APPENDIX AD1

Results of Alternative Ecosystem Diagnosis and Treatment (EDT) Scenarios

1. INTRODUCTION

In response to the comments and requests made during technical policy and public review period for the May 2004 draft Walla Walla Subbasin Plan (WWSBP), the Walla Walla Subbasin Planning Team (www.wallawallawatershed.org) is leading efforts to modify the WWSBP to satisfy Northwest Power and Conservation Council (NWPCC) planning requirements for revisions to the WWSBP. This technical appendix was developed to help clarify the technical connections between the assessment of the Walla Walla Subbasin, and the WWSBP management plan (WWSBP Section 7). The WWSBP included an EDT analysis of biological objectives developed during the WWSBP planning process which were used to generate scenarios of passive, active, and passive plus active restoration actions. Those objectives and scenarios were focused only on geographic areas identified in the assessment, and were based on general biological objectives. Co-managers identified a need to model biological objectives and scenarios related to significant programmatic activities not addressed in the May 2004 WWSBP biological objectives. Some of these objectives and scenarios related to specific types of restoration actions, and others were related to the cumulative impacts of restoration actions in and out of priority geographic areas.

The following text describes revisions to the baseline Walla Walla EDT model, and hypothetical restoration scenarios modeled using this revised EDT model version. Mobrand Biometrics performed a quality control/quality assurance examination of the Walla Walla EDT model, and identified technical, data entry, and model-derived limitations with the version used in the WWSBP assessment. Changes to the EDT model were documented, and a new version of the model was published on the internet for public and technical review. A new baseline assessment was conducted. The results of this assessment were compared and contrasted with those presented in the May 2004 version of the WWSBP. Using the revised baseline assessment, new hypothetical restoration scenarios were developed. These scenarios were modeled based on strategies identified by the co-management agencies. The changing of attributes in geographic areas, outside of priority geographic areas for the purpose of running the included scenarios should in no way, be interpreted as contradicting the strategies in the Walla Walla Subbasin Plan Section 7. The named priority restoration and protection geographic areas are still considered as priority for restorative and protective actions and are supported by the authors of this addendum.

2. EDT MODEL CORRECTIONS

Mobrand Biometrics evaluated the Walla Walla EDT model used for the May 2004 WWSBP, identified potential problems and limitations with the model, and suggested revisions. Some revisions were associated with specific watersheds, and others were needed subbasin-wide. Best available science was used throughout, and the changes appear to have brought additional realism to the estimates of effectiveness by the model, and its responses to hypothetical management actions.

Given the short time frame and lack of resources, not all interested parties were able to participate in the revision of the baseline data or in the building of EDT scenarios. A revised baseline model has been posted on the Mobrand website (www.mobrand.com/EDT), on the Walla Walla Watershed Planning website (www.wallawallawatershed.org), and on the Walla Walla Basin Watershed Council website (www.wwbwc.org). In addition, the May 2004 EDT model has been archived and is available on the

Walla Walla Basin Watershed Council and Walla Walla Watershed Planning websites. Technical review must be completed for the changes in the baseline data to be finalized. Walla Walla ecosystem modeling is an ongoing process and additional opportunities for changes in baseline data will occur. It is imperative that the baseline data for EDT receive broad technical review prior to its use in further planning efforts, such as the ongoing Walla Walla Habitat Conservation Plan. In addition, the scenarios that were completed represent only a small subset of the scenarios that could be run to further the state of knowledge in the basin. Technical review of the scenarios presented here, as well as the development of additional scenarios, will need to be completed in order to provide the best information possible to planning efforts such as the Prioritization Framework outlined in this Addendum. The following sections describe the problems and limitations associated with specific areas or features, and provide an explanation of the changes made to the Walla Walla EDT model.

2.1 MILL CREEK REVISIONS

The May 2004 version of the Walla Walla EDT model suggested that the Mill Creek system was far less productive for summer steelhead and spring Chinook than has been observed in recent years (Contor, 2003; Mendel, 2003). These deviations are important, because considerable resources are being devoted to restoring the middle and lower Mill Creek watershed and reintroducing salmon in portions of the Mill Creek system. A team of three scientists reviewed each stream characteristic in the May 2004 model; Keith Underwood (S.P. Cramer & Associates), Kevin Malone (Mobrand Biometrics), and Jesse Schwartz (CTUIR). Based on that review, the features listed in the following discussion were evaluated. Each metric was either revised, or may need to be reconsidered in the future.

2.1.1 Minimum Widths

Mill Creek EDT reaches 13 through 18 were defined as having a minimum summer low-flow width of 7 to 8 feet. These numbers are contrary to published results , possibly because of a transcription error, or from using the meter scale instead of feet, as the model requires. Minimum widths were updated using data from Contor et al (2003) and Sankovitch (2003).

2.1.2 Confinement

The confinement rating for Mill Creek reach 18 was corrected, based on data from Paul Sankovitch, who measured decreased confinement of that reach as compared to Mill Creek reaches 17 and 19 (Sankovitch, 2003).

2.1.3 Habitat Composition

Mill Creek reaches 16 to 20 do not show differences between the historic and current conditions for flows, confinement, riparian condition, large woody debris, and gradient, but do have different habitat compositions. These attribute ratings appear to contradict themselves; however, no changes were made because no revised data were available. This metric needs further study in these reaches.

2.1.4 Yellowhawk Creek Routing

The Mill Creek system structure includes an alluvial fan with complex surface and groundwater exchange, interdependence among tributaries, and multiple downstream and upstream passage routes. EDT was designed for systems with a linear downstream passage structure. The EDT model is not capable of representing the complex stream corridor structure associated with alluvial fans or distributary-type systems.

Steelhead and Chinook smolts and adults leaving from or returning to the upper Mill Creek system can migrate by at least two routes; using either the Mill Creek mainstem or Yellowhawk Creek. Under current conditions in EDT, much of the flow from the Mill Creek watershed is diverted through the city of Walla Walla during high flow conditions. Within this reach the habitat is characterized by concrete flood control structures with severe velocity problems, little refugia, and multiple adjoining weirs and ladders. The Yellowhawk migration corridor is characterized by ***comparatively*** intact substrate, flow regimes, refugia, etc. Radio tagged adult summer steelhead have been detected migrating up Yellowhawk Creek with minimal delay (Schwartz, 2004). Conversely, extended delay has been observed on the Mill Creek system at Gose Street, and no radio tagged adults have been detected passing through this reach. It is not evident that Gose Street or the Mill Creek channel is a complete barrier, but it is clear from preliminary telemetry data that the system represents a significant obstruction. In addition it is clear from the May 2004 EDT analysis that, assuming the system was properly represented in EDT, the Mill Creek constructed channel represents sub-optimal habitat that generates mortality and reduces productivity.

The May 2004 EDT version was structured to route all fish through the Mill Creek system. In the model this resulted in significant mortality of returning adults due to the numerous passage complications and poor habitat quality for these reaches. In the May 2004 EDT version the degraded quality of the habitat in this system resulted in significant mortality to the Mill Creek population, and no simulated carrying capacity. Because the habitat and passage conditions were too poor, it was not possible to simulate production in the Mill Creek system using this model structure. In reality, the system supports a small sub-population of reintroduced spring Chinook and endemic summer steelhead. Both adults and juveniles use the Yellowhawk system for passage and rearing (Mendel, 2003 and Schwartz et al 2004).

The revised model was structured to allow fish to pass through Yellowhawk, and prevents them from migrating through Mill Creek. This model structure more accurately reflects passage conditions in the Mill Creek watershed, however it does not allow for the evaluation of passage restoration projects within the Mill Creek concrete channel. The May 2004 Subbasin Plan clearly addresses this issue, citing the Mill Creek system as one that requires significant attention and resources to solve the many passage problems that exist. A large amount of attraction water flows through the engineered reaches of Mill Creek, and a detectable fraction of the Mill Creek sub-population attempts to pass there. It is important to note that the EDT version used for this technical appendix was built with the assumption that passage to the Mill Creek headwaters will be improved in some way as identified in the May 2004 WWSBP section 3.6.4.

2.2 SYSTEM-WIDE STREAM ATTRIBUTE REVISIONS

2.2.1 Dam Passage

Adult summer steelhead have not been observed successfully navigating the Gose Street Dam, which is the farthest downstream obstruction in the Mill Creek System. Therefore, the precise impacts of most of the upstream structures have yet to be evaluated. Bennington Dam is located upstream of the convergence of Yellowhawk and Mill Creeks, and has received several radio tagged adults. Data from CTUIR telemetry studies suggest that, under current operational criteria, 50 percent of the fish that arrive at Bennington Dam will successfully navigate its ladder (Schwartz et al, 2004). In addition, video monitoring by the U.S. Army Corps of Engineers (USACE) has demonstrated successful passage at the Bennington Ladder by spring Chinook, bull trout, and summer steelhead (Tice, 2004). The May 2004 EDT version suggested that only 20 percent of adults would pass the dam. This factor was revised to reflect this more recent data to reflect a 60 percent passage efficiency during all flow regimes. Similarly, data presented in Schwartz et al 2004 showed a 90 percent passage efficiency for Nursery Bridge Dam under low flow conditions. This obstruction was originally rated 80 percent efficient under low flow conditions. The obstruction was updated to allow 100 percent efficiency under high flow conditions, and

90 percent efficiency under summer low flows. These values may be optimistic and should be considered in the future as additional data and analysis becomes available.

2.2.2 Temperature Minimum

Several Walla Walla mainstem EDT reaches (Walla Walla Reaches 16-23) received a 4.0 rating for temperature minimums; suggesting 12 days in a row with temperatures well below 1.0°C. While these reaches do become quite cold in the winter, data suggest that their average winter temperatures linger around 4°C (Contor, 2003). In EDT a rating of 4.0 represents glacial or sub-glacial streams that experience more extreme winter conditions than those observed in the Walla Walla Subbasin. All temperature minimum ratings were decreased to a 3.0 or less for all Mill Creek and Walla Walla mainstem reaches where groundwater influences generally maintain water temps above 1.0°C.

2.2.3 Temperature Maximum

Temperature maximum ratings for the upper Walla Walla mainstem did not reflect the recently published total maximum daily load (TMDL) analysis, and the associated temperature monitoring data for several reaches. The TMDL was used to revise temperature maximum estimates for Walla Walla Reaches 10-23.

2.2.4 Historic Channel Lengths

The Walla Walla Basin Watershed Council provided estimates of historic reach lengths associated with lost sinuosity, or curves and bends, for the Oregon portions of the Subbasin, and the Walla Walla mainstem through Oregon and Washington (Table 1). These estimates of historic reach length were not included in the May 2004 version of the EDT. Within the Oregon portion of the Walla Walla subbasin, and for reaches that have likely experienced some straightening since Euro-American settlement, historic channel lengths were calculated by assigning EDT reaches general Rosgen classifications. EDT reaches were equated to broad Rosgen stream classifications based loosely upon confinement and gradient. More rigorous steps were taken to reassign Rosgen classifications to Walla Walla Main Stem and South Fork Walla Walla reaches through the TMDL development process (cite TMDL). Potential channel length was calculated, based on valley length and sinuosity. For example, low-gradient streams in the basin, such as lower Pine Creek, were equated to Rosgen E-type streams. Rosgen assigns a range of sinuosity values (1.5 and above for E-type streams), so Pine was assumed to have a potential sinuosity of 1.5. If the valley distance between the upstream and downstream points of the EDT reach "Pine1" was found to be six miles, it was assumed that the potential stream length was 9 miles (6 miles times the 1.5 sinuosity value for E-type streams).

Generally these classifications are associated with a range of sinuosity values. When possible, Rosgen classifications were derived (directly or indirectly) from data gathered in the field. In other cases, general stream type classifications were assigned based on gradient. The lower end of the range of sinuosity values associated with the stream type was selected, and the historic channel length was calculated by multiplying that value by the linear distance between the upstream and downstream ends of the EDT reach. In cases where human-caused channel straightening has not occurred, the current channel length was assumed to be the same as the historic (Table 1). This was generally the case in headwater reaches.

Table 1 Historic and Current Lengths for EDT Reaches Evaluated for the Walla Walla TMDL Model

EDT Reach Name	Historic Length (km)	Current Length (km)
Pine 1 B	0.8373106	0.837311
Little Mud 1	3.15	2.844
Swartz Creek	5.124	4.456
Pine 2	1.4775568	1.178
Pine 4	0.4698864	0.353977
Pine 6	2.655	2.584
Dry 1 (Pine)	1.1855114	1.002
Dry 2 (Pine)	2.5515	2.004
Dry 3 (Pine)	3.15	2.367
Dry 4 (Pine)	3.5472	3.296
Dry 5 (Pine)	3.876	3.457
Dry 6 (Pine)	1.866	1.265
Dry 7 (Pine)	5.646	5.646
Pine 7	0.9116477	0.863826
Pine 9	0.2698864	0.18428
Pine 11	11.9748	11.883
Pine 13	0.2879545	0.255492
Pine 15	2.3076	2.223
Pine 16	2.7684	2.559
Pine 18	1.9548	1.946
Pine 20	8.599	8.599
Mud Creek (Walla)	1.0957386	1.06
Walsh 2	0.5	0.431818
West Little WW2	3.528	2.879
WestLittleWW3	3.1125	2.285
Millcreek13	1.7196	1.664
Henry Canyon1	0.3670455	0.367045
Webb Cr	0.8028409	0.802841
Henry Canyon 2	2.296	2.296
Mill 14	1.4964	1.398
Tiger Creek 1	0.7185606	0.718561
Tiger Tributary	1.333	1.333
Tiger Creek 2	2.349	2.349
Mill 15	0.8412879	0.841288
Mill 16	0.6443182	0.644318
Low Creek	2.04	2.04
Mill 17	0.3206439	0.320644
Broken Creek	2.685	2.685
Millcreek 18	0.5185606	0.518561

EDT Reach Name	Historic Length (km)	Current Length (km)
Big Spring Br 3	2.3085	1.753
Unnamed Spring 3	1.9725	1.401
E. Little Walla 3	2.16	1.655
E. Little Walla 4	3.7275	2.792
E. Little Walla 5	2.1075	1.608
Cottonwood NF	0.9179924	0.917992
Cottonwood 3	3.8664	3.4
Cottonwood MF	1.815	1.815
Cottonwood SF	2.965	2.965
Birch 1	0.7210227	0.451515
Birch 3	3.3732	3.462
Birch5	4.188	3.805
Walla 16	3.368	2.057
Walla 17	2.59	1.412
Walla 18	1.7	0.939583
Walla 20	2.3	1.247
Walla 22	2.291	1.271
Couse 1	1.596	1.134
Couse 3	2.0376	1.809
Couse 4	3.762	3.883
Couse 5	1.6416	1.444
Couse 6	5.937	5.937
Walla 23	5.99	3.594
Walla NF 1	3.7296	3.404
Walla NF 2	5.5344	5.214
Little Meadow Canyon	1.336	1.336
Walla NF 3	1.6032	1.567
Big Meadow Canyon	1.839	1.839
Walla NF 4	1.3968	1.287
Walla NF 5	6.818	6.818
Walla SF 1	7.93	4.92
Flume Canyon	3.316	3.316
Walla SF 2	6.71	3.936
Walla SF 3	1.021	1.021
Elbow Creek 1	0.5909091	0.590909
Elbow Creek 2	0.9609848	0.960985
Elbow Creek Tributary	0.2592803	0.25928
Elbow Creek 3	0.3657197	0.36572
Walla SF 4	1.822	1.822
Walla SF 5	1.404	1.404
Bear Creek	1.337	1.337

EDT Reach Name	Historic Length (km)	Current Length (km)
Walla SF 6	1.031	1.031
Kees Canyon	1.101	1.101
Walla SF 7	0.4314394	0.431439
Burnt Cabin Gulch	2.705	2.705
Walla SF 8	0.3285985	0.328598
Swede Canyon	0.9039773	0.903977
Walla SF 9	0.8162879	0.816288
Table Creek	0.8064394	0.806439
Deadman Gulch	0.3075758	0.307576
Walla SF 10	1.851	1.851
Skiphorton Creek 1	1.673	1.673
Skiphorton Tributary	0.8350379	0.835038
Skiphorton Creek 2	1.185	1.185
Walla SF 11	3.006	3.006
Reser Creek	1.063	1.063
Walla SF 12	0.7223485	0.722348
Husky Sp Creek	3.134	3.134
Walla SF 13	0.9755682	0.975568
Walla SF Tributary	2.641	2.641
Walla SF 14	2.883	2.883
Bear Trap Sp	1.489	1.489
Walla SF 15	2.628	2.628

2.2.5 Large Woody Debris

The historical conditions of the Walla Walla valley riparian zones are unknown. However, on their famed journey, Lewis and Clark clearly documented extensive recruitment of large woody debris to the Walla Walla mainstem reaches, as did the settlers of the city of Walla Walla after numerous Mill Creek floods. The historic condition of this attribute should have been ranked pristine for all Mill Creek, Touchet, and Walla Walla mainstem reaches, but was ranked as slightly disturbed. These rankings were corrected to represent a pristine condition. There are differing opinions as to what a pristine rating for large woody debris should look like, what stream reaches were historically capable of supporting this level of wood production or retention, and what the impacts might be to fish production. This has been addressed in more detail on coastal streams in the Pacific Northwest that are surrounded by temperate rainforests, but has received comparably little attention in the Columbia Plateau. The ability of Columbia Plateau streams to support large woody debris, historic conditions of this attribute, and representation in EDT should all be re-addressed in future modeling and planning efforts.

2.2.6 Mainstem conditions

The EDT results presented in the subbasin plan were calculated using a standalone version of EDT run in Microsoft Access, rather than the web-based version used by most subbasins. The Access and Web models have some inherent differences, one of which is that the Access modeled template conditions with the "true" template conditions in the Columbia mainstem. The web version uses current mainstem and marine conditions to describe the "historical" productivity of the system. The intent of the web-based model structure is to quantify the restoration potential within the Walla Walla Subbasin, whereas the results presented in the subbasin plan provide an estimate of the restoration potential in and out of the Walla Walla system.

In addition the web-based version does not include fitness effects used to evaluate the impacts of mainstem conditions on fish fitness. Instead the web-based version deals only with the impacts of harvest in the mainstem and marine systems. By using the web-based version, we were able to generate a model that is on par with those presented by other subbasins in the Columbia Plateau, and one that represents the potential for restoration and mitigation within the Walla Walla, irrespective of mainstem and marine mortality.

2.3 FISH POPULATION STRUCTURE

The May 2004 EDT version segregated Walla Walla, Mill Creek, and Touchet sub-populations, and separated "tributary" from "mainstem" sub-populations for summer steelhead. This population structure is relatively complicated. For the purpose of this modeling exercise, steelhead populations were aggregated for the Walla Walla Subbasin. Three sub-populations, the Walla Walla, the Mill Creek, and the Touchet, were defined for spring Chinook and summer steelhead. This aggregated structure was used primarily to save time when running scenarios due to the limited timeline within which this addendum was produced. Future analyses should use sub-populations segregated by watershed structure if possible.

In the May 2004 EDT version, spring Chinook populations were described as 50 percent resident and 50 percent transient. CTUIR data suggests that only a small portion of Walla Walla spring Chinook move during 0-1 rearing. Data regarding life history is limited for the subbasin, but is currently under investigation by CTUIR and others. Resident and transient juvenile spring Chinook and summer steelhead have been observed in the Mill Creek and Walla Walla Rivers, but the proportions of these life history types have yet to be accurately quantified. To deal with this ambiguity and lack of data, the population structure was adjusted to 50 percent resident and 50 percent transient for all species.

2.4 IMPLICATIONS OF EDT MODEL REVISIONS

The May 2004 EDT version predicted no capacity for Mill Creek to support spring Chinook production. CTUIR biologists have documented returns at or near replacement for outplanted spring Chinook in the Mill Creek system, suggesting ratings were ranked incorrectly, or that the model is not realistically representing the Walla Walla system. Similarly, CTUIR biologists have documented extensive use of the upper Mill Creek system by summer steelhead; whereas, the May 2004 Walla Walla EDT model suggested virtually no capacity in that system. After making the above changes, the Walla Walla EDT model suggested increased current productivity for Walla Walla spring Chinook and summer steelhead (tables 2 and 3). This revised model performance is in line with several preliminary reports documenting greater productivity in the Walla Walla system, over that reported in the May 2004 Walla Walla Subbasin Plan (Contor, 2003; Tice, 2003).

Comparing results from the May 2004 EDT version to those of the October 2004 version is extremely complicated. The May 2004 EDT model was run on a laptop using historical mainstem conditions for estimates of historic production. The October 2004 EDT model was run on the Mobrand Biometrics web server, using current mainstem conditions for all estimates of productivity. Nonetheless it is interesting to note the changes in model output resulting from the above revisions. The results presented below are for both the May 2004 and October 2004 stream attribute datasets run on the Mobrand Biometrics web server for comparison. These values should not be directly compared with those presented in the subbasin plan body and technical assessment due to differences in the EDT models used to populate the stream reach datasets in this addendum.

Another implication of the revised EDT modeling concerns steelhead production in the mainstem Walla Walla River. Results of EDT model runs seem to substantially underestimate expected increases in steelhead abundance and productivity for protection and restoration efforts in mainstem areas. The model favors tributary use by steelhead over mainstem use. This is reflected in greater productivity and diversity rates assigned to smaller, higher gradient streams relative to larger, lower gradient streams. Fisheries managers believe it is likely that the mainstem Walla Walla is as productive as its tributaries. The model needs to be revised to eliminate this bias and then rerun to compare potential benefits for steelhead in mainstem areas of the Walla Walla Basin with benefits in the tributaries.

Table 2 Revised EDT Estimates of Adult Spring Chinook and Summer Steelhead Productivity in the Walla Walla Subbasin

Population	Scenario	Diversity Index	Productivity	Capacity	Abundance
Juveniles: January 2004 Stream Reach Attribute					
Mill Creek Spring Chinook	Current without harvest		--	4,381	--
	Current with harvest		--	4,381	--
	Historic potential		247	55,076	45,728
South Fork Walla Walla Spring Chinook	Current without harvest		200	12,416	9,319
	Current with harvest		201	12,417	9,139
	Historic potential		356	31,273	28,245
Walla Walla Mainstem Spring Chinook	Current without harvest		73	86,642	4,541
	Current with harvest		74	86,642	4,077
	Historic potential		243	22,548	178,110
Touchet Spring Chinook	Current without harvest		84	38,280	3,379
	Current with harvest		84	38,281	2,918
	Historic potential		262	159,713	121,077
Walla Walla Summer Steelhead	Current without harvest		74	22,208	3,205
	Current with harvest		74	22,208	3,205
	Historic potential		187	69,200	50,591
Juveniles: October 2004 Stream Reach Attribute Dataset					
Mill Creek Spring Chinook	Current without harvest		129	6,061	1,785
	Current with harvest		132	6,061	1,665
	Historic potential		266	63,990	53,640
Touchet Spring Chinook	Current without harvest		74	33,729	3,878
	Current with harvest		75	33,729	3,548
	Historic potential		244	215,507	171,400
Walla Walla Spring Chinook	Current without harvest		176	669,926	58,843
	Current with harvest		178	669,979	54,932
	Historic potential		292	864,797	556,945
Walla Walla Summer Steelhead	Current without harvest		194	143,793	93,888
	Current with harvest		194	143,793	93,888
	Historic potential		250	284,845	228,836

Population	Scenario	Diversity Index	Productivity	Capacity	Abundance
Adults: January 2004 Stream Reach Attribute Dataset					
Mill Creek Spring Chinook	Current without harvest	0%	---	4	---
	Current with harvest	0%	---	3	---
	Historic potential	100%	7.2	1,267	1,090
South Fork Walla Walla Spring Chinook	Current without harvest	50%	6.4	230	187
	Current with harvest	49%	5.1	214	172
	Historic potential	100%	11.4	897	818
Walla Walla Mainstem Spring Chinook	Current without harvest	2%	1.7	105	44
	Current with harvest	2%	1.6	98	37
	Historic potential	91%	6.3	2,272	1,913
Touchet Spring Chinook	Current without harvest	3%	2.0	128	65
	Current with harvest	3%	1.9	120	58
	Historic potential	98%	7.2	4,264	3,670
Walla Walla Summer Steelhead	Current without harvest	1%	1.4	191	51
	Current with harvest	1%	1.4	191	51
	Historic potential	68%	4.3	1,310	1,005
Adults: October 2004 Stream Reach Attribute Dataset					
Mill Creek Spring Chinook	Current without harvest	4%	1.9	41	20
	Current with harvest	3%	1.9	38	17
	Historic potential	100%	7.6	1,436	1,248
Touchet Spring Chinook	Current without harvest	4%	2.0	116	59
	Current with harvest	3%	1.9	108	53
	Historic potential	97%	7.1	3,998	3,439
Walla Walla Spring Chinook	Current without harvest	13%	5.0	457	366
	Current with harvest	12%	4.8	426	336
	Historic potential	94%	7.8	6,132	5,350
Walla Walla Summer Steelhead	Current without harvest	9%	3.8	1,899	1,393
	Current with harvest	9%	3.8	1,899	1,393
	Historic potential	78%	5.9	5,620	4,660

The revised representation of current and historic conditions will result in revised estimates of the benefits of management actions. The biological objectives outlined in the May 2004 Walla Walla Subbasin Plan were developed based on considerable public input, and represent important goals for the subbasin. These biological objectives were run in a scenario using the corrected October 2004 stream reach attribute database (Table 3). The revised stream reach attribute dataset shows a greater increase in productivity, capacity, and abundance from achieving the biological objectives described in the subbasin plan.

Table 3 Comparison of Biological Objectives Using Historical Data and Model Estimates from May 2004 and October 2004

Population	Scenario	Diversity Index	Productivity	Capacity (# of fish)	Abundance (# of fish)
Adults					
Mill Creek Spring Chinook	Current without harvest	4%	1.9	41	20
	May 2004 Biological Objectives	5%	2.1	73	37
	Historic potential	100%	7.6	1,436	1,248
Touchet Spring Chinook	Current without harvest	4%	2.0	116	59
	May 2004 Biological Objectives	26%	2.2	465	256
	Historic potential	97%	7.1	3,998	3,439
Walla Walla Spring Chinook	Current without harvest	13%	5.0	457	366
	May 2004 Biological Objectives	27%	5.4	1,162	948
	Historic potential	94%	7.8	6,132	5,350
Walla Walla Summer Steelhead	Current without harvest	9%	3.8	1,899	1,393
	All 10-19-04 Registered	20%	3.8	2,823	2,072
	Historic potential	78%	5.9	5,620	4,660
Juveniles					
Mill Creek Spring Chinook	Current without harvest		129	6,061	1,785
	May 2004 Biological Objectives		133	16,790	3,835
	Historic potential		266	63,990	53,640
Touchet Spring Chinook	Current without harvest		74	33,729	3,878
	May 2004 Biological Objectives		90	59,344	16,618
	Historic potential		244	215,507	171,400
Walla Walla Spring Chinook	Current without harvest		176	669,926	58,843
	May 2004 Biological Objectives		192	822,868	148,971
	Historic potential		292	864,797	556,945
Walla Walla Summer Steelhead	Current without harvest		184	143,793	93,888
	May 2004 Biological Objectives		182	188,890	125,877
	Historic potential		250	284,845	228,836

3. RESULTS OF EDT SCENARIOS

This section describes the results of the new EDT scenarios that were outlined in Section 1.1 of the Addendum Document. **NOTE**: EDT uses "if you build it, they will come" assumptions. The results are based heavily on the capacity of the habitat, rather than on the dynamics of the environment or population in question. In a sentence form, EDT results should be stated as one of three types of if-then statements.

1. If our understanding of the Walla Walla Subbasin is reasonable, then the subbasin currently, and historically, had the capacity to support on average (A) and (B) numbers of fish because abundance is and was limited by (C) and (D) sets of limiting factors within a geographic area.
2. If (E) projects are implemented on the ground in (F) Walla Walla Subbasin geographic areas, than (G) conditions will change by (H) extent.
3. If (G) attributes change in the Walla Walla Subbasin by (H) extent, the Subbasin would have the capacity to support (I) number of fish.

Statement one is addressed in the "baseline" scenario of current average conditions. Statements two and three are addressed in the scenario results. The value "H" is modified for each scenario to calculate the relationship between the restoration of certain fractions (percentages) of the habitat to template conditions, and the increased capacity "I" of the habitat to rear numbers of fish. In tables 5, 7, 9, 11, and 13 below, the columns show the percent restoration towards template conditions for each attribute associated with the restoration of a corresponding fraction of the habitat. Relationships between the attribute ratings, percent habitat restored, and the various flow regimes were derived from previously published work as cited below. The results are presented in the form of potential increased capacity of the system under various restoration scenarios. Each result should be read as "the hypothetical increase in the capacity of the habitat to rear fish (numbers of juveniles or spawners)".

3.1.1 Passage

Passage restoration was modeled for all potential sources of delay or mortality identified in the Subbasin Plan. Passage at each obstruction was modeled as 100 percent restored. Table 3 shows the EDT estimated increase in spawner capacity associated with each passage restoration scenario.

In several scenarios, the restoration of passage did not increase the capacity of the Walla Walla system for either focal species. This should not be interpreted as a suggestion that the obstruction does not cause delay or mortality. In the context of EDT, a zero-net increase in capacity suggests that the impact of the obstruction is not significant under current conditions ***as compared to other limiting factors***. Section 3.1.5 includes an analysis of passage restoration in combination with other habitat restoration actions. These model products suggest that the benefits of passage restoration actions to habitat capacity will increase when other limiting factors are addressed in tandem (see Table 4). One likely reason for the minimal response to obstruction restoration observed in this EDT model is that the subbasin's highest priority passage problem, the Mill Creek channel, has been removed from this analysis. The May 2004 EDT analysis clearly showed that the restoration of passage in Mill Creek would provide significant benefit to the system.

A note about the passage estimates: considerable work has been conducted to estimate the impacts of passage at the obstructions listed in Table 4. Reasonable data is not available in all instances, and in some instances the results presented below do not seem compatible with results obtained in the field. The reasons for this are unclear at this time. The reader is referred to Contor et al. (2003) and Schwartz et al

(2004) for a discussion of the impacts of passage problems in the Walla Walla Subbasin. These estimates, and the potential benefits of restoration, should be revisited as new data become available.

Table 4 Passage Restoration Scenarios Modeled Using EDT, and the Hypothetical Benefits to Spring Chinook and Summer Steelhead Habitat Capacity

Obstruction	Mill Creek Spring Chinook	Touchet Spring Chinook	Walla Walla Spring Chinook	Walla Walla Summer Steelhead
Bennington Dam Passage Restoration	16	0	0	267
Big Spring Low Flow Passage Restoration	0	0	0	0
Birch Creek Culver Restoration	0	0	0	0
Birch Creek Low Flow Passage Restoration	0	0	0	0
Bryant Urban Stream Culvert Passage	0	0	0	0
Burlingame Dam Restoration	1	1	0	14
Doan Creek Passage Restoration	1	0	14	0
Dry Creek Lower Waitsburg Road Passage Restoration	0	0	0	4
Dry Creek at Sapolil Passage Restoration	0	0	0	4
Garrison Creek at Lark St Passage Restoration	0	0	8	0
Garrison Creek Minor Obst Passage Restoration	0	0	0	0
Hofer Dam and Siphon Passage Restoration	0	10	0	0
Kooskooskie Dam Passage Restoration	1	0	0	0
Mud Creek Culvert Passage Restoration	0	0	0	4
Nursery Bridge Dam Passage Restoration	0	0	3	0
Pine(15) Creek Culvert Passage Restoration	0	0	0	1
Pine(4) Creek Minor Obst Passage Restoration	0	0	0	1
Russell Creek CCC Dam Passage Restoration	0	0	0	0
Russell Creek Dam Passage Restoration	0	0	0	9
Stone Creek Dam Passage Restoration	0	0	0	9
Titus Creek Culvert Passage Restoration	0	0	0	0
Touchet Falls Passage Restoration	0	3	0	0
WDFW Acclimation Pond Passage Restoration	0	1	0	0
Whiskey Creek Culvert Passage Restoration	0	0	0	7
Yellowhawk Creek Diversion Dam Passage Restoration	0	0	0	0
Yellowhawk Dam Passage Restoration	0	0	0	0
All Passage Restoration	23	15	18	309

Units are the increase in number of spawners the habitat can produce.

3.1.2 Flow Restoration

Flow restoration is a timely and significant topic in the Walla Walla Subbasin for a number of reasons. Understanding the benefits of flow is critical to effective planning and water resource management. The Walla Walla Total Maximum Daily Load (TMDL) (Butcher and Bower, 2004) and Instream Flow

Incremental Methodology (IFIM) were used to develop restoration targets and corresponding attribute modifications for the Walla Walla flow restoration scenarios. The TMDL analysis explicitly describes the potential impacts of flow, vegetation, and stream morphology on stream temperature along several reaches along the Walla Walla River. This analysis makes it possible to estimate the impacts of restoration of stream conditions on temperature in the Walla Walla mainstem, and to develop a general framework to describe similar interactions on the Mill Creek and Touchet mainstems. EDT operates at a relatively coarse scale, making it relatively simple to modify flow, stream width, and water quality attributes as well.

Tables 5 through 7 show the scenarios that were run for each population and watershed, and the corresponding attribute ratings. The approximate ratios between flow, temperature, and minimum width were used for the Touchet and Mill Creek Rivers were taken from those used in the Walla Walla TMDL. The flow values are for Nursery Bridge, Dayton Fish Weir, and Bennington Dam flow measurement points. Reaches and geographic areas modified for the Walla Walla flow restoration scenario are shown in Table 8. Please note that for the scenario descriptors listed as a percent, the values represent a percent restoration towards the template conditions of the categorical attributes used in EDT. They do not represent the fraction of change in the quantitative attribute itself.

Table 5 Flow Restoration Scenario for the Walla Walla River

CFS	Temperature (%)	Flow (%)	Width Min (%)	Dissolved Oxygen (%)
40	5	20	25	5
55	10	33	50	10
80	25	50	75	25
100	33	75	100	30

Table 6 Attribute Restoration Ratings for Two Flow Regimes in the Mill Creek River

CFS	Temperature (%)	Flow (%)	Width Min (%)	Dissolved Oxygen (%)
25	10	50	50	10
50	33	75	75	33

Table 7 Attribute Restoration Ratings for Two Flow Regimes in the Touchet River

CFS	Temperature (%)	Flow (%)	Width Min (%)	Dissolved Oxygen (%)
25	10	50	50	10
50	33	100	100	33

Table 8 Reaches and Geographic Areas Modified for the Walla Walla Flow Restoration Scenario

EDT REACH	GEOGRAPHIC AREA
Touchet5	Lower Touchet
Touchet4	Lower Touchet
Touchet5	Lower Touchet
Touchet3	Lower Touchet
Touchet2	Lower Touchet
Touchet1	Lower Touchet
Walla1	Lower Walla Walla
Walla2	Lower Walla Walla
Mill11	Mill Cr, Bennington Dam to Blue Cr
Mill10	Mill Cr, Bennington Dam to Blue Cr
Mill15	Mill Cr, Blue Cr to Walla Walla water intake
Mill14	Mill Cr, Blue Cr to Walla Walla water intake
Mill13	Mill Cr, Blue Cr to Walla Walla water intake
Mill12	Mill Cr, Blue Cr to Walla Walla water intake
Mill9	Mill Cr, Gose Street to Bennington Dam
Mill8	Mill Cr, Gose Street to Bennington Dam
Mill7	Mill Cr, Gose Street to Bennington Dam
Mill5	Mill Cr, Gose Street to Bennington Dam
Mill6	Mill Cr, Gose Street to Bennington Dam
Mill3	Mill Cr, mouth to start of Corps Project
Mill2	Mill Cr, mouth to start of Corps Project
Mill1	Mill Cr, mouth to start of Corps Project
Mill4	Mill Cr, mouth to start of Corps Project
Mill20	Mill Cr, Walla Walla water intake to access limit
Mill19	Mill Cr, Walla Walla water intake to access limit
Mill18	Mill Cr, Walla Walla water intake to access limit
Mill17	Mill Cr, Walla Walla water intake to access limit
Mill16	Mill Cr, Walla Walla water intake to access limit
NFTouchet6	NF Touchet Mainstem
NFTouchet5	NF Touchet Mainstem
NFTouchet4	NF Touchet Mainstem
NFTouchet3	NF Touchet Mainstem
NFTouchet2	NF Touchet Mainstem
NFTouchet1	NF Touchet Mainstem
NFTouchet1	NF Touchet Mainstem
WallaNF5	NF Walla Walla, L. Meadows to access limit
WallaNF4	NF Walla Walla, L. Meadows to access limit
WallaNF3	NF Walla Walla, L. Meadows to access limit
WallaNF2	NF Walla Walla, mouth to L. Meadows Canyong Cr

EDT REACH	GEOGRAPHIC AREA
WallaNF1	NF Walla Walla, mouth to L. Meadows Canyong Cr
WallaSF13	SF Walla Walla, Elbow to access limit
WallaSF12	SF Walla Walla, Elbow to access limit
WallaSF11	SF Walla Walla, Elbow to access limit
WallaSF10	SF Walla Walla, Elbow to access limit
WallaSF9	SF Walla Walla, Elbow to access limit
WallaSF8	SF Walla Walla, Elbow to access limit
WallaSF7	SF Walla Walla, Elbow to access limit
WallaSF6	SF Walla Walla, Elbow to access limit
WallaSF4	SF Walla Walla, Elbow to access limit
WallaSF4	SF Walla Walla, Elbow to access limit
WallaSF14	SF Walla Walla, Elbow to access limit
WallaSF15	SF Walla Walla, Elbow to access limit
WallaSF3	SF Walla Walla, mouth to Elbow Creek
WallaSF2	SF Walla Walla, mouth to Elbow Creek
WallaSF1	SF Walla Walla, mouth to Elbow Creek
Touchet9	Touchet, Coppei to forks
Touchet7	Touchet, Coppei to forks
Touchet6	Touchet, Coppei to forks
Touchet8	Touchet, Coppei to forks
Touchet8	Touchet, Coppei to forks
Walla6	Walla Walla, Dry to Mill
Walla6	Walla Walla, Dry to Mill
Walla7	Walla Walla, Dry to Mill
Walla14	Walla Walla, E Little Walla Walla to Tumalum Br
Walla15	Walla Walla, E Little Walla Walla to Tumalum Br
Walla16	Walla Walla, E Little Walla Walla to Tumalum Br
Walla22	Walla Walla, Little Walla Walla Diversion to Forks
Walla23	Walla Walla, Little Walla Walla Diversion to Forks
Walla10	Walla Walla, Mill to E L. Walla Walla
Walla11	Walla Walla, Mill to E L. Walla Walla
Walla12	Walla Walla, Mill to E L. Walla Walla
Walla13	Walla Walla, Mill to E L. Walla Walla
Walla9	Walla Walla, Mill to E L. Walla Walla
Walla8	Walla Walla, Mill to E L. Walla Walla
Walla20	Walla Walla, Nursery Br to Little WW Diversion
Walla5	Walla Walla, Touchet to Dry
Walla4	Walla Walla, Touchet to Dry
Walla3	Walla Walla, Touchet to Dry
Walla17	Walla Walla, Tumalum Bridge to Nursery Bridge
Walla18	Walla Walla, Tumalum Bridge to Nursery Bridge

EDT REACH	GEOGRAPHIC AREA
Yellowhawk4	Yellowhawk mainstem
Yellowhawk3	Yellowhawk mainstem
Yellowhawk7	Yellowhawk mainstem
Yellowhawk1	Yellowhawk mainstem
Yellowhawk2	Yellowhawk mainstem
Yellowhawk5	Yellowhawk mainstem
Yellowhawk6	Yellowhawk mainstem
Yellowhawk6	Yellowhawk mainstem

Increases in flow were positively correlated with increases in spawner and juvenile capacity (Figures 1 through 6). Increases in capacity associated with flow restoration were smaller than expected. This should not be misinterpreted as a suggestion that flow and capacity are not related. Instead it suggests that other limiting factors must be addressed prior to or simultaneous with flow restoration actions to produce maximum benefits to the system. Section 3.1.5 includes the results of several flow restoration regimes in combination with other restoration actions. The impacts of flow restoration in these multi-faceted scenarios appear to be more evident and significant than those received from a restoration program focusing only on flow. It is interesting to note that Figure 2 shows a decrease in steelhead production associated with increased flows from 80 to 100 cfs. Although this pattern is compatible with those presented by Caldwell and Shedd (2002), it is unclear why they are evident in EDT, which does not use the same variables as IFIM in producing its estimates of capacity. These patterns should be investigated further before flow restoration goals are established.

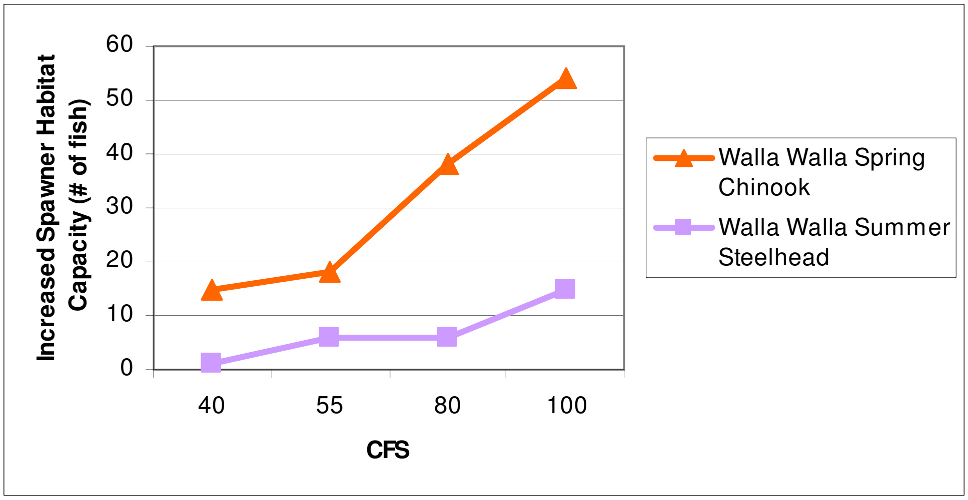

Figure 1 Modeled Relationship Between Summer Low Flows and Spawner Habitat Capacity for the Walla Walla River

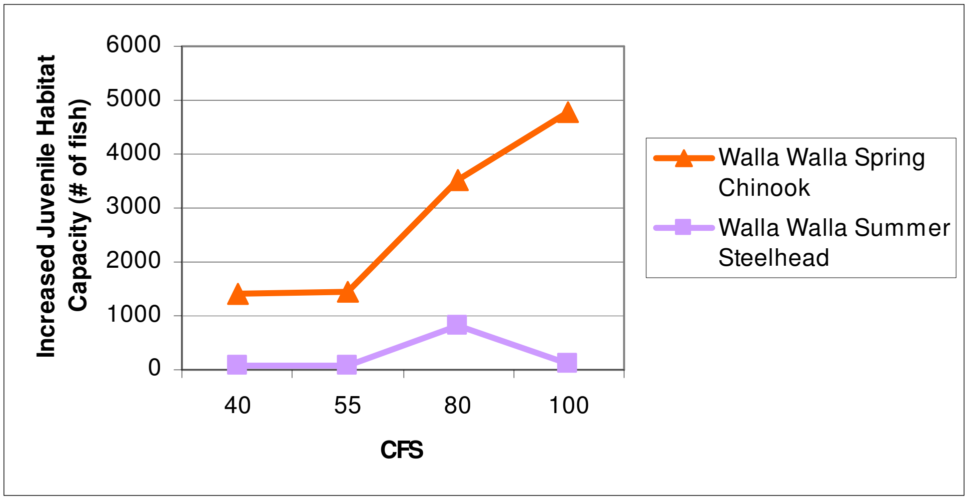

Figure 2 Modeled Relationship Between Summer Low Flows and Juvenile Habitat Capacity in the Walla Walla River

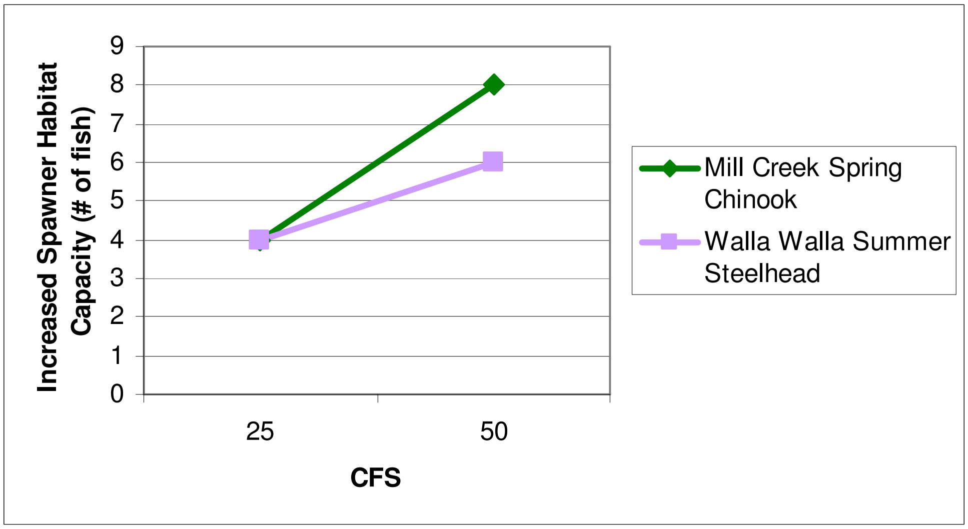

Figure 3 Modeled Relationship Between Summer Low Flows and Spawner Habitat Capacity in the Mill Creek River

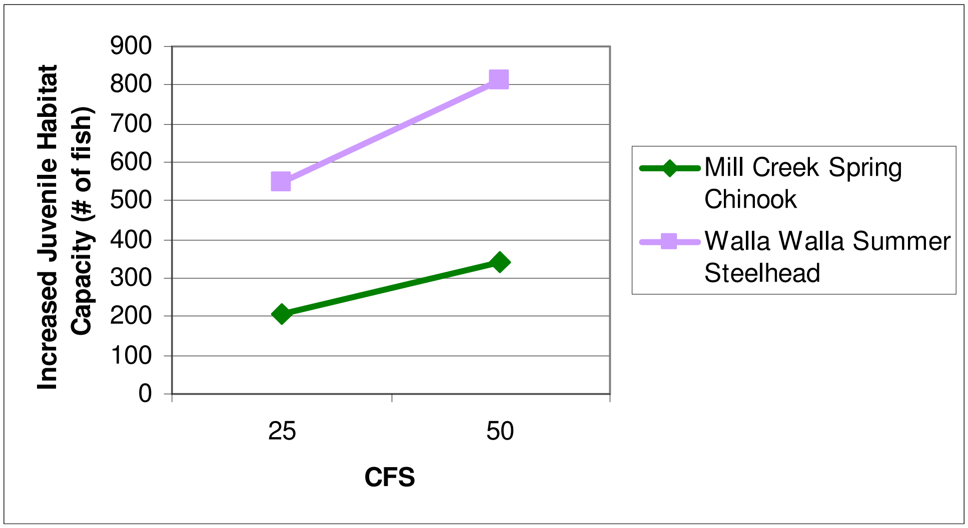

Figure 4 Modeled Relationship Between Summer Low Flows and Juvenile Habitat Capacity in the Mill Creek River

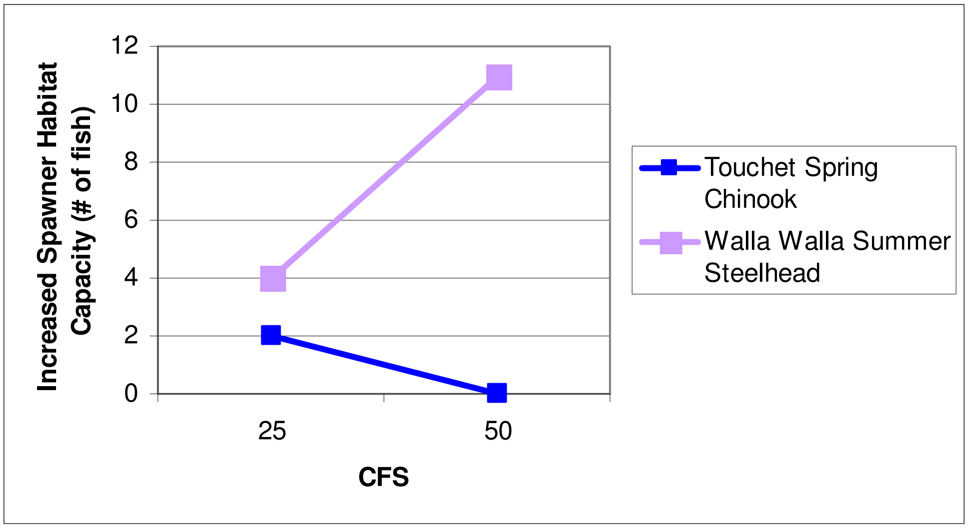

Figure 5 Modeled Relationship Between Summer Low Flows and Spawner Habitat Capacity in the Touchet River

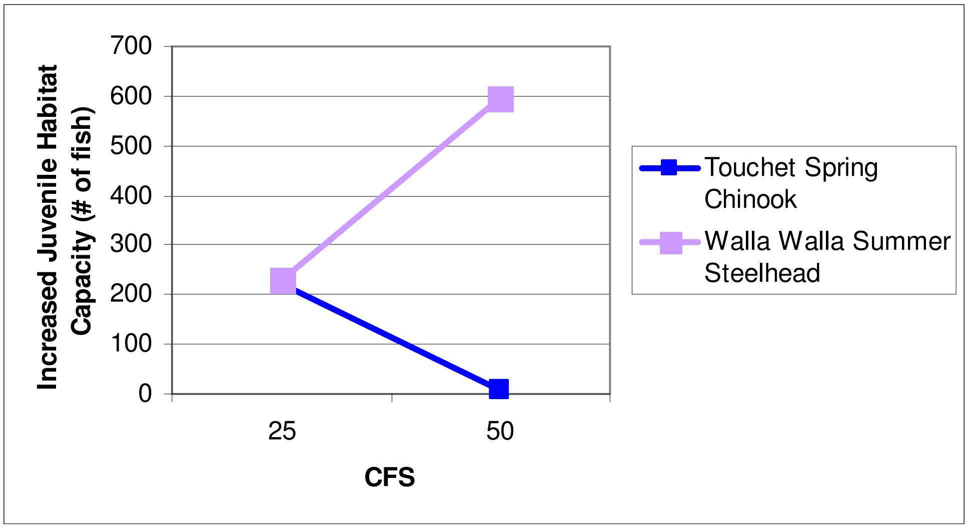

Figure 6 **Modeled Relationship Between Summer Low Flows and Juvenile Habitat Capacity in the Touchet River**

3.1.3 Riparian Restoration

Riparian restoration is a powerful tool for managing streams because it affects several stream attributes simultaneously. Riparian restoration can result in shade improvement, increased input of wood, and bank stabilization. A number of riparian restoration projects are currently implemented, funded, proposed, or planned for the Walla Walla Subbasin. Often these projects are not focused on priority geographic areas because they are connected with willing landowners, geographically specific resources, or restoration programs of spatially-focused entities such as conservation districts or NGOs. Although these activities may not receive BPA funding for work outside of priority geographic areas, as described in the prioritization framework of this document, the benefits of those actions should be considered in the planning process. Therefore the benefits of riparian and instream restoration actions were modeled subbasin-wide. For the purpose of this modeling exercise "riparian restoration" included the restoration of confinement and hydromodifications, as these actions were necessary to improve riparian function as a whole. Four scenarios were run for each population with increases in the fraction of restored habitat (Table 9).

Table 9 **Attribute Restoration Ratings for Riparian Restoration Scenarios**

Percent of Habitat Restored	Confinement Hydromodifications (%)	Riparian Function (%)	Wood (%)	Benthos Diversity (%)	Temperature (%)	Dissolved Oxygen (%)
25%	25	25	25	25	5	2
50%	50	50	50	50	10	5
75%	75	75	75	75	20	10
100%	100	100	100	100	33	20

Riparian restoration had positive and significant impacts on the Walla Walla EDT model's estimation of capacity. These benefits were distributed across the Walla Walla, Mill Creek, and Touchet watersheds.

Riparian restoration had a greater impact on capacity than any other single metric analyzed in this study (see Figures 7 and 8). While riparian restoration does not address all of the limiting factors identified in the biological assessment, it is an action that is likely to be used by a number of co-management agencies. The results of this analysis suggest this technique would have significant impacts in the geographic areas that have restoration potential in the Walla Walla Subbasin.

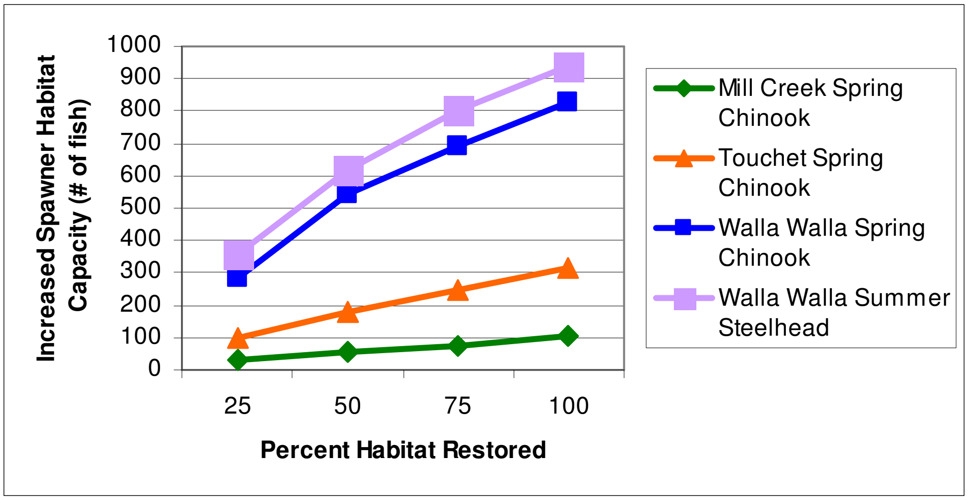

Figure 7 **Modeled Relationship Between Increased Riparian Restoration and Spawner Capacity in the Walla Walla Subbasin**

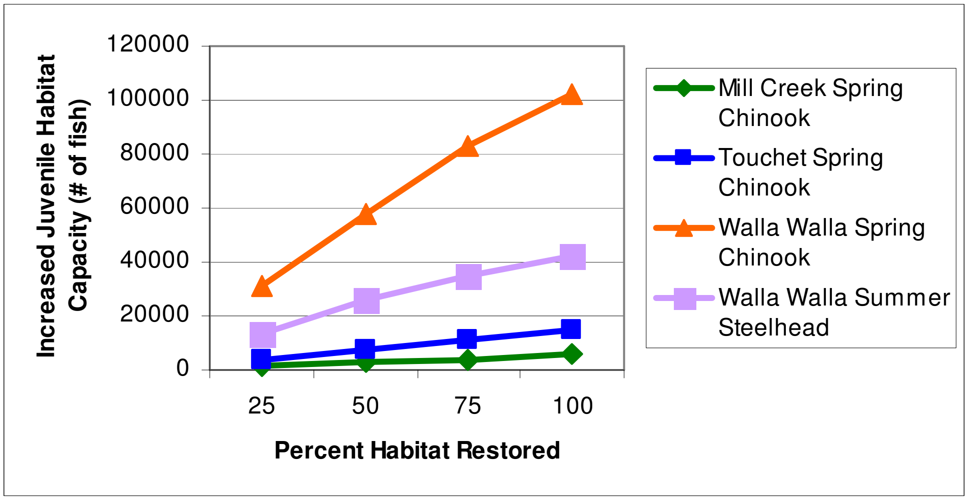

Figure 8 **Modeled Relationship Between Increased Riparian Restoration and Juvenile Habitat Capacity in the Walla Walla Subbasin**

In this modeling exercise, riparian restoration also included the restoration of hydromodifications such as dikes and levies due to the intimate linkages between this type of management action and the restoration of riparian function. However, the restoration of dikes and levies can be achieved without riparian fencing or planting, and is often considered separate from these actions in the planning process. The restoration of hydromodifications in the Walla Walla EDT model is displayed in Table 10. It is interesting to note that the benefits of the restoration of all channel hydromodifications in the subbasin is approximately two-thirds of the increase in capacity associated with the restoration of 25 percent of riparian function.

Table 10 Habitat Capacity Benefits of a Complete Restoration of All Significant Hydromodifications Within the Walla Walla Subbasin

	Mill Creek Spring Chinook	Touchet Spring Chinook	Walla Walla Spring Chinook	Walla Walla Summer Steelhead
Adults	24	78	277	237
Juveniles	921	2857	23473	8423

3.1.4 Instream Modifications

Instream modifications were modeled for all Walla Walla Subbasin EDT reaches. This scenario assumed that instream habitat restoration actions would be distributed evenly around the subbasin.. The May 2004 Walla Walla Subbasin plan states clearly that restoration actions should target priority geographic areas. However, several co-managers pointed out that NGOs, conservation districts, and others would likely implement instream restoration actions in non-priority geographic areas because their resources were place-focused. Therefore, to fully understand the benefits of instream restoration in a real-world context, it was necessary to simulate the restoration of these attributes across the subbasin.

Restoration of 25, 50, 75, and 100 percent of Walla Walla instream habitat was modeled. For the purposes of this exercise, instream modifications included boulder placement, large woody debris placement, gravel supplementation, or pool formation (Table 11).

Table 11 Restoration Attribute Ratings for the Four Instream Modification Scenarios

Percent Habitat Restored	Wood (%)	Backwater Pools (%)	Pools (%)	Small Cobble (%)	Large Cobble and Boulders (%)	Benthic Macroinvertebrate Div (%)
25%	25	25	25	25	25	5
50%	50	50	50	50	50	10
75%	75	75	75	75	75	25
100%	100	100	100	100	100	33

The instream modification scenarios had positive and substantial impacts on habitat capacity that increased with restoration intensity (see Figures 9 and 10). Instream modifications are a useful tool for addressing specific habitat degradation problems, or for mitigating lost habitat quantity or quality. Instream modifications do not provide streams with shade, so their direct benefit to fish production may often be less than that derived from riparian restoration actions. The results of this analysis suggest that in areas where riparian restoration is impractical, instream modifications can provide significant benefits to fish production in the Walla Walla Subbasin. Combinations of riparian and instream modifications are discussed in the next section. As might be expected, the benefits of diverse scenarios were comparatively greater then either riparian or instream restoration actions alone.

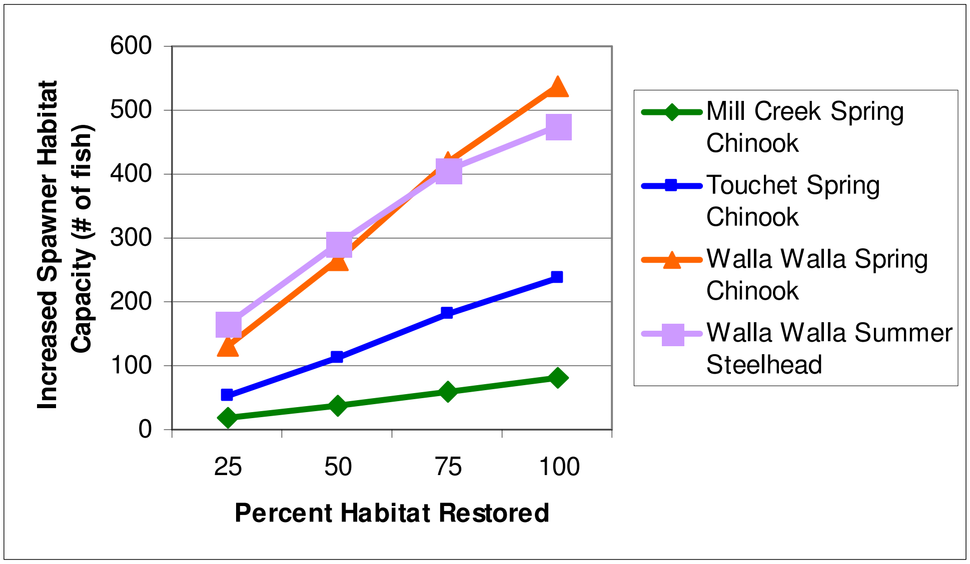

Figure 9 **Modeled Relationship Between Instream Habitat Restoration and Spawner Capacity in the Walla Walla Subbasin**

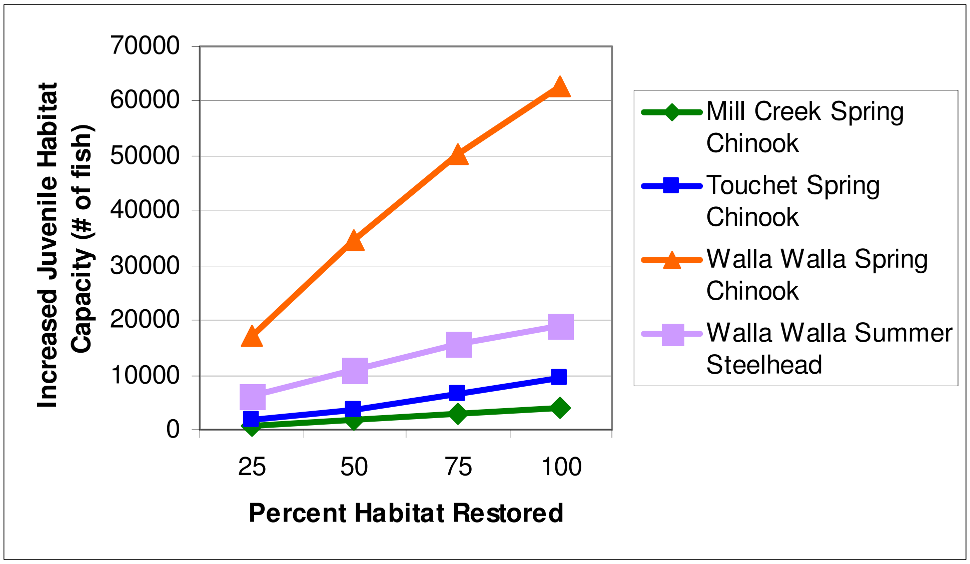

Figure 10 **Modeled Relationship Between Instream Habitat Restoration and Juvenile Rearing Capacity in the Walla Walla Subbasin**

3.1.5 Combined Scenarios

Scenarios were combined at different levels of intensity to discern general benefits of different scenario combinations. Table 12 shows the regimes modeled. See each scenario type and level of efficacy for the specific attribute modifications used.

Table 12 Combinations of Restoration Scenarios

	Riparian Restoration	Instream Modifications	Flow Restoration Walla Walla/Mill Creek/Touchet	Passage
Regime 1	25%	25%	40/25/25	0%
Regime 2	25%	25%	40/25/25	100%
Regime 3	25%	25%	80/50/50	0%
Regime 4	25%	25%	80/50/50	100%
Regime 5	50%	50%	40/25/25	0%
Regime 6	50%	50%	40/25/25	100%

Flow scenarios are for the Walla Walla/Mill Creek/Touchet sections.

Passage restoration appears to have a far more significant impact on habitat capacity when in combination with other actions. For example, the difference in summer steelhead capacity between Regime 3 and Regime 4 is nearly 400 spawners. This number is far greater than total benefits of restoring passage under current conditions. Regime 2 appears to have performed strongest in terms of producing the greatest increase in capacity with the smallest restoration of habitat. A diversified, multifaceted approach appears to be most effective at addressing limiting factors and increasing capacity (see Figures 11 and 12).

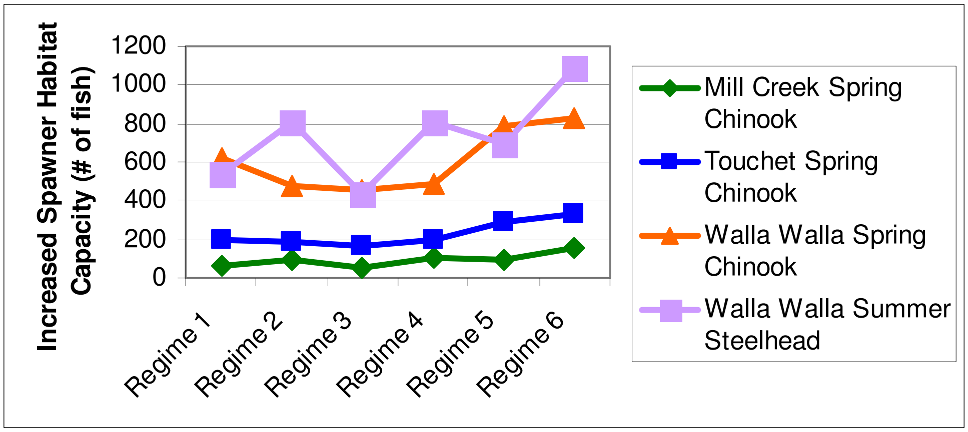

Figure 11 Modeled Restoration Regimes and Their Corresponding Increases in Spawner Capacities for the Walla Walla Subbasin

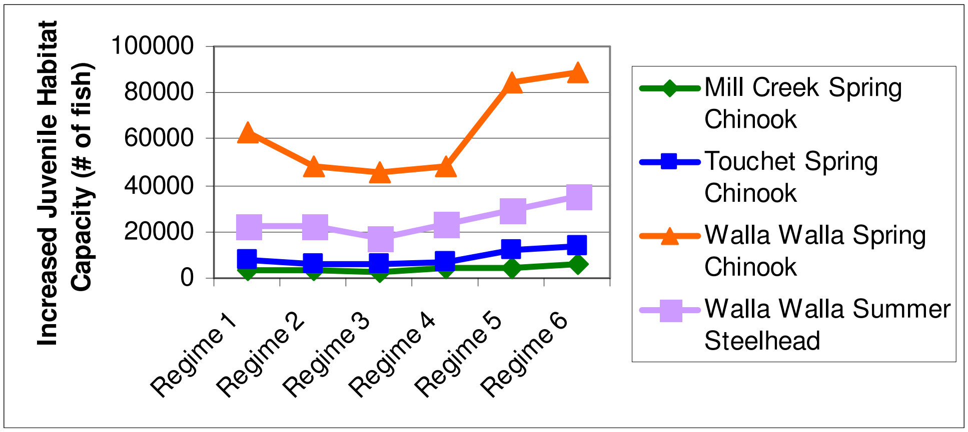

Figure 12 Modeled Restoration Regimes and Their Corresponding Increases in Juvenile Capacity for the Walla Walla Subbasin

A combined flow and riparian restoration regime was modeled for the Walla Walla mainstem, North Fork, and South Fork reaches. This scenario investigated the combined impacts of increased flows and restoration of riparian function in 25, 50, 75, and 100 percent of the habitat. Estimates of temperature restoration for mainstem reaches were derived from the Walla Walla TMDL analysis. The restoration potential of South Fork and North Fork reaches was derived from the fraction towards template for each attribute and regime taken from the Walla Walla TMDL analysis (Tables 13 and 14).

Table 13 Flow/Riparian Restoration Scenarios, Attributes Modified, and the Approximate Fraction Towards Historic Conditions Used

CFS	Riparian Restoration (%)	Confinement Hydro modifications (%)	Riparian Function (%)	Wood (%)	Benthos Diversity (%)	Temperature (%)	Flow (%)	Width Min (%)	Dissolved Oxygen (%)
40	25	25	25	25	25	10	25	25	25
55	50	50	50	50	50	25	33	33	50
80	75	75	75	75	75	33	50	50	75
100	100	100	100	100	100	50	75	75	100

Table 14 Geographic Areas Modeled in the Walla Walla Flow-Riparian Restoration Scenario

GEOGRAPHIC AREA
Lower Walla Walla
Walla Walla, Touchet to Dry
Walla Walla, Dry to Mill
Walla Walla, Mill to E L. Walla Walla
Walla Walla, E Little Walla Walla to Tumalum Br
Walla Walla, Tumalum Bridge to Nursery Bridge
Walla Walla, Nursery Br to Little WW Diversion
Walla Walla, Little Walla Walla Diversion to Forks
SF Walla Walla, Elbow to access limit
SF Walla Walla, mouth to Elbow Creek
NF Walla Walla, L. Meadows to access limit

The combination of flow and riparian restoration was far more effective than either approach singularly in the Walla Walla River. In this scenario a small capacity response is gained from a 25 percent restoration of habitat conditions. However, significant responses were observed from actions impacting 50 percent or more of the habitat conditions. The results of this scenario also support the suggestion that a diversified approach is needed to address limiting factors and increase production in the Walla Walla (see Figures 13 and 14). Note the differences between these results, and those presented in section 3.1.2 on flow restoration.

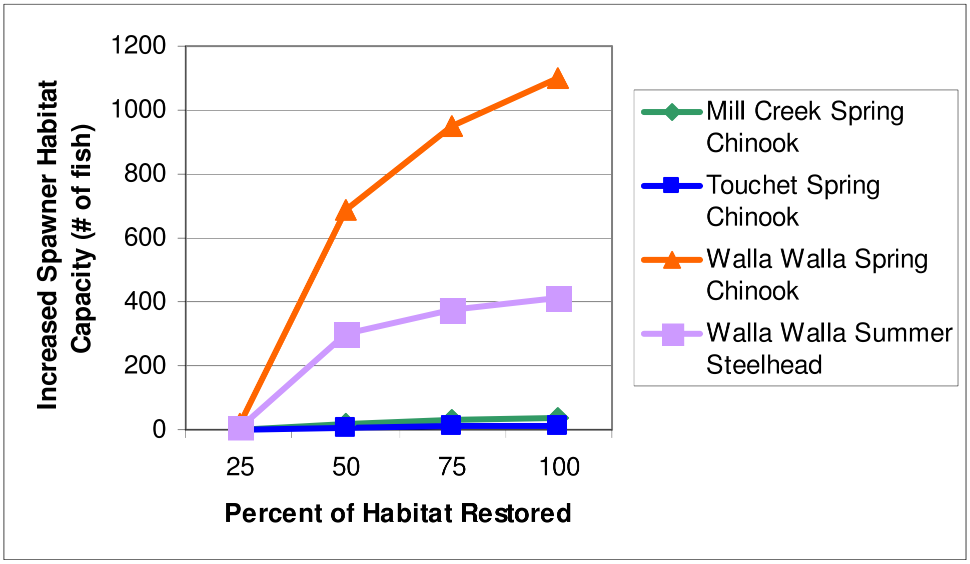

Figure 13 Modeled Relationship Between Flow and Riparian Restoration in the Walla Walla Mainstem and Spawner Habitat Capacity in the Walla Walla Subbasin

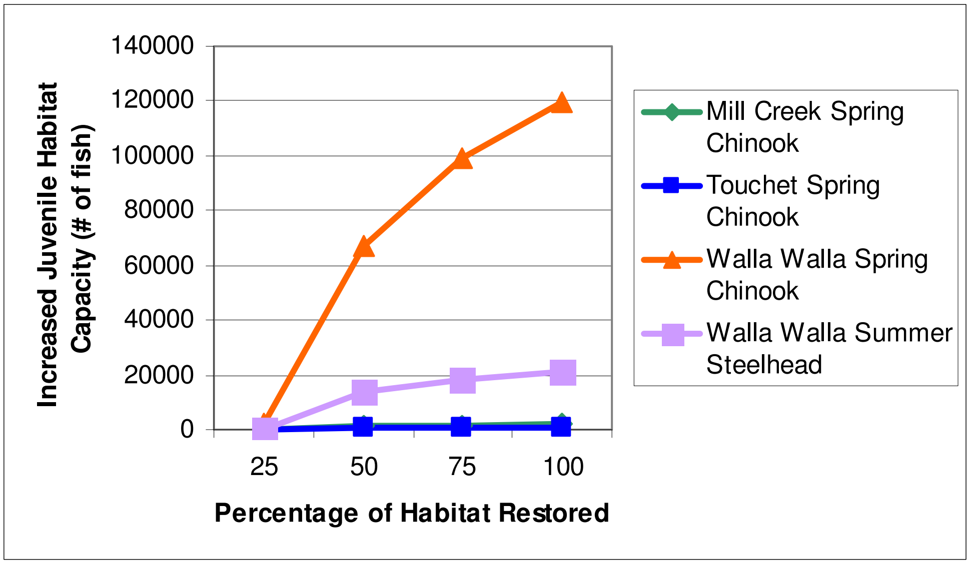

Figure 14 Modeled Relationship Between Flow and Riparian Restoration in the Walla Walla Mainstem Reaches, and Juvenile Habitat Capacity in the Walla Walla Subbasin

3.1.6 Rainwater Restoration

The Rainwater Property contains approximately 20,000 acres of preserve and 10 miles of the South Fork Touchet River. The property is managed by CTUIR for wildlife and fisheries mitigation. Conditions prior to the acquisition seven years ago were poor throughout much of the Rainwater watershed. The plan for restoration includes riparian protection and planting, large woody debris placement, boulder placement, road decommissioning, and reconnection of the channel with the flood plain. A scenario was run restoring 100 percent of the large woody debris, riparian function, benthic macroinvertebrate diversity, substrate composition, bed-scour, water quality, and temperature attributes. The results below suggest a theoretical maximum of fish benefits associated with this project. The EDT model suggests that restoration of the system may lead to a significant increase in capacity (Table 15). It would be interesting to see a comparable analysis of the wildlife benefits associated with this project.

NOTE: It was not the intent of this modeling exercise to endorse or permit restoration of the Rainwater property. Rainwater represents a unique strategy; the conservation and restoration of a large portion of the upper Touchet watershed and South Fork Touchet riparian and instream habitat. The purpose of modeling this scenario was to provide managers with a means of comparing this type of action with the other strategies modeled above and discussed in the subbasin plan.

Table 15 Increase in Spawner and Juvenile Habitat Capacity and Abundance Associated with the Restoration of the Rainwater Property

		Capacity	Abundance
Touchet Spring Chinook	Adults	176	165
	Juveniles	5956	14636
Walla Walla Summer Steelhead	Adults	86	49
	Juveniles	5677	2897

LITERATURE CITED

Butcher, D. and Bower, B. (eds) 2004 Appendix A. River Temperature Analysis; Vegetation, hydrology, and morphology, Walla Walla River Subbasin. Review Draft, Walla Walla Basin Watershed Council and the State Oregon Department of Environmental Quality. 116 pages.

Caldwell, B. and Shedd, J. (2002) Walla Walla River Fish Habitat Analysis Using the Instream Flow Incremental Methodology. Water Resources Program, Washington Department of Ecology. Technical Report 02-11-009

Contor, C., Lambert, M., and Mahoney, B. 2004. Walla Walla Basin Natural Production Monitoring and Evaluation Project Progress Report, 2003. Confederated Tribes of the Umatilla Indian Reservation, report submitted to Bonneville Power Administration, Project No. 2000-039-00.

Contor, Craig R. and Amy Sexton, Editors. 2003. Walla Walla Basin Natural Production Monitoring and Evaluation Project Progress Report, 1999-2002. Confederated Tribes of the Umatilla Indian Reservation, report submitted to Bonneville Power Administration, Project No. 2000-039-00.