mouth to source)	E	30	B	8
Lower Walla Walla (mouth to Touche)	E	38	A	1
Walla Walla, Little Walla Walla Diversion	C	3	E	38
Walla Walla, Tumalum Bridge to Nursery	C	6	E	35
W Little Walla Walla Drainage (plus Wals	D	21	C	21
Yellowhawk Tribs (Lassater, Russell, Res	D	25	C	17
Mill Cr, Bennington Dam to Blue Cr (plusT	D	19	D	24
Mill Cr, Walla Walla water intake to acces	C	11	E	32
Upper Dry Cr (Sapolil to forks)	D	24	C	19
Upper SF Walla Walla tribs (excluding Sk	C	5	E	38
Lower Dry Cr (mouth to Sapolil)	E	34	B	11
Mill Cr, Gose Street to Bennington Dam	E	38	B	7
Walla Walla, Nursery Br to Little Walla W	C	8	E	38
Skiphorton & Reser Creek Drainages	C	12	E	37
Garrison Cr Drainage (plus Bryant)	E	37	C	14
Upper Mill Tribs (NF, Low, Broken, Parad	D	17	E	34
Lower Mill Cr Tribs (Doan & Cold)	D	26	D	27
Birch Creek Drainage	D	27	D	28
Stone Cr Drainage	E	35	C	21
Dry Cr Tribs (Mud[Dixie], Mud[Dry], NF D	E	32	D	25
Middle Mill Cr Tribs (Henry Canyon, Webl	D	27	D	31
Blue Cr Drainage (including L. Blue)	E	36	D	26
Lower Touche (mouth to Coppei)	E	38	E	33



Scenario Diagnostic Report – Diagnostic Summary

Priority 1 and 2 Subbasin Actions – 100 years

Walla Walla Summer Steelhead
Protection and Restoration Strategic Priority Summary After Scenario Implementation

Geographic area priority			Attribute class priority for restoration																
Geographic area	Protection benefit	Restoration benefit	Channel stability	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Lower Walla Walla (mouth to Touche)		A	B	C	B		B	C	A				B	B	A	B	C	
Lower Touche (mouth to Coppei)			C		C		C		C					C	A	C	C	B
Walla Walla, Touche to Dry (plus Mud Cr)		B	C				B	C	A				C	C	A	B		B
Pine Cr mainstem (plus Swartz)	C	B	C				C		B						B	C		B
Dry Cr [Pine] Drainage		B	C				B		B	C					B	B		B
Lower Dry Cr (mouth to Sapolil)		B	C		C		B		B		B		C		A	B	C	C
Upper Dry Cr (Sapolil to forks)		C	C		C		C		C		B				A	B		C
Dry Cr Tribs (Mud[Dixie], Mud[Dry], NF Dry & SF Dry)			B		C		B		B	C	A				A	B		C
Walla Walla, Dry to Mill		B	C		C		B		B	C			C	B	B	A	B	
W Little Walla Walla Drainage (plus Walsh)		C	C				B		C				C		A	A		B
Mill Cr, mouth to start of Corps Project at Gose St		B	C		C		B		B	C			C		B	B	C	B
Lower Mill Cr Tribs (Doan & Cold)			B				B		B	C	A				A	B	C	B
Mill Cr, Gose Street to Bennington Dam		B	C		C		B	C	B	C	A				A	B		B
Mill Cr, Bennington Dam to Blue Cr (plusTitus)			C		C		B		B		A				B	B	C	B
Blue Cr Drainage (including L. Blue)			B				B		B				C		A	A		B
Mill Cr, Blue Cr to Walla Walla water intake	C	B	C				C		C						B	C		B
Middle Mill Cr Tribs (Henry Canyon, Webb &Tiger)			B				C		C									C
Mill Cr, Walla Walla water intake to access limit	C																	
Upper Mill Tribs (NF, Low, Broken, Paradise)															C			B
Walla Walla, Mill to E L. Walla Walla (plus MacAvoy &		B	C				C		B	C					B	B		C
Garrison Cr Drainage (plus Bryant)		C	C		C		B	C	B	C	A		C		A	B		B
Stone Cr Drainage		C	B		C		B	C	B	B	A		C		A	B		B
E Little Walla Walla Drainage (plus Unnamed Spring &	C	C	C				C		C		C				B			B
Walla Walla, E Little Walla Walla to Tumalum Bridge	C	C	C				C		C						B	C		C
Yellowhawk mainstem (mouth to source)		B	C		C		C		B	C			C		B	B		
Yellowhawk Tribs (Lassater, Russell, Reser & Caldwel		C	B				B		B	C	A				A	B		B
Cottonwood Cr Drainage (including NF, SF & MF)		B	B				C		C						B	B		C
Birch Creek Drainage			C				B		B	C					B	B		B
Walla Walla, Tumalum Bridge to Nursery Bridge	C																	B
Walla Walla, Nursery Br to Little Walla Walla Diversior	C																	B
Walla Walla, Little Walla Walla Diversion to forks	C																	B
Couse Creek Drainage		C	C				C		C			C			C	C		C
NF Walla Walla, mouth to L. Meadows Canyon Cr (plu	C		C															B
NF Walla Walla, L. Meadows to access limit (plus Big I	C	C	C				C		C									
SF Walla Walla, mouth to Elbow Creek	B																	B
Lower SF Walla Walla Tribs (Flume Canyon, Elbow)	C		B												C			B
SF Walla Walla, Elbow to access limit	A	B																
Upper SF Walla Walla tribs (excluding Skiphorton & R(	C																	
Skiphorton & Reser Creek Drainages	C																	

1/ "Channel stability" applies to freshwater areas only.

Key to strategic priority (corresponding Benefit Category letter also shown)

A	B	C	D & E
High	Medium	Low	Indirect or General

Appendix H

Literature Cited

Beechie, T.J., and S. Bolton. 1999. An approach to restoring salmonid habitat-forming processes in Pacific Northwest watersheds. Fisheries 24:6-15.

Beechie, T.J., G. Pess, E. Beamer, G. Lucchetti, and R.E. Bilby. 2004. Role of watershed assessments in recovery planning for salmon. Pages 194-225 in D. Montgomery, S. Bolton, and D.B. Booth (eds.) Restoration of Puget Sound Rivers. University of Washington Press, Seattle, WA.

Bolton, S., D.B. Booth, and D.R. Montgomery. 2004. Restoration of Puget Sound rivers: do we know how to do it? Pages 483-490 in D. Montgomery, S. Bolton, and D.B. Booth (eds.) Restoration of Puget Sound Rivers. University of Washington Press, Seattle, WA.

Cockrum, T., and M. Omeg. 2003. Fifteenmile Creek orchard pesticide pollution risk study; WyEast Resource Conservation and Development Area. Annual Report, Project No. 200102200, BPA Report DOE/BP-00005254-1.

Collins, B.D., D.R. Montgomery, and A.D. Haas. 2002. Historical changes in the distribution and functions of large wood in Puget Lowland rivers. Canadian Journal of Fisheries and Aquatic Sciences 59:66-76.

Fox, M.J. 2001. A new look at the quantities and volumes of instream wood in forested basins within Washington State. Masters Thesis. University of Washington, Seattle, Washington.

Fox, M.J. 2003. Spatial organization, position, and source characteristics of large woody debris in natural systems. PhD Dissertation. University of Washington, Seattle, Washington.

Konrad, C.P. 2004. Opportunities and constraints for urban stream rehabilitation. Pages 292-317 in D. Montgomery, S. Bolton, and D.B. Booth (eds.) Restoration of Puget Sound Rivers. University of Washington Press, Seattle, WA.

Lichatowich, J., L. Mobrand, L. Lestelle, and T. Vogel. 1995. An approach to the diagnosis and treatment of depleted Pacific salmon populations in freshwater ecosystems. Fisheries (Bethesda) 20:10-18.

Maser, C. and J.R. Sedell. 1994. From the Forest to the Sea: the Ecology of Wood in Streams, Rivers, Estuaries, and Oceans, St. Lucie Press, Delray Beach, Florida.

Middle Deschutes Local Advisory Committee. 2006. Middle Deschutes Agricultural Water Quality Management Area Plan. Jefferson County SWCD, Redmond, OR.

Naiman, R.J., C.A. Johnston, and J.C. Kelley. 1988. Alteration of North American streams by beaver. BioScience 38:753-762.

Naiman, R.J., H. Décamps, and M.E. McClain. 2005. Riparia Ecology, Conservation and Management of Streamside Communities. Elsevier Academic Press.

Opperman, J.J., and A.M. Merenlender. 2004. The effectiveness of riparian restoration for improving in-stream fish habitat in four hardwood-dominated California streams. North American Journal of Fisheries Management 24: 822-834.

Platts, W.S. 1991. Livestock grazing. In: W.R. Meehan (Ed.). Influence of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society Special Publication No. 19.

APPENDIX I

Oregon Mid-Columbia Steelhead
Cost Estimates for Recovery Actions

Cost Estimates for Recovery Actions
Draft – 9 October 2007

Introduction

The ESA section 4(f)(1) requires that recovery plans include "estimates of the time required and the cost to carry out those measures needed to achieve the Plan's goal and to achieve intermediate steps toward that goal" (16 U.S.C. 1531-1544, as amended). This draft appendix is intended to meet this ESA requirement and will be used by NMFS to estimate the total recovery costs for the Mid-Columbia steelhead DPS in its draft Mid-Columbia Steelhead DPS Plan.

The Oregon Department of Fish and Wildlife (ODFW), together with its Recovery Planning Team, Management Action Teams, and the Oregon Mid-Columbia River Sounding Board have developed an extensive list of projects needed to recover the Oregon populations in the Mid-Columbia steelhead DPS. These projects are intended to address the recovery of ESA-listed Mid-Columbia River steelhead. The project list was developed using the most up-to-date assessment of Mid-Columbia steelhead recovery needs, without consideration of cost or potential funding. This draft appendix provides cost estimates for each project where available information was sufficient to do so.

Methods and Data

The basic approach taken to estimate the cost of each project was to combine estimates of the scale of the project and the cost per scalar unit for that type of project. This method is known as the unit cost method, and it is appropriate when approximate estimates are sufficient. The estimation took the following steps:

1. Actions listed in Section 9 of the draft Mid-Columbia Steelhead DPS Plan were grouped into a set of project types (*e.g.*, bank stabilization and exclusion fencing). In some cases, the actions listed in Section 9 differed only in minor variations in wording; in other cases, actions had more significant descriptive variations but could still be linked to a standard project type.
2. The scale for each action listed in Section 9 was determined using information in that section or supplemental information provided by ODFW. Scale was measured in two basic ways:

    a. Stream miles of treatment, taken from the EDT analysis used in the recovery plan; or
    b. Number of structures, taken from Section 9 of the recovery plan or provided by ODFW.

    In a few cases, the scale of an action was not used in the cost estimation, as the action was unique to a particular location (*e.g.*, Phase III of the Umatilla Basin Project). For some actions, no scale estimate is available at this time, in which case no cost estimate is provided in this draft appendix.

3. The unit cost of a project type was estimated using cost data from existing habitat restoration projects and professional judgment. These costs reflected the materials and labor needed to implement a project (see step #4 for additional costs). Three sets of data were used to support the estimation of unit costs:

    a. Habitat restoration project costs in the Oregon portion of the NMFS Interior Columbia recovery domain and in adjacent Washington subbasins. The cost data were drawn from three funding sources: the Oregon Watershed Enhancement Board (OWEB) grant program, the Grande Ronde Model Watershed Program (GRMWP), and the Washington State Salmon Recovery Funding Board (SRFB) grant program. This data set included approximately 1400 individual habitat restoration projects. Projects that included only one type of activity were then analyzed to estimate the unit cost of that activity.
    b. GRMWP unit cost estimates. For a limited number of project types, the GRMWP estimated unit costs of their projects (personal communication, Cecilia Noyes, GRMWP).
    c. SRFB unit costs. As part of the SRFB grant process, applicants provide the SRFB with estimates of the unit costs for various project types. Unit cost estimates were drawn from SRFB projects in the Washington portion of the NMFS Interior Columbia recovery domain for this dataset.

    The three data sources provided different amounts of coverage for the full set of project types constructed in the first step and in a few cases (*e.g.*, land acquisition and water rights transfers), they did not have sufficient data to support the estimation of unit costs. Where the data were judged to be sufficient in quantity and quality, professional judgment was used to develop a unit cost estimate, favoring the mid-point of a range across data sources and projects (where a valid range existed) and rounding appropriately to avoid a false sense of precision.

4. Finally, the resulting total cost estimate was multiplied by 1.6 to reflect the additional costs of project planning, coordination, engineering, permits, and so forth. The multiplier was estimated after consulting with ODFW and other parties experienced in habitat restoration project implementation.

Cost Estimates for Recovery Actions

Table I-1 provides cost estimates for all recovery actions by population, strategy, and category of action. The action categories are the following:

- Baseline: These are the actions categorized as part of an ongoing, existing program. No cost estimate is provided for these actions.
- Cost estimate exists: These are actions for which a estimate and scale are available.

- TBD: These are actions that do not have cost estimates at this time and that are listed as To Be Determined (TBD). The reason for the TBD status is indicated in the following way:
    - TBD (1): In these cases, costs need to be developed for specific sites and projects.
    - TBD (2): These are actions for which a unit cost estimate exists but for which no scale (stream miles or project inventory) is available.
    - TBD (3): These are actions for which a unit cost estimate needs to be developed. These actions may also need a scale estimate.

The Action name is taken from Section 9 of the draft Mid-Columbia Steelhead DPS Plan. The Total Cost Estimate columns are the following:

- P1 miles: Cost estimate for the Priority 1 stream miles used in the EDT analysis.
- P1-2 miles: Cost estimate for the Priority 1 and Priority 2 stream miles used in the EDT analysis.
- Projects: Cost estimate for the number of structures (screens, culverts, etc.) identified for that action and population.

If an action is categorized as Baseline, the cost estimate is listed as N/A (Not Applicable). The cost estimates for P1 miles and P1-2 miles are cumulative (P1 cost estimate < P1-2 cost estimate) and should not be added together. The Projects cost estimate can be added to either the P1 miles estimate or the P1-2 estimate.

<u>Current Average Expenditures on Habitat Projects for Mid-Columbia River Steelhead</u>

Table I-2 provides information on current expenditures and expected five year budget amounts for habitat projects by a wide range of local, state, and federal agencies and NGOs. This table provides context for the estimated costs of recovery actions and provides a basis for estimating possible levels of funding for recovery plan implementation over a given period of time.

Table I-1: All Actions by Population, Strategy, and Category				
Population, Strategy, Category	**Action name**	**Total Cost Estimate**		
		P1 miles	**P1-2 miles**	**Projects**
Deschutes River Eastside				
1. Protect and conserve natural ecological processes that support the viability of populations and their primary life history strategies throughout their life cycle.				
Baseline	Consistently apply Best Management Practices and existing laws to protect and conserve natural ecological processes.	N/A		
	Develop new and manage existing habitat Cooperative Agreements	N/A		
Cost estimate exists	Conduct outreach to resource users and managers	$0	$0	$176,000
TBD	Protect and conserve rare and unique functioning habitats	TBD (3)		
	Protect the highest quality habitats through acquisition or conservation easements	TBD (3)		
2. Restore passage and connectivity to habitats blocked or impaired by artificial barriers and maintain unimpaired passage and connectivity.				
Baseline	Maintain irrigation diversions and screens	N/A		
Cost estimate exists	Culverts: Replace or remove barriers blocking passage including dams, road culverts, irrigation structures, infiltration galleries	$0	$0	$160,000
	Provide screening at 100% of irrigation diversions	$0	$0	$0
TBD	Dams: Replace or remove barriers blocking passage including dams, road culverts, irrigation structures, infiltration galleries	TBD (2)		
	Irrigation Structures: Replace or remove barriers blocking passage including dams, road culverts, irrigation structures, infiltration galleries	TBD (2)		
3. Restore floodplain connectivity and function and maintain unimpaired connectivity and function.				
Baseline	Promote the maintenance and creation of beaver dams to restore the role in natural ecological processes.	N/A		
Cost estimate exists	Reconnect floodplains to channels	$4,893,840	$8,897,760	$0
	Reconnect side channels and off-channel habitats to stream channels	$4,893,840	$8,897,760	$0

Table I-1: All Actions by Population, Strategy, and Category				
Population, Strategy, Category	**Action name**	**Total Cost Estimate**		
		P1 miles	**P1-2 miles**	**Projects**
4. Restore degraded channel structure and complexity and maintain unimpaired structure and complexity.				
Cost estimate exists	Increase role and abundance of wood and large organic debris in streambeds	$743,821	$743,821	$0
	Restore natural channel form, includes berm and levee removal	$4,893,840	$8,897,760	$0
	Stabilize streambanks with passive restoration processes	$4,893,840	$8,897,760	$0
5. Restore riparian condition and LWD recruitment and maintain unimpaired conditions.				
Cost estimate exists	Install off-stream livestock watering	$0	$0	$0
	Install/maintain fencing to exclude livestock from riparian areas	$724,320	$2,516,734	$0
	Restore natural riparian communities	$1,957,536	$4,530,120	$0
TBD	Eradicate invasive plant species from riparian areas	TBD (2)		
	Develop grazing strategies that promote riparian recovery	TBD (3)		
6. Restore natural hydrograph to provide sufficient flow during critical periods.				
Baseline	Implement agricultural water conservation measures	N/A		
	Improve irrigation conveyance and efficiency	N/A		
	Monitor/regulate water withdrawals	N/A		
Cost estimate exists	Water retention structures	$316,324	$197,702	$0
TBD	Lease or purchase water rights and convert to instream	TBD (3)		
7. Improve degraded water quality and maintain unimpaired water quality.				
Baseline	Continue TMDL monitoring	N/A		
	Implement Agricultural Water Quality Management Plan	N/A		
	Manage irrigation return flow to reduce extreme stream temperatures	N/A		
	Minimize unnatural factors that lead to fluctuations in dissolved oxygen levels	N/A		

Table I-1: All Actions by Population, Strategy, and Category				
Population, Strategy, Category	**Action name**	**Total Cost Estimate**		
		P1 miles	**P1-2 miles**	**Projects**
8. Restore degraded upland processes to minimize unnatural rates of erosion and runoff, and maintain unimpaired natural upland processes.				
Baseline	Convert to perennial crops/vegetation (CRP)	N/A		
	Employ BMPs to minimize unnatural rates of erosion	N/A		
	Promote reforestation and fuels management	N/A		
TBD	Achieve 95% conversion to no till farming	TBD (2)		
	Remove junipers	TBD (2)		
	Restore native upland plants and remove noxious weeds	TBD (2)		
	Upgrade or remove problem forest roads	TBD (2)		
Deschutes River Westside				
1. Protect and conserve natural ecological processes that support the viability of populations and their primary life history strategies throughout their life cycle.				
Baseline	Adopt and manage Cooperative Agreements	N/A		
	Consistently apply Best Management Practices and existing laws to protect and conserve natural ecological processes.	N/A		
	Special management designations on public lands	N/A		
Cost estimate exists	Conduct outreach to resource users and managers	$0	$0	$176,000
TBD	Protect and conserve rare and unique functioning habitats	TBD (3)		
	Protect the highest quality habitats through acquisition or conservation easements	TBD (3)		
2. Restore passage and connectivity to habitats blocked or impaired by artificial barriers and maintain unimpaired passage and connectivity.				
Baseline	Restore passage at Pelton-Round Butte Complex	N/A		
Cost estimate exists	Culverts: Replace barriers blocking passage including dams, road culverts and irrigation structures	$0	$0	$0
	Provide screening at 100% of irrigation diversions	$0	$0	$0
	Replace screens that do not meet criteria	$0	$0	$0

Table I-1: All Actions by Population, Strategy, and Category

Population, Strategy, Category	Action name	Total Cost Estimate P1 miles	P1-2 miles	Projects
TBD	Dams: Replace barriers blocking passage including dams, road culverts and irrigation structures	TBD (2)		
	Irrigation Structures: Replace barriers blocking passage including dams, road culverts and irrigation structures	TBD (2)		
3. Restore floodplain connectivity and function and maintain unimpaired connectivity and function.				
Baseline	Promote the maintenance and creation of beaver dams to restore the role in natural ecological processes.	N/A		
Cost estimate exists	Reconnect floodplains to channels	$5,407,200	$25,249,680	$0
	Reconnect side channels and off-channel habitats to stream channels	$5,407,200	$25,249,680	$0
4. Restore degraded channel structure and complexity and maintain unimpaired structure and complexity.				
Cost estimate exists	Increase role and abundance of wood and large organic debris in streambeds	$875,197	$2,308,992	$0
	Restore natural channel form	$5,407,200	$25,249,680	$0
	Stabilize streambanks	$5,407,200	$25,249,680	$0
5. Restore riparian condition and LWD recruitment and maintain unimpaired conditions.				
Cost estimate exists	Install fencing to exclude livestock from riparian areas	$0	$153,920	$0
	Install off-stream livestock watering	$0	$0	$0
	Plant riparian vegetation where appropriate	$1,120,933	$1,120,933	$0
	Restore natural riparian communities	$372,384	$9,351,936	$0
TBD	Eradicate invasive plant species from riparian areas	TBD (2)		
	Develop grazing strategies that promote riparian recovery	TBD (3)		
6. Restore natural hydrograph to provide sufficient flow during critical periods.				
Baseline	Implement agricultural water conservation measures	N/A		
	Improve irrigation conveyance and efficiency	N/A		
	Monitor/regulate water withdrawals	N/A		
TBD	Lease or purchase water rights and convert to instream	TBD (3)		

Table I-1: All Actions by Population, Strategy, and Category				
Population, Strategy, Category	**Action name**	**Total Cost Estimate**		
		P1 miles	**P1-2 miles**	**Projects**
7. Improve degraded water quality and maintain unimpaired water quality.				
Baseline	Continue TMDL monitoring	N/A		
	Implement Agricultural Water Quality Management Plan	N/A		
	Manage irrigation return flow to reduce extreme stream temperatures	N/A		
	Minimize unnatural factors that lead to fluctuations in dissolved oxygen levels	N/A		
TBD	Reduce chemical pollution inputs	TBD (1)		
8. Restore degraded upland processes to minimize unnatural rates of erosion and runoff, and maintain unimpaired natural upland processes.				
Baseline	Employ BMPs to minimize unnatural rates of erosion	N/A		
	Utilize appropriate fire suppression techniques	N/A		
TBD	Achieve 95% conversion to no till farming	TBD (2)		
	Restore native upland plants	TBD (2)		
	Upgrade or remove problem forest roads	TBD (2)		
Fifteenmile				
1. Protect and conserve natural ecological processes that support the viability of populations and their primary life history strategies throughout their life cycle.				
Baseline	Consistently apply Best Management Practices and existing laws to protect and conserve natural ecological processes.	N/A		
Cost estimate exists	Conduct outreach to resource users and managers	$0	$0	$176,000
TBD	Protect and conserve rare and unique functioning habitats	TBD (3)		
	Protect the highest quality habitats through acquisition or conservation easements	TBD (3)		
2. Restore passage and connectivity to habitats blocked or impaired by artificial barriers and maintain unimpaired passage and connectivity.				
Cost estimate exists	Culverts: Replace barriers blocking passage including dams, road culverts and irrigation structures	$0	$0	$480,000
	Provide screening at 100% of irrigation diversions	$0	$0	$0
	Replace screens that do not meet criteria	$0	$0	$0

Table I-1: All Actions by Population, Strategy, and Category				
Population, Strategy, Category	**Action name**	**Total Cost Estimate**		
		P1 miles	**P1-2 miles**	**Projects**
TBD	Dams: Replace barriers blocking passage including dams, road culverts and irrigation structures	TBD (2)		
	Irrigation Structures: Replace barriers blocking passage including dams, road culverts and irrigation structures	TBD (2)		
3. Restore floodplain connectivity and function and maintain unimpaired connectivity and function.				
Baseline	Promote the maintenance and creation of beaver dams to restore the role in natural ecological processes.	N/A		
Cost estimate exists	Reconnect floodplains to channels	$779,528	$912,978	$0
	Reconnect side channels and off-channel habitats to stream channels	$5,846,464	$6,847,336	$0
4. Restore degraded channel structure and complexity and maintain unimpaired structure and complexity.				
Cost estimate exists	Increase role and abundance of wood and large organic debris in streambeds	$622,397	$622,397	$0
	Restore natural channel form	$5,846,464	$6,847,336	$0
	Stabilize streambanks	$9,620,850	$9,620,850	$0
5. Restore riparian condition and LWD recruitment and maintain unimpaired conditions.				
Cost estimate exists	Install fencing to exclude livestock from riparian areas	$638,230	$825,006	$0
	Install off-stream livestock watering	$438,365	$541,992	$0
	Plant riparian vegetation where appropriate	$0	$0	$0
	Restore natural riparian communities	$1,148,814	$1,485,011	$0
TBD	Eradicate invasive plant species from riparian areas	TBD (2)		
	Develop grazing strategies that promote riparian recovery	TBD (3)		
6. Restore natural hydrograph to provide sufficient flow during critical periods.				
Baseline	Implement agricultural water conservation measures	N/A		
	Implement urban conservation measures	N/A		
	Improve irrigation conveyance and efficiency	N/A		
	Monitor/regulate water withdrawals	N/A		
TBD	Finish piping Orchard Ridge and Wolf Run diversions	TBD (1)		
	Lease or purchase water rights and convert to instream	TBD (3)		

Table I-1: All Actions by Population, Strategy, and Category				
Population, Strategy, Category	**Action name**	**Total Cost Estimate**		
		P1 miles	**P1-2 miles**	**Projects**
7. Improve degraded water quality and maintain unimpaired water quality.				
Baseline	Continue TMDL monitoring	N/A		
	Implement Agricultural Water Quality Management Plan	N/A		
	Manage irrigation return flow to reduce extreme stream temperatures	N/A		
	Minimize unnatural factors that lead to fluctuations in dissolved oxygen levels	N/A		
TBD	Reduce chemical pollution inputs	TBD (1)		
8. Restore degraded upland processes to minimize unnatural rates of erosion and runoff, and maintain unimpaired natural upland processes.				
Baseline	Convert to perennial crops/vegetation	N/A		
	Develop Integrated Fruit Production (IFPnet) plans	N/A		
	Employ BMPs to minimize unnatural rates of erosion	N/A		
	Promote fuel management	N/A		
TBD	Initiate demonstration projects	TBD (1)		
	Achieve 95% conversion to no till farming	TBD (2)		
	Upgrade or remove problem forest roads	TBD (2)		
Lower John Day				
1. Protect and conserve natural ecological processes that support the viability of populations and their primary life history strategies throughout their life cycle.				
Baseline	Adopt and manage Cooperative Agreements	N/A		
	Consistently apply Best Management Practices and existing laws to protect and conserve natural ecological processes.	N/A		
	Designate additional wilderness and wild and scenic status	N/A		
	Protect access to key habitats	N/A		
	Special management designations in forest and BLM plans	N/A		
Cost estimate exists	Conduct outreach to resource users and managers	$0	$0	$176,000
TBD	Protect high quality habitats through acquisition or conservation easements	TBD (3)		
2. Restore passage and connectivity to habitats blocked or impaired by artificial barriers and maintain unimpaired passage and connectivity.				

Table I-1: All Actions by Population, Strategy, and Category				
Population, Strategy, Category	**Action name**	**Total Cost Estimate**		
		P1 miles	**P1-2 miles**	**Projects**
Cost estimate exists	Culverts: Remove or replace barriers blocking passage such as dams, road culverts and irrigation structures	$0	$0	$6,560,000
	Provide screening at 100% of irrigation diversions	$0	$0	$640,000
	Replace screens that do not meet criteria	$0	$0	$400,000
TBD	Dams: Remove or replace barriers blocking passage such as dams, road culverts and irrigation structures	TBD (2)		
	Irrigation Structures: Remove or replace barriers blocking passage such as dams, road culverts and irrigation structures	TBD (2)		
	Remove or minimize use of push up dams	TBD (2)		
3. Restore floodplain connectivity and function and maintain unimpaired connectivity and function.				
Baseline	Promote the maintenance and creation of beaver dams to restore the role in natural ecological processes.	N/A		
Cost estimate exists	Reconnect floodplains to channels	$15,839,274	$21,082,046	$0
	Reconnect side channels and off-channel habitats to stream channels	$9,583,718	$21,082,046	$0
TBD	Restore wet meadows	TBD (2)		
4. Restore degraded channel structure and complexity and maintain unimpaired structure and complexity.				
Cost estimate exists	Place stable wood and other large organic debris in streambeds	$1,102,763	$2,459,573	$0
	Restore natural channel form	$7,165,397	$21,082,046	$0
	Stabilize streambanks	$11,271,989	$21,082,046	$0
5. Restore riparian condition and LWD recruitment and maintain unimpaired conditions.				
Cost estimate exists	Restore natural riparian vegetative communities	$6,148,883	$17,121,854	$0
TBD	Develop grazing strategies that promote riparian recovery	TBD (3)		

Table I-1: All Actions by Population, Strategy, and Category

Population, Strategy, Category	Action name	Total Cost Estimate		
		P1 miles	P1-2 miles	Projects
6. Restore natural hydrograph to provide sufficient flow during critical periods.				
Baseline	Implement agricultural water conservation measures	N/A		
	Improve irrigation conveyance and efficiency	N/A		
	Monitor/regulate water withdrawals	N/A		
TBD	Lease or acquire water rights and convert to instream	TBD (3)		
7. Improve degraded water quality and maintain unimpaired water quality.				
Baseline	Apply BMPs to animal feeding operations	N/A		
	Continue TMDL monitoring	N/A		
Cost estimate exists	Increase riparian shading	$2,273,984	$4,507,195	$0
TBD	Reduce chemical pollution inputs	TBD (1)		
8. Restore degraded upland processes to minimize unnatural rates of erosion and runoff, and maintain unimpaired natural upland processes.				
Baseline	Employ BMPs to forest practices, livestock grazing, road management and agricultural practices	N/A		
TBD	Initiate demonstration projects	TBD (1)		
	Continue to promote no-till farming or other seeding techniques that reduce erosion where site conditions and technology are suitable	TBD (2)		
	Manage vegetation, including juniper removal	TBD (2)		
	Restore native upland plant communities	TBD (2)		
	Upgrade or remove problem forest roads	TBD (2)		

Table I-1: All Actions by Population, Strategy, and Category				
Population, Strategy, Category	**Action name**	**Total Cost Estimate**		
		P1 miles	**P1-2 miles**	**Projects**
Middle Fork John Day				
1. Protect and conserve natural ecological processes that support the viability of populations and their primary life history strategies throughout their life cycle.				
Baseline	Adopt and manage Cooperative Agreements	N/A		
	Consistently apply Best Management Practices and existing laws to protect and conserve natural ecological processes.	N/A		
	Designate additional wilderness and wild and scenic status	N/A		
	Protect access to key habitats	N/A		
	Special management designations in forest and BLM plans	N/A		
Cost estimate exists	Conduct outreach to resource users and managers	$0	$0	$176,000
TBD	Protect and conserve rare and unique functioning habitats	TBD (3)		
	Protect high quality habitats through acquisition or conservation easements	TBD (3)		
2. Restore passage and connectivity to habitats blocked or impaired by artificial barriers and maintain unimpaired passage and connectivity.				
Cost estimate exists	Culverts: Remove or replace barriers blocking passage such as dams, road culverts and irrigation structures	$0	$0	$18,320,000
	Replace screens that do not meet criteria	$0	$0	$560,000
TBD	Construct ladders over existing permanent concrete or earth fill dams	TBD (2)		
	Dams: Remove or replace barriers blocking passage such as dams, road culverts and irrigation structures	TBD (2)		
	Irrigation Structures: Remove or replace barriers blocking passage such as dams, road culverts and irrigation structures	TBD (2)		
	Remove or minimize use of push up dams	TBD (2)		
3. Restore floodplain connectivity and function and maintain unimpaired connectivity and function.				
Baseline	Promote the maintenance and creation of beaver dams to restore the role in natural ecological processes.	N/A		
Cost estimate exists	Reconnect floodplains to channels	$5,430,067	$6,017,350	$0
	Reconnect side channels and off-channel habitats to stream channels	$5,430,067	$6,017,350	$0

Table I-1: All Actions by Population, Strategy, and Category				
Population, Strategy, Category	**Action name**	**Total Cost Estimate**		
		P1 miles	**P1-2 miles**	**Projects**
TBD	Restore wet meadows	TBD (2)		
4. Restore degraded channel structure and complexity and maintain unimpaired structure and complexity.				
Cost estimate exists	Place stable wood and other large organic debris in streambeds and in floodplains	$316,626	$704,531	$0
	Restore natural channel form	$4,889,888	$5,665,810	$0
	Stabilize streambanks	$2,340,901	$5,477,170	$0
5. Restore riparian condition and LWD recruitment and maintain unimpaired conditions.				
Cost estimate exists	Restore natural riparian vegetative communities	$2,542,437	$5,262,030	$0
TBD	Develop grazing strategies that promote riparian recovery	TBD (3)		
6. Restore natural hydrograph to provide sufficient flow during critical periods.				
Baseline	Implement agricultural water conservation measures	N/A		
	Improve irrigation conveyance and efficiency	N/A		
	Increase pool habitat (beaver ponds)	N/A		
	Monitor/regulate water withdrawals	N/A		
TBD	Lease or acquire water rights and convert to instream	TBD (3)		
7. Improve degraded water quality and maintain unimpaired water quality.				
Baseline	Apply BMPs to animal feeding operations	N/A		
	Continue TMDL monitoring	N/A		
	Manage return flow to reduce extreme stream temperatures	N/A		
Cost estimate exists	Increase riparian shading	$891,400	$1,489,614	$0
TBD	Reduce chemical pollution and nutrient inputs	TBD (1)		
8. Restore degraded upland processes to minimize unnatural rates of erosion and runoff, and maintain unimpaired natural upland processes.				
Baseline	Employ BMPs to forest practices, livestock grazing, road management and agricultural practices	N/A		
Cost estimate exists	Upgrade or remove problem forest roads	$1,060,800	$1,060,800	$0

Table I-1: All Actions by Population, Strategy, and Category				
Population, Strategy, Category	**Action name**	**Total Cost Estimate**		
		P1 miles	**P1-2 miles**	**Projects**
TBD	Initiate demonstration projects	TBD (1)		
	Manage vegetation, including juniper removal	TBD (2)		
	Restore native upland plant communities	TBD (2)		
North Fork John Day				
1. Protect and conserve natural ecological processes that support the viability of populations and their primary life history strategies throughout their life cycle.				
Baseline	Adopt and manage Cooperative Agreements	N/A		
	Consistently apply Best Management Practices and existing laws to protect and conserve natural ecological processes.	N/A		
	Designate additional wilderness and wild and scenic status	N/A		
	Protect access to key habitats	N/A		
	Special management designations in forest and BLM plans	N/A		
Cost estimate exists	Conduct outreach to resource users and managers	$0	$0	$176,000
TBD	Protect high quality habitats through acquisition or conservation easements	TBD (3)		
2. Restore passage and connectivity to habitats blocked or impaired by artificial barriers and maintain unimpaired passage and connectivity.				
Cost estimate exists	Culverts: Remove or replace barriers blocking passage such as dams, road culverts and irrigation structures	$0	$0	$16,000,000
	Provide screening at 100% of irrigation diversions	$0	$0	$120,000
TBD	Construct ladders over existing permanent concrete or earth fill dams, or remove the barrier	TBD (2)		
	Dams: Remove or replace barriers blocking passage such as dams, road culverts and irrigation structures	TBD (2)		
	Irrigation Structures: Remove or replace barriers blocking passage such as dams, road culverts and irrigation structures	TBD (2)		
	Remove or minimize use of push up dams	TBD (2)		

Table I-1: All Actions by Population, Strategy, and Category				
Population, Strategy, Category	**Action name**	**Total Cost Estimate**		
		P1 miles	**P1-2 miles**	**Projects**
3. Restore floodplain connectivity and function and maintain unimpaired connectivity and function.				
Baseline	Promote the maintenance and creation of beaver dams to restore the role in natural ecological processes.	N/A		
Cost estimate exists	Reconnect floodplains to channels	$2,104,989	$3,364,150	$0
	Reconnect side channels and off-channel habitats to stream channels and reconnect surface flow/restore fish passage in tributaries.	$2,237,203	$3,364,150	$0
TBD	Restore wet meadows	TBD (2)		
4. Restore degraded channel structure and complexity and maintain unimpaired structure and complexity.				
Cost estimate exists	Place stable wood and other large organic debris in streambeds and in floodplains	$504,664	$1,157,562	$0
	Restore natural channel form	$2,082,064	$3,364,150	$0
	Stabilize streambanks	$775,710	$1,766,690	$0
5. Restore riparian condition and LWD recruitment and maintain unimpaired conditions.				
Cost estimate exists	Restore natural riparian vegetative communities	$2,108,218	$3,116,517	$0
TBD	Develop grazing strategies that promote riparian recovery	TBD (3)		
6. Restore natural hydrograph to provide sufficient flow during critical periods.				
Baseline	Implement agricultural water conservation measures	N/A		
	Improve irrigation conveyance and efficiency	N/A		
	Increase pool habitat (beaver ponds)	N/A		
	Monitor/regulate water withdrawals	N/A		
TBD	Lease or acquire water rights and convert to instream	TBD (3)		
7. Improve degraded water quality and maintain unimpaired water quality.				
Baseline	Apply BMPs to animal feeding operations	N/A		
	Continue TMDL monitoring	N/A		
	Manage return flow to reduce extreme stream temperatures	N/A		
Cost estimate exists	Increase riparian shading	$679,021	$1,704,357	$0

Table I-1: All Actions by Population, Strategy, and Category				
Population, Strategy, Category	**Action name**	**Total Cost Estimate**		
		P1 miles	**P1-2 miles**	**Projects**
TBD	Address contamination from mine related discharge	TBD (1)		
	Reduce chemical pollution inputs	TBD (1)		
8. Restore degraded upland processes to minimize unnatural rates of erosion and runoff, and maintain unimpaired natural upland processes.				
Baseline	Employ BMPs to forest practices, livestock grazing, road management and agricultural practices	N/A		
Cost estimate exists	Upgrade or remove problem forest roads	$707,200	$707,200	$0
TBD	Initiate demonstration projects	TBD (1)		
	Manage vegetation, including juniper removal	TBD (2)		
	Restore native upland plant communities	TBD (2)		
South Fork John Day				
1. Protect and conserve natural ecological processes that support the viability of populations and their primary life history strategies throughout their life cycle.				
Baseline	Adopt and manage Cooperative Agreements	N/A		
	Consistently apply Best Management Practices and existing laws to protect and conserve natural ecological processes.	N/A		
	Designate additional wilderness and wild and scenic status	N/A		
	Protect access to key habitats	N/A		
	Special management designations in forest and BLM plans	N/A		
Cost estimate exists	Conduct outreach to resource users and managers	$0	$0	$176,000
TBD	Protect high quality habitats through acquisition or conservation easements	TBD (3)		
2. Restore passage and connectivity to habitats blocked or impaired by artificial barriers and maintain unimpaired passage and connectivity.				
Cost estimate exists	Culverts: Remove or replace barriers blocking passage such as dams, road culverts and irrigation structures	$0	$0	$5,520,000
	Provide screening at 100% of irrigation diversions	$0	$0	$0
	Replace screens that do not meet criteria	$0	$0	$160,000

Table I-1: All Actions by Population, Strategy, and Category				
Population, Strategy, Category	**Action name**	**Total Cost Estimate**		
		P1 miles	**P1-2 miles**	**Projects**
TBD	Construct ladders over existing permanent concrete or earth fill dams	TBD (2)		
	Dams: Remove or replace barriers blocking passage such as dams, road culverts and irrigation structures	TBD (2)		
	Irrigation Structures: Remove or replace barriers blocking passage such as dams, road culverts and irrigation structures	TBD (2)		
	Remove or minimize use of push up dams	TBD (2)		
3. Restore floodplain connectivity and function and maintain unimpaired connectivity and function.				
Baseline	Promote the maintenance and creation of beaver dams to restore the role in natural ecological processes.	N/A		
Cost estimate exists	Reconnect floodplains to channels	$0	$275,830	$0
	Reconnect side channels and off-channel habitats to stream channels	$0	$275,830	$0
TBD	Restore wet meadows	TBD (2)		
4. Restore degraded channel structure and complexity and maintain unimpaired structure and complexity.				
Cost estimate exists	Place stable wood and other large organic debris in streambeds and in floodplains	$205,523	$205,523	$0
	Restore natural channel form	$0	$275,830	$0
	Stabilize streambanks	$0	$0	$0
5. Restore riparian condition and LWD recruitment and maintain unimpaired conditions.				
Cost estimate exists	Restore natural riparian vegetative communities	$926,317	$1,234,920	$0
TBD	Develop grazing strategies that promote riparian recovery	TBD (3)		
6. Restore natural hydrograph to provide sufficient flow during critical periods.				
Baseline	Implement agricultural water conservation measures	N/A		
	Improve irrigation conveyance and efficiency	N/A		
	Increase pool habitat (beaver ponds)	N/A		
	Monitor/regulate water withdrawals	N/A		
TBD	Lease or acquire water rights and convert to instream	TBD (3)		

Table I-1: All Actions by Population, Strategy, and Category

Population, Strategy, Category	Action name	Total Cost Estimate		
		P1 miles	P1-2 miles	Projects
7. Improve degraded water quality and maintain unimpaired water quality.				
Baseline	Apply BMPs to animal feeding operations	N/A		
	Continue TMDL monitoring	N/A		
	Manage return flow to reduce extreme stream temperatures	N/A		
Cost estimate exists	Increase riparian shading	$94,026	$532,170	$0
TBD	Reduce chemical pollution and nutrient inputs	TBD (1)		
8. Restore degraded upland processes to minimize unnatural rates of erosion and runoff, and maintain unimpaired natural upland processes.				
Baseline	Employ BMPs to forest practices, livestock grazing, road management and agricultural practices	N/A		
TBD	Initiate demonstration projects	TBD (1)		
	Manage vegetation, including juniper removal	TBD (2)		
	Restore native upland plant communities	TBD (2)		
	Upgrade or remove problem forest roads	TBD (2)		
Umatilla				
1. Protect and conserve natural ecological processes that support the viability of populations and their primary life history strategies throughout their life cycle.				
Baseline	Consistently apply Best Management Practices and existing laws to protect and conserve natural ecological processes.	N/A		
	Continue existing protections and/or increase protection of Federal lands; implement Forest Practices Act and PACFISH/INFISH	N/A		
	Establish setbacks to protect waterways from forest management, agricultural activities, and other land use practices that would disrupt ecosystem function	N/A		
	Explore opportunities to incorporate priority areas into state legislation.	N/A		
	Incorporate priority habitat areas into the Natural Area Overlay Zone provision of the Umatilla County Development Ordinance	N/A		
	Review, modify and enforce existing land use planning documents and ordinances pertaining to riparian and floodplain management to better address habitat and water quality issues.	N/A		

Table I-1: All Actions by Population, Strategy, and Category

Population, Strategy, Category	Action name	Total Cost Estimate P1 miles	P1-2 miles	Projects
Cost estimate exists	Conduct outreach to resource users and managers	$0	$0	$176,000
TBD	Protect high quality habitats through acquisition, conservation easements and cooperative agreements	TBD (3)		
2. Restore passage and connectivity to habitats blocked or impaired by artificial barriers and maintain unimpaired passage and connectivity.				
Baseline	Operate and Maintain fish passage facilities to meet criteria	N/A		
Cost estimate exists	Construct ladders over existing permanent concrete or earth fill dams	$0	$0	$1,600,000
	Culverts: Remove or replace barriers blocking passage such as dams, road culverts and irrigation structures	$0	$0	$800,000
	Irrigation Structures: Remove or replace barriers blocking passage such as dams, road culverts and irrigation structures	$0	$0	$2,880,000
	Provide screening at 100% of irrigation diversions	$0	$0	$0
	Replace screens that do not meet criteria	$0	$0	$0
TBD	Dams: Remove or replace barriers blocking passage such as dams, road culverts and irrigation structures	TBD (2)		
3. Restore floodplain connectivity and function and maintain unimpaired connectivity and function.				
Cost estimate exists	Reconnect floodplains to channels	$5,595,674	$5,595,674	$0
	Reconnect side channels and off-channel habitats to stream channels	$5,595,674	$5,595,674	$0
TBD	Remove dikes and levies	TBD (2)		
4. Restore degraded channel structure and complexity and maintain unimpaired structure and complexity.				
Cost estimate exists	Place stable wood and other large organic debris in streambeds	$1,067,592	$1,067,592	$0
	Restore natural channel form	$4,966,422	$6,089,248	$0
	Stabilize and protect streambanks	$5,019,445	$5,019,445	$0
TBD	Construct rock and log weirs to create pool habitats or elevate incised channels	TBD (2)		

Table I-1: All Actions by Population, Strategy, and Category				
Population, Strategy, Category	**Action name**	**Total Cost Estimate**		
		P1 miles	**P1-2 miles**	**Projects**
5. Restore riparian condition and LWD recruitment and maintain unimpaired conditions.				
Baseline	Maintain existing widths of RHCAs on USFS lands.	N/A		
Cost estimate exists	Develop no-cultivation riparian buffer on agricultural lands and establish riparian setbacks for structures in areas where activities could upset riparian function	$263,339	$263,339	$0
	Restore natural riparian vegetative communities	$3,701,598	$3,701,598	$0
	Riparian exclosure fencing	$1,890,197	$1,890,197	$0
TBD	Close, remove, and restore riparian road prisms	TBD (2)		
	Develop grazing strategies that promote riparian recovery	TBD (3)		
6. Restore natural hydrograph to provide sufficient flow during critical periods.				
Baseline	Implement agricultural water conservation measures	N/A		
	Monitor/regulate water withdrawals	N/A		
TBD	Implement Umatilla Basin Project Phase I and II	TBD (1)		
	Implement Umatilla Basin Project Phase III	TBD (3)		
	Downstream water rights transfers	TBD (3)		
	File for additional ISWRs	TBD (3)		
	Lease or acquire water rights and convert to instream	TBD (3)		
7. Improve degraded water quality and maintain unimpaired water quality.				
Baseline	Implement water quality management plans	N/A		
TBD	Address point sources of water pollution	TBD (1)		
8. Restore degraded upland processes to minimize unnatural rates of erosion and runoff, and maintain unimpaired natural upland processes.				
Baseline	Employ BMPs to forest practices, livestock grazing, road management and agricultural practices	N/A		
TBD	Restore native upland plant communities	TBD (2)		
	Initiate demonstration projects	TBD (1)		
	Upgrade or remove problem forest roads	TBD (2)		

Table I-1: All Actions by Population, Strategy, and Category

Population, Strategy, Category	**Action name**	**Total Cost Estimate**		
		P1 miles	**P1-2 miles**	**Projects**
Upper John Day				
1. Protect and conserve natural ecological processes that support the viability of populations and their primary life history strategies throughout their life cycle.				
Baseline	Adopt and manage Cooperative Agreements	N/A		
	Consistently apply Best Management Practices and existing laws to protect and conserve natural ecological processes.	N/A		
	Designate additional wilderness and wild and scenic status	N/A		
	Protect access to key habitats	N/A		
	Special management designations in forest and BLM plans	N/A		
Cost estimate exists	Conduct outreach to resource users and managers	$0	$0	$176,000
TBD	Protect high quality habitats through acquisition or conservation easements	TBD (3		
2. Restore passage and connectivity to habitats blocked or impaired by artificial barriers and maintain unimpaired passage and connectivity.				
Cost estimate exists	Culverts: Remove or replace barriers blocking passage such as dams, road culverts and irrigation structures	$0	$0	$8,800,000
	Provide screening at 100% of irrigation diversions	$0	$0	$1,560,000
	Replace screens that do not meet criteria	$0	$0	$1,880,000
TBD	Construct ladders over existing permanent concrete or earth fill dams	TBD (2)		
	Dams: Remove or replace barriers blocking passage such as dams, road culverts and irrigation structures	TBD (2)		
	Irrigation Structures: Remove or replace barriers blocking passage such as dams, road culverts and irrigation structures	TBD (2)		
	Remove or minimize use of push up dams	TBD (2)		
3. Restore floodplain connectivity and function and maintain unimpaired connectivity and function.				
Baseline	Promote the maintenance and creation of beaver dams to restore the role in natural ecological processes.	N/A		
Cost estimate exists	Reconnect floodplains to channels	$4,459,760	$4,459,760	$0
	Reconnect side channels and off-channel habitats to stream channels	$6,132,419	$7,431,558	$0

Table I-1: All Actions by Population, Strategy, and Category				
Population, Strategy, Category	**Action name**	**Total Cost Estimate**		
		P1 miles	**P1-2 miles**	**Projects**
TBD	Restore wet meadows	TBD (2)		
4. Restore degraded channel structure and complexity and maintain unimpaired structure and complexity.				
Cost estimate exists	Place stable wood and other large organic debris in streambeds	$357,072	$1,082,350	$0
	Restore natural channel form	$7,520,379	$9,277,286	$0
	Stabilize streambanks	$4,459,760	$5,496,088	$0
5. Restore riparian condition and LWD recruitment and maintain unimpaired conditions.				
Cost estimate exists	Restore natural riparian vegetative communities	$2,337,970	$5,731,272	$0
TBD	Develop grazing strategies that promote riparian recovery	TBD (3)		
6. Restore natural hydrograph to provide sufficient flow during critical periods.				
Baseline	Implement agricultural water conservation measures	N/A		
	Improve irrigation conveyance and efficiency	N/A		
	Increase pool habitat (beaver ponds)	N/A		
	Monitor/regulate water withdrawals	N/A		
TBD	Lease or acquire water rights and convert to instream	TBD (3)		
7. Improve degraded water quality and maintain unimpaired water quality.				
Baseline	Apply BMPs to animal feeding operations	N/A		
	Continue TMDL monitoring	N/A		
	Manage return flow to reduce extreme stream temperatures	N/A		
Cost estimate exists	Increase riparian shading	$1,787,741	$2,324,475	$0
TBD	Reduce chemical pollution and nutrient inputs	TBD (1)		
8. Restore degraded upland processes to minimize unnatural rates of erosion and runoff, and maintain unimpaired natural upland processes.				
Baseline	Employ BMPs to forest practices, livestock grazing, road management and agricultural practices	N/A		
Cost estimate exists	Upgrade or remove problem forest roads	$104,000	$104,000	$0

Table I-1: All Actions by Population, Strategy, and Category

Population, Strategy, Category	Action name	Total Cost Estimate P1 miles	Total Cost Estimate P1-2 miles	Total Cost Estimate Projects
TBD	Initiate demonstration projects	TBD (1)		
	Manage vegetation, including juniper removal	TBD (2)		
	Restore native upland plant communities	TBD (2)		
Walla Walla				
1. Protect and conserve natural ecological processes that support the viability of populations and their primary life history strategies throughout their life cycle.				
Baseline	Consistently apply Best Management Practices and existing laws to protect and conserve natural ecological processes.	N/A		
	Continue existing protections and/or increase protection of Federal lands; implement Forest Practices Act and PACFISH/INFISH	N/A		
	Establish setbacks to protect waterways from forest management, agricultural activities, and other land use practices that would disrupt ecosystem function	N/A		
	Explore opportunities to incorporate priority areas into state legislation.	N/A		
	Incorporate priority habitat areas into the Natural Area Overlay Zone provision of the Umatilla County Development Ordinance	N/A		
	Review, modify and enforce existing land use planning documents and ordinances pertaining to riparian and floodplain management to better address habitat and water quality issues.	N/A		
Cost estimate exists	Conduct outreach to resource users and managers	$0	$0	$176,000
TBD	Protect and conserve rare and unique functioning habitats	TBD (3)		
	Protect high quality habitats through acquisition, conservation easements and cooperative agreements	TBD (3)		
2. Restore passage and connectivity to habitats blocked or impaired by artificial barriers and maintain unimpaired passage and connectivity.				
Baseline	Operate and Maintain fish passage facilities	N/A		

Table I-1: All Actions by Population, Strategy, and Category				
Population, Strategy, Category	**Action name**	**Total Cost Estimate**		
		P1 miles	**P1-2 miles**	**Projects**
Cost estimate exists	Construct ladders over existing permanent irrigation diversions	$0	$0	$1,760,000
	Culverts: Remove or replace barriers blocking passage such as dams, bridges, road culverts and irrigation structures	$0	$0	$1,760,000
	Irrigation Structures: Remove or replace barriers blocking passage such as dams, bridges, road culverts and irrigation structures	$0	$0	$0
	Provide screening at 100% of irrigation diversions	$0	$0	$0
	Replace screens that do not meet criteria	$0	$0	$0
TBD	Dams: Remove or replace barriers blocking passage such as dams, bridges, road culverts and irrigation structures	TBD (2)		
3. Restore floodplain connectivity and function and maintain unimpaired connectivity and function.				
Baseline	Promote the maintenance and creation of beaver dams to restore the role in natural ecological processes.	N/A		
Cost estimate exists	Reconnect floodplains to channels	$1,969,200	$2,589,120	$0
	Reconnect side channels and off-channel habitats to stream channels	$1,969,200	$7,197,120	$0
TBD	Remove dikes and levies	TBD (2)		
4. Restore degraded channel structure and complexity and maintain unimpaired structure and complexity.				
Baseline	Implement bridge maintenance BMPs	N/A		
Cost estimate exists	Place stable wood and other large organic debris in streambeds	$302,064	$302,064	$0
	Restore natural channel form	$2,589,120	$7,197,120	$0
	Stabilize and protect streambanks	$2,589,120	$7,197,120	$0
TBD	Construct rock and log weirs to create pool habitats or elevate incised channels	TBD (2)		
5. Restore riparian condition and LWD recruitment and maintain unimpaired conditions.				
Cost estimate exists	Develop no-cultivation riparian buffer on agricultural lands and establish riparian setbacks for structures in areas where activities could upset riparian function	$129,456	$359,856	$0
	Restore natural riparian vegetative communities	$1,035,648	$2,878,848	$0
	Riparian exclosure fencing	$575,360	$1,599,360	$0

Table I-1: All Actions by Population, Strategy, and Category				
Population, Strategy, Category	**Action name**	**Total Cost Estimate**		
		P1 miles	**P1-2 miles**	**Projects**
TBD	Close, remove, and restore riparian road prisms	TBD (2)		
	Develop grazing strategies that promote riparian recovery	TBD (3)		
	Protect high quality riparian habitats and unstable areas	TBD (3)		
6. Restore natural hydrograph to provide sufficient flow during critical periods.				
Baseline	Close areas to appropriation of new water uses	N/A		
	Improve irrigation conveyance and efficiency	N/A		
	Investigate feasibility of water storage or exchange to improve instream flows for steelhead	N/A		
	Monitor/regulate water withdrawals	N/A		
	Set criteria to protect flows for fish habitat from new appropriations	N/A		
TBD	Aquifer storage and recovery	TBD (1)		
	Enhance hyporheic flows and spring inputs	TBD (1)		
	Implement shallow aquifer recharge	TBD (1)		
	Downstream water rights transfers	TBD (3)		
	File for additional ISWRs	TBD (3)		
	Lease or acquire water rights and convert to instream	TBD (3)		
7. Improve degraded water quality and maintain unimpaired water quality.				
Baseline	Implement pest management plans for fruit growers	N/A		
	Implement water quality management plans	N/A		
	Improve municipal stormwater management and treatment	N/A		
	Permit and enforce actions that could affect water quality	N/A		
	Permit waterway alteration activities and enforce rules	N/A		
TBD	Address point sources of water pollution	TBD (1)		

Table I-1: All Actions by Population, Strategy, and Category				
Population, Strategy, Category	**Action name**	**Total Cost Estimate**		
		P1 miles	**P1-2 miles**	**Projects**
8. Restore degraded upland processes to minimize unnatural rates of erosion and runoff, and maintain unimpaired natural upland processes.				
Baseline	Apply BMPs to forest practices, livestock grazing, road management and agricultural practices	N/A		
TBD	Implement CREP and CCRP buffers	TBD (3)		
	Initiate demonstration projects	TBD (1)		
	Restore native upland plant communities	TBD (2)		
	Upgrade or remove problem forest roads	TBD (2)		

Table I-2
Current Average Expenditures on Habitat Projects for Mid-Columbia River Steelhead

Agency or Organization	Program	Recent average annual expenditures or budget	Expected next five year expenditures	Comments
Fifteenmile Creek Population				
CTWSRO	CREP	$10,000/yr	$50,000	
	Fifteenmile habitat program		100,000	Coordinate LWD, riparian exclosures, riparian plantings
Wasco Co. SWCD	Riparian buffers	$103,000/yr	$500,000	Funds are for technical work. USDA Farm Services Agency and OWEB leveraging technical dollars under CREP program.
	No-till conversion	$40,000/yr	$100,000	Nearing saturation/completion
	Irrigation efficiency	$30,000/yr	150,000	
	Fish habitat	$125,000/yr	$250,000	eliminate passage barriers, add rootwads, jhooks, eliminate fords
USFS	Fish habitat – Fifteenmile Cr	$25,000/yr		Partner in project
ODFW	Fish Habitat- Fifteenmile Cr	$322,662/yr	$1,600,000	Riparian exclosures, off channel water, instream habitat, M&E
	Fish Screening	$200,000/yr	$800,000	New construction and O&M
Totals - **Fifteenmile Creek Population**		$855,662/yr	$3,550,000	
Eastside Deschutes River Population				
USFS	Fish habitat - Trout Cr	$30,000/yr	$150,000	Partner in project
	Culvert Replacements	$75,000/yr	$500,000	
	Trout Creek (2)			
	Dick Creek			
Sherman County SWCD	CREP	$300,000/yr	$1,250,000	Depends on program availability, Includes rental payments, installed practices, maintenance, etc.
	Habitat	$20,000/yr	$100,000	Passive restoration projects, i.e. off-stream water, tree planting
	Upland	$155,000/yr	$775,000	Erosion control structures, pasture fencing, brush control, range reseeding, etc.

Table I-2
Current Average Expenditures on Habitat Projects for Mid-Columbia River Steelhead

Agency or Organization	Program	Recent average annual expenditures or budget	Expected next five year expenditures	Comments
Jefferson SWCD	Trout Creek Watershed Improvement and CREP – Fish Habitat	$395,000/yr		Phase 3 Trout Creek Channel Habitat Improvement Project – Channel Reconstruction Project
	Trout Creek Watershed Improvement & CREP– Fish Habitat		$650,000	Antelope Creek Channel Habitat Improvement Project & CREP – 2 miles
	IWM		$500,000	Irrigation Improvement Projects
Deschutes River Conservancy	Instream habitat restoration	$15,000/yr	$75,000	
PGE	Fish habitat – Trout Cr Ranch	$75,000/yr	$950,000	PGE-managed project
	Fish habitat – Trout Cr	$300,000 in 2006	$600,000	Funding of projects. PGE spent $300,000 funding 3 projects in 2006.
Wasco Co. SWCD	Riparian buffers	$40,000/yr	$200,000	Funds are for technical work. USDA Farm Services Agency and OWEB are leveraging the technical dollars under the CREP program.
	Upland conservation	$120,000/yr	$400,000	
ODFW	Fish habitat – Trout Creek	$335,000/yr	$1,750,000	Riparian exclosures, off channel water developments, berm removal/channel reconstruction work.
	Fish screening and passage- Trout Creek	$100,000/yr	$500,000	New construction and O&M
BLM	Upland and riparian weed treatment	$36,000/yr	$180,000	
	Stream and riparian restoration	$29,000/yr	$150,000	Includes maintenance work on existing projects
Totals - **Eastside Deschutes River Population**		$2,025,000/yr	$8,730,000	
Westside Deschutes River Population				
USFS	Fish habitat - Whychus Cr	$30,000/yr	$150,000	Partner in project
	Fish habitat – Metolius R	$25,000/yr	$150,000	Partner in project

Table I-2
Current Average Expenditures on Habitat Projects for Mid-Columbia River Steelhead

Agency or Organization	Program	Recent average annual expenditures or budget	Expected next five year expenditures	Comments
	Culvert Replacements in Metolius River Watershed	$100,000/yr	$150,000	Lake Creek, Roaring Creek and Bear Valley Creek
CTWSRO	Reservation Watershed maintenance (Shitike, Warm Springs rivers)	$46,000/yr	$750,000	Implementing and maintaining riparian exclosures, solar jacks, off channel water sources.
	Fish habitat (Beaver Creek, Whychus, Mill, Shitike, Coyote, Quartz, Metolius, lower Deschutes river)	$32,000/yr	$250,000	Large channel reconstruction, lwd, gabion and berm removals, riparian plantings
	Passage improvements road decommissioning	$120,000/yr	$600,000	Replacing or removing culverts for improved passage and capacity
Deschutes River Conservancy	Instream Leasing	$30,000/yr	$150,000	Whychus Creek
	Water Rights Acquisitions	$200,000/yr	$1,000,000	Whychus Creek
	Water Conservation	$900,000/yr	$4,500,000	Whychus Creek
Upper Deschutes Watershed Council	Fish habitat / stream restoration / riparian restoration (private land)	$275,000/yr	$3,250,000	Major projects scheduled on Whychus Creek (4 miles), Lake Creek, and Metolius River
	Screening / passage at diversions	$0/yr	$875,000	Major diversion retrofit projects scheduled.
	Culvert upgrades	$0/yr	$125,000	Several small improvement projects scheduled.

Table I-2
Current Average Expenditures on Habitat Projects for Mid-Columbia River Steelhead

Agency or Organization	Program	Recent average annual expenditures or budget	Expected next five year expenditures	Comments
PGE	Fish habitat – Whychus Cr	$18,000 – 2006		
	Fish habitat – Metolius R			
	Fish habitat – Lower Deschutes	$120,000 – 2006		
Wasco So. SWCD	Riparian buffers	$15,000/yr	$75,000	Funds are for technical work. USDA Farm Services Agency and OWEB are leveraging the technical dollars under the CREP program.
	Upland conservation (includes irrig. efficiency)	$50,000/yr	$250,000	
ODFW	Fish habitat – planning, coordination, M&E	$15,000/yr	$75,000	Whychus Creek and Metolius River
BLM	Upland and riparian weed treatment	$9,000/yr	$45,000	
	Stream and riparian restoration	$29,000/yr	$150,000	Includes maintenance work on existing projects
Totals - **Westside Deschutes River Population**		$2,014,000/yr	$12,545,000	
Crooked River Population (reintroduction area)				
PGE	Fish habitat – Crooked R	$150,000 in 2006		Funding of projects, including McKay Cr
Deschutes River Conservancy	Instream leasing	$40,000/yr	$200,000	
	Water rights acquisitions	$400,000/yr	$2,000,000	
	Water conservation	$1,000,000/yr	$5,000,000	
Crooked River Watershed Council	Passage and screening		$2,700,000	Lower Crooked River and McKay Creek
	Fish habitat – Crooked River & McKay Creek		$1,400,000	Habitat enhancement – Prineville Valley and Private Lands (McKay Cr)
USFS	Fish habitat – McKay Creek drainage	$50,000/yr	$120,000	McKay and Little McKay fish habitat improvements

Table I-2
Current Average Expenditures on Habitat Projects for Mid-Columbia River Steelhead

Agency or Organization	Program	Recent average annual expenditures or budget	Expected next five year expenditures	Comments
	Culvert Replacements	$100,000/yr	$375,000	Improvements in passage in the Little McKay and McKay Creeks and tribs.
ODFW	Fish screening and Passage	$200,000/yr	$1,000,000	New construction and O&M
	Fish habitat – planning, coordination, M&E	$15,000/yr	$75,000	
BLM	Upland and riparian weed treatment	$27,000/yr	$110,000	
	Stream and riparian restoration	$22,000/yr	$110,000	Includes maintenance work on existing projects
	Fish Passage		$155,500	Stearns Dam Removal
Totals - **Crooked River Population (reintroduction area)**		$2,004,000/yr	$13,245,500	
Lower John Day River Population (below Dayville)				
Gillian County SWCD	habitat	$33,000/yr	$165,000	OWEB
	Rock Creek project	$28,000/yr		One year
	Weed control	$30,000/yr	$120,000	From Oregon Weed Board
ODFW	Fish Habitat - Lower	$100,000/yr	$500,000	(BPA funded @ $540,000 in 2007 and $440,000 for 2008-2009). The budget is spread out depending on projects within the John Day Subbasin.
	Fish screening and Passage	$450,000/yr	$2,250,000	New construction and O&M – John Day screen shop
Sherman County SWCD	CREP	$400,000/yr	$2,000,000	Depends on program availability, Includes rental payments, installed practices, maintenance, etc.
	Habitat	$30,000/yr	$150,000	Passive restoration projects, i.e. off-stream water, tree planting, and 1 possible channel project
	Upland	$185,000/yr	$925,000	Erosion control structures, pasture fencing, brush control, range reseeding, etc.
CTWSRO	Pine Creek Conservation area	$210,000/yr	$1,750,000	Invasive weed control, CREP implementation, prescribed fire, juniper control
	John Day watershed restoration program	$42,000/yr	$325,000	Riparian plantings, juniper control, off channel water developments.

Table I-2
Current Average Expenditures on Habitat Projects for Mid-Columbia River Steelhead

Agency or Organization	Program	Recent average annual expenditures or budget	Expected next five year expenditures	Comments
	John Day watershed restoration program	$294,532/yr	$1,500,000	Pushup dam removals, Point of diversion consolidation, return flow coolers,
USFS	Fish Habitat – Rock Creek	$30,000/yr		
	Various projects		$100,000	Ochoco NF
	Culvert Replacements – Various tribs		$375,000	Ochoco NF
Wasco Co. SWCD	Riparian buffers	$15,000/yr	$75,000	Funds are for technical work. USDA Farm Services Agency and OWEB are leveraging the technical dollars under the CREP program.
Wheeler County SWCD	Passage – diversion projects, culverts, bridge	$485,000/yr	$2,425,000	Replacement of push-up dams and other barriers, culvert replacement, fish ladder, screen, Service Creek bridge
	Irrigation efficiency	$390,000/yr	$1,450,000	Converting open ditch to pipelines
	uplands	$99,300/yr	$500,000	Upland development, juniper removal and abatement, spring development
BLM	Upland and riparian weed treatment	$54,000/yr	270,000	
	Stream and riparian restoration	$43,000/yr	$215,000	Includes maintenance work on existing projects
Totals - **Lower John Day River Population (below Dayville)**		$2,918,832/yr	$15,095,000	
North Fork John Day Population				
CTUIR	Fish habitat	$321,000/yr	$1,600,000	(BPA - $249,000; NRCS - $50,000; PCSRF - $22,000)
ODFW	Fish habitat – North Fork drainage	$200,000/yr	$500,000	(BPA funded @ $540,000 in 2007 and $440,000 for 2008-2009). The budget is spread out depending on projects within the John Day Subbasin.
	Fish screening and Passage	$300,000/yr	$1,500,000	New construction and O&M – John Day screen shop
CTWSRO	John Day watershed restoration program	$136000/yr	0	Pushup dam removals/ replacements
Grant SWCD	Fish Habitat – mine tailings, shaping for	$192,000/yr	$960,000	OWEB, Umatilla NF, CTUIT, USFW Service Partners and Acid Spill

Table I-2
Current Average Expenditures on Habitat Projects for Mid-Columbia River Steelhead

Agency or Organization	**Program**	**Recent average annual expenditures or budget**	**Expected next five year expenditures**	**Comments**
	Flood Plain, reconnection & habitat diversity – Clear Creek			
North Fork John Day Watershed Council	Fish Habitat	$14,500/yr	$650,000	Levee Removal (future projects include push-up dam removals)
	Uplands	$40,000/yr	$350,000	(off stream watering, spring developments, juniper removal)
	Weed Treatment	$15,000/yr	$125,000	(cost share program and development of a CWMA)
USFS	Culverts and bridge fish passage improvements	$50,000/yr	$150,000	Umatilla and Wallowa-Whitman NFs
	Riparian planting	$10,000/yr	$25000	Partner projects-Umatilla NF
	Road decommissioning-and obliterations	$30,000/yr	$250,000	fire and watershed restoration-Umatilla NF
	Abandoned dredge tailings, redistribution/floodplain restoration	$70,000/yr	$25,000	Umatilla NF/Granite Creek watershed/partner w/Grant SWCD and CTUIR
	Floodplain restoration/wood and revegetation	$0/yr	$25,000	Umatilla NF Partner projects w/ Grant SWCD
	Road maintenance	$30,000/yr	$150,000	Erosion reduction-Umatilla NF
	Instream habitat improvement		$25,000	Partner project w/CTUIR
	Dredge tailing/fish passage restoration	$0/yr	$50,000	Wallowa-Whitman NF/Granite Creek watershed
	Upland revegetation		$400,000	Fire rehab-Umatilla NF
BLM	Upland and riparian weed treatment	$9,000/yr	$45,000	
	Stream and riparian restoration	$7,000/yr	$175,000	Includes maintenance work on existing projects
Totals - **North Fork John Day Population**		$1,424,500/yr	$7,005,000	

Table I-2
Current Average Expenditures on Habitat Projects for Mid-Columbia River Steelhead

Agency or Organization	Program	Recent average annual expenditures or budget	Expected next five year expenditures	Comments
Middle Fork John Day Population				
ODFW	Fish Habitat - Middle	$100,000/yr	$500,000	(BPA funded @ $540,000 in 2007 and $440,000 for 2008-2009). The budget is spread out depending on projects within the John Day Subbasin.
	Fish screening and Passage	$300,000/yr	$1,500,000	New construction and O&M – John Day screen shop
CTWSRO	Oxbow Conservation area	$139,000/yr	$1,750,000	Invasive weed program, in-channel habitat improvements, CREP
	Forrest Conservation area	$146,000/yr	$367,000	Invasive weed program, in-channel habitat improvements, CREP
	John Day watershed restoration program	$42,000/yr	$330,000	Riparian plantings, juniper control, off channel water developments.
Grant SWCD	Fish passage – irrigation diversions MF and tributaries	$243,835/yr	$1,250,000	BPA, BOR
North Fork John Day Watershed Council	Fish Habitat		$300,000	Culvert replacement
	Uplands	$20,000/yr	$150,000	Off stream watering, juniper removal
	Weed Treatment	$7,000/yr	$50,000	(cost share and development of a CWMA)

Table I-2
Current Average Expenditures on Habitat Projects for Mid-Columbia River Steelhead

Agency or Organization	Program	Recent average annual expenditures or budget	Expected next five year expenditures	Comments
The Nature Conservancy	Fish habitat		$375,000	
USFS	Riparian planting/revegetation	$10,000/yr	0/yr	Fire rehab.-Umatilla NF
	Noxious weed control	$20,000/yr	$50,000	Umatilla NF
USFS	Riparian revegetation	$28,000/yr	$25,000	Culvert replacement sites-Malheur NF
	Noxious weed control	$50,000/yr	$250,000	Malheur NF
Totals - **Middle Fork John Day Population**		$1,105,835/yr	$6,897,000	
South Fork John Day Population				
ODFW – 2007-Fish Habitat	Fish Habitat - Middle	$30,000/yr	$150,000	(BPA funded @ $540,000 in 2007 and $440,000 for 2008-2009). The budget is spread out depending on projects within the John Day Subbasin.
	Fish screening and Passage	$300,000/yr	$1,500,000	New construction and O&M – John Day screen shop
CTWSRO	John Day watershed restoration program		$0	Pushup dam removals, Point of diversion consolidation, return flow coolers, pump stations
	John Day watershed restoration program	$10000/yr	$50,000	Riparian plantings, juniper control, off channel water developments
USFS	Culvert Replacements – various tribs	$25,000/yr	$150,000	Ochoco NF
USFS	Noxious weed control	$30,000/yr	$150,000	
	Erosion control seeding	$644,000/yr	$50,000	Fire restoration
Grant SWCD	Uplands - Juniper & Weed Control, Riparian Fence, Off-Site Stock Water, Seeding	$177,500/yr	8875,000	USDA National Forest Title II

Table I-2
Current Average Expenditures on Habitat Projects for Mid-Columbia River Steelhead

Agency or Organization	**Program**	**Recent average annual expenditures or budget**	**Expected next five year expenditures**	**Comments**
BLM	Upland and riparian weed treatment	$36,000/yr	$180,000	
	Stream and riparian restoration	$29,000/yr	$150,000	Includes maintenance work on existing projects
Totals - **South Fork John Day Population**		$1,281,500/yr	$11,255,000	
Upper John Day River Population				
ODFW – 2007- Fish Habitat	Fish Habitat - Upper	$110,000/yr	$550,000	(BPA funded @ $540,000 in 2007 and $440,000 for 2008-2009). The budget is spread out depending on projects within the John Day Subbasin.
	Fish screening and Passage	$450,000/yr	$2,250,000	New construction and O&M -- John Day screen shop.
CTWSRO	John Day watershed restoration program	$436,000/yr	$2,500,000	Pushup dam removals, Point of diversion consolidation, return flow coolers,
	John Day watershed restoration program	$42,000/yr	$325,000	Riparian plantings, juniper control, off channel water developments.
Grant SWCD	Fish Passage, Diversions & Culverts, Irrigation Return Flow Cooling	$691,390/yr	$3,500,000	BPA, BOR
USFS	Noxious weed control	$50,000/yr	$250,000	
	Grazing management improvement-upland water development	$60,000/yr	0/yr	
	Riparian fence	$25,000/yr	$50,000	
BLM	Upland and riparian weed treatment	$9,000/yr	$45,000	
	Stream and riparian restoration	$7,000/yr	$35,000	Includes maintenance work on existing projects
Totals - **Upper John Day River Population**		$1,880,390/yr	$9,505,000	
Umatilla River Population				
CTUIR	Fish habitat	$548,000/yr	$2,700,000	(BPA - $326,000; PCSRF - $22,000; EPA - $150,000; WHIP - $50,000)
Umatilla Co. Soil	Fertilizer reduction	$150,520/yr	$300,000	OWEB & EPA incentive to use precision Ag technology

Table I-2 Current Average Expenditures on Habitat Projects for Mid-Columbia River Steelhead				
Agency or Organization	**Program**	**Recent average annual expenditures or budget**	**Expected next five year expenditures**	**Comments**
& Water Conservation District	Weed Control	$103,250/yr	$500,000	OWEB-Promoting use of the WeedSeeker
	Fish passage improvement	$150,000/yr	$750,000	OWEB-ODF&W Improve fish passage on Birch Creek and irrigation efficiency
	Off stream watering facilities	$71,044/yr	$400,000	OWEB- providing upland watering facilities
USFS		$0		USFS is not currently investing in the subbasin with active restoration
ODFW	Fish habitat	$300,000/yr	$1,400,000	BPA funded
	Fish screening and Passage	$100,000/yr	$500,000	New construction and O&M -- John Day screen shop
Totals - **Umatilla River Population**		$1,422,814/yr	$6,550,000	
Walla Walla River Population				
CTUIR	BPA fish habitat	$338,000/yr	$1,700,000	
	BPA ladders/screens	$250,000/yr	$1,250,000	
	other	$22,000/yr	$110,000	
	TOTAL	$610,000/yr	$3,050,000	(BPA - $588,000; PCSRF - $22,000)
Walla Walla WSC	Fish passage	$76,000/yr	$800,000	OWEB, NRCS –push up dam replacements
	Flow improvement	$157,000/yr	$1,200,000	OWEB, BPA, NRCS – irrigation efficiencies/ conserved water transferred to instream water right
	Habitat/ levee setback	$89,000/yr	$250,000	OWEB - moving corral off creek bank, setting back private levee
	Pesticide use reduction	$20,000/yr	$60,000	ODEQ – assisting growers in reducing the amount of pesticides reaching streams
Umatilla Co. Soil & Water Conservation District	Animal (cattle) Relocation	$62,142/yr		OWEB- moving cattle off creek riparian area to an upland

Table I-2
Current Average Expenditures on Habitat Projects for Mid-Columbia River Steelhead

Agency or Organization	Program	Recent average annual expenditures or budget	Expected next five year expenditures	Comments
USFS		$0		USFS is not currently investing in the subbasin with active restoration
WWBWC	Habitat restoration	$48,000/yr	$240,000	Funded by OWEB
ODFW John Day screen shop	Fish screening and Passage	$100,000/yr	$500,000	New construction and O&M
Totals - **Walla Walla River Population**		$1,772,142/yr	$9,160,000	

APPENDIX J

U.S. Forest Service Briefing Paper

Fuels Treatment as an Action Contributing to Recovery of ESA-listed Anadromous Salmonids

Forest Service Briefing Paper

Subject Fuels treatment as an action contributing to recovery of ESA-listed anadromous salmonids

Key Messages

- Science-based assessments of the Columbia and Snake River basins have documented that both forest and aquatic ecosystems have undergone important changes from historical conditions.
  - Forests structure, composition, and patterns have been significantly altered, resulting in a higher risk of stand replacement fires.
  - Watersheds have been degraded, threatening the stability and persistence of native fishes -- including ESA-listed salmon and steelhead stocks.
- Growing public recognition of degraded forest and aquatic ecosystem condition has resulted in policy and scientific debate over whether fuels treatments provide benefits to ESA-listed salmonid populations, or conversely, represent a risk of further degradation in watershed conditions on which they depend.
- Context matters – any evaluation of trade-offs (benefits and risks) to ESA-listed salmonids from fuels treatments will be dependent on local conditions and successful integration of objectives.
- Three primary elements must be integrated to meet both forest and aquatic system restoration objectives:
  - Conservation of key remnant aquatic and forested habitats with their associated native fish and wildlife populations, to serve as 'building blocks' for the future;
  - Restoration of degraded watersheds (both forest and aquatic conditions); and
  - Restoration of more natural patterns of forest habitat, including patterns of dead and down trees to reduce the landscape risk of large and damaging wildfires.
- A multi-scale analysis –assessments at both the recovery domain and watershed scales---is clearly an important process to evaluate tradeoffs between the benefits and risks of fuels treatment activities and assess their value in support of recovery of ESA-listed salmonids. Such analyses provide a framework and necessary geographic context and specificity to evaluate fuels treatments based on each recovery domain and watershed's unique bio-physical characteristics.

Reiman et al. (2000) provide a critical "first step" or "coarse filter" analytical framework to assist managers, policy-makers, and technicians in evaluating these trade-offs (benefits/risks). Based on their integrated analysis of terrestrial and aquatic ecosystems in the Interior Columbia River Basin, each subbasin was assigned a general 'theme' and specific management recommendations are outlined regarding opportunities for fuels treatment actions and other restorative actions to maintain and restore the integrity of watershed and aquatic systems (Figure 1). Additional, finer-scale watershed analyses will often be necessary to refine this approach in order to: 1) recognize commonality in management goals, opportunities, and conflicts; and 2) identify specific, integrated actions needed to support ESA-listed fishes. An example of such an analysis is displayed in Figures 2 and 3.

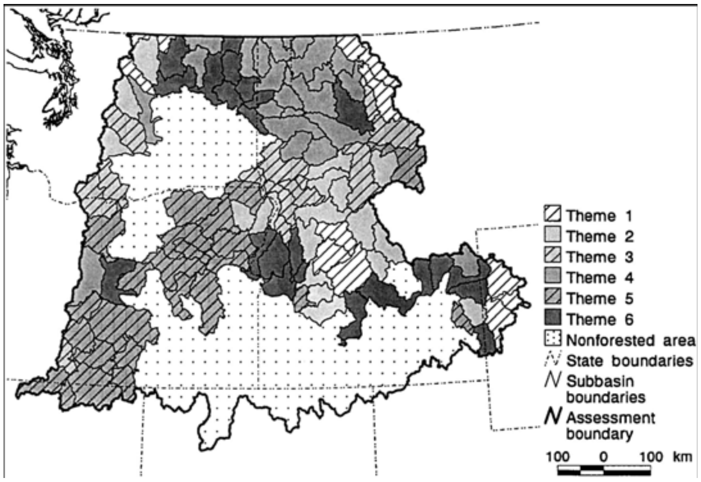


Figure 1 (from Rieman et al. 2000)

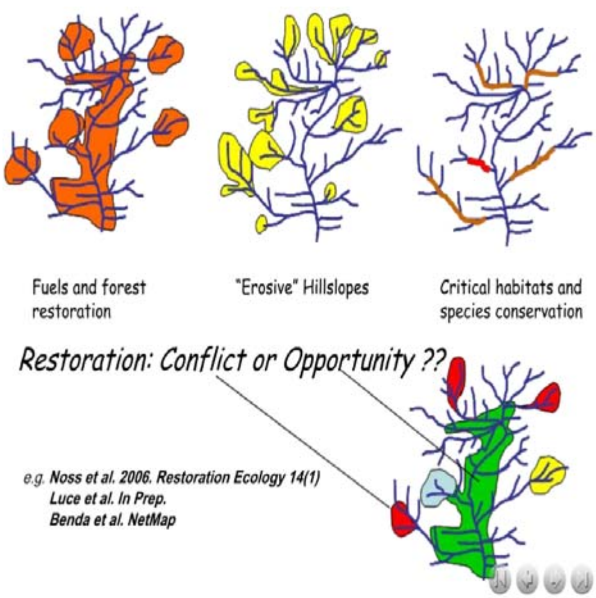


Figure 2 (from Rieman et al. 2007)

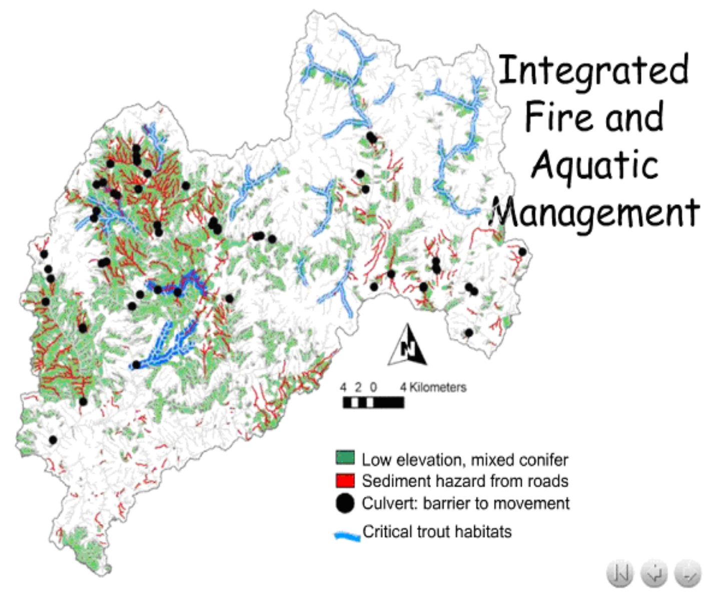


Figure 3 (from Rieman et al. 2007)

Where management objectives and conditions in forested and aquatic systems are in conflict, significant care and investment in analysis and management activities may be required. Placing subbasins into the appropriate theme, as described above, should be considered as an important first step in the prioritization of management resources expended in recovery. By focusing intensive restoration initially in areas of greatest potential ecological benefit and least risk, the skills and opportunity to move into more sensitive areas will likely emerge.

This paper was summarized and sections excerpted from the Rieman et al. (2000) publication by L. Ulmer, B. Staab, D. Shively, and S. Woltering; USDA, Forest Service, Portland, Oregon.

References:
Rieman, B.E., D.C. Lee, R.F. Thurow, P.F. Hessburg, and J.R.Sedell. 2000. Toward an Integrated Classification of Ecosystems: Defining Opportunities for Managing Fish and Forest Health. Environmental Management Vol. 25, No. 4, pp. 425-444.

Reiman, B, C. Luce, J. Dunham, A. Rosenberger, J. Buffington, M. Dare, H. Neville, P. Hessburg, A. Black, and C. Miller. 2007. Wildfire and Fish: Implications for Management. Presentation. USFS Watershed Seminar Series.

Attachment A: Themes from Rieman (2000)

Theme 1: Wild and Minimally Roaded, Cold and Moist Forests – exhibit the least departure from historical conditions in either forest or aquatic ecosystems (roadless, wilderness) and provide the best opportunity to conserve elements of ecosystems most resembling natural or historical conditions

Management Implications

- Due to low departure from historical conditions (forested & aquatic), active restoration is a low priority relative to subbasins under other 'themes'
- Primary management opportunity is to conserve existing conditions
- Both managed and natural ignitions can play an important role in restoring forests

Theme 2: Semi-Wild and Moderately-Roaded Areas – represent forest and aquatic conditions varying from fair to relatively healthy (blocks of wilderness, roadless)

Management Implications

- Conserve existing integrity of high-elevation and headwater areas
- Actively restore more productive and lower risk conditions in middle and lower montane settings

Theme 3: Mixed and Opposing Conditions – conditions in forest and aquatic ecosystems are not consistent. Forests within these subbasins have the highest departure in mean fire frequency and severity. Although aquatic systems are rated as favorable, in contrast to forested areas, strong salmonid populations are found in only an average number of subbasins but most fish communities are still dominated by native species.

Management Implications

- Maintaining and improving the productivity of aquatic ecosystems and restoring forests will likely require active management.
- Although there may be opportunities to restore aquatic and forest conditions simultaneously, it may necessitate trade-offs. Aquatic systems within this theme are generally in good condition but overlap with poor forest conditions. Emphasis of forest treatments may pose unacceptable risks to watershed objectives
- Potential conflict between management objectives support the need for more
- detailed risk analysis (watershed scale)

Theme 4: Mixed Conditions, Moist Forests – subbasins in this class exhibit moderate to high levels of departure from historical conditions in both forest and aquatic systems due to extensive land management and high road densities. The need for restoration in both systems, and the productive nature of the forests, implies both risks and opportunities for management.

Management Implications

- There is a need to restore both.
- As there are productive forests, and areas of both productive aquatic habitat and intact fish communities, these subbasins may be priorities for investments in restoration.
- Due to the extensive and, potentially surplus road networks, opportunities for active forest restoration is high. Removal of roads after forest restoration work is completed could lead to improved watershed conditions where sediment and fragmentation is limiting recovery.
- The presence of large areas of moist forest types within this theme expands management opportunities. Historically, mixed and lethal fire regimes were dominant suggesting large and intense disturbance events with long recovery periods
- Recommend focused and intense restoration actions over short time periods (5-10 years) with longer time periods for recovery (30-50 years). This restoration strategy may minimize the need for extensive and permanent road networks and enable large-scale restoration with less funding.

Theme 5: Mixed Condition, Dry Forest – both forest and aquatic systems are similar to subbasins under Theme 4 (departure from historical conditions, high road densities, extensive land management) but dry forest types are dominant. Theme 5 differs from Theme 4 in that forests are less productive, historical fire regimes were primary non-lethal and mixed and had frequent fire return intervals.

Management Implications

- Restoration needs similar to those recommended under Theme 4 but active restoration will require more frequent entry and a higher level of maintenance for a more extensive road network.
- Economic benefits from logging (dry forest types) are lower than under Theme 4 and probably will not support low-impact operations (e.g., helicopter logging) as often as in more productive moist forest types. This will in turn require that existing road networks remain in place, long-term to derive any economic benefit.
- Although the same opportunities for aquatic habitat restoration are found as under Theme 4 (removal of unnecessary roads), forest restoration should make use of existing roads, rather than construct new ones, and attempt to eliminate roads limiting watershed integrity.

Theme 6: Poor Conditions – both forest and aquatic systems are in poor condition. For aquatic systems, they are in a degraded condition with remaining populations of native fishes often isolated and fragmented. Fragmentation of habitat is most common in lower elevation lands adjoining forested areas. For forest systems, the composition and degree of departure from historical conditions is similar to Theme 5. In contrast, subbasins under Theme 6 comprise a more diverse mix of dry and moist forest conditions with fire frequency changes also not as pronounced. Road densities are also lower than under Theme 4 or 5.

Management Implications

- Limited opportunity for restoration of functional aquatic networks
- Conserve remnant habitats of native fishes and maintain high water quality
- Forest restoration activities would present low risk to remaining critical habitat providing these are sited appropriately