Appendix N. Reference Watersheds

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Appendix N. Reference Watersheds

One method chosen to assess the seriousness of sedimentation in the upper South Fork Clearwater River (SF CWR) Subbasin was to compare stream habitat data to that from watersheds that are generally recognized to be in good condition. With input from the Watershed Advisory Group, hydrologists, biologists, and other specialists, we selected Upper Meadow Creek and Bargamin Creeks as reference streams for the tributaries of the SF CWR. The Imnaha River from across the Snake River in Oregon and the lower, main stem reach of Meadow Creek were selected as a reference rivers to compare to the main stem SF CWR.

Reference Comparisons for the SF CWR Tributaries

The Nez Perce National Forest monitors conditions in the Meadow Creek and Bargamin Creek watersheds because they are relatively undisturbed. Reference and comparison locations are shown in Figure N-1. Figure N-1 also shows that Meadow and Bargamin Creeks have similar geology to the SF CWR Subbasin. Likewise, Meadow and Bargamin Creeks have similar rainfall and topography to the upper basin of the SF CWR Subbasin.

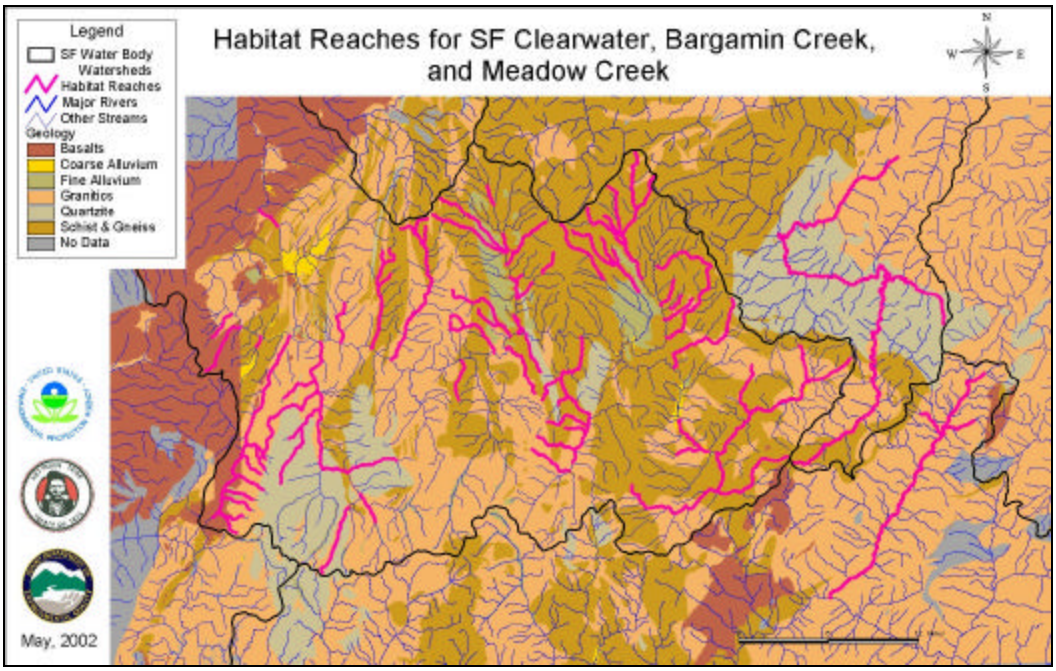

Figure N-1. Locations of Stream Habitat Reference Data for Upper Meadow Creek, Bargamin Creek, and Various Stream Reaches in the SF CWR Subbasin

We sorted the data by stream order into two categories, first and second order vs. third and fourth, so that we would be comparing data from similarly sized streams. We compared the stratified data from the Upper Meadow and Bargamin Creek watersheds

against stratified stream data from the entire SF CWR Subbasin and against stratified data from the Newsome Creek watershed only. We selected the Newsome Creek watershed because it has several 303(d) listed segments and is relatively well sampled. The comparisons are shown in the following series of figures (Figures N-2 through N-6).

Plots of the data show good trends, but the variability of the data is such that statistical significance at one standard deviation cannot be shown. In almost all cases, cobble embeddedness (CE) in the SF CWR Subbasin is significantly higher than in Upper Meadow and Bargamin Creeks. Similarly, for the pool parameters measured, pool qualities in Meadow and Bargamin Creeks were better than in the SF CWR Subbasin. Only a few of the comparisons (average pool tailout depth for small streams from both Newsome Creek and the whole SF CWR against the reference streams and pool average maximum depth for large streams between Newsome Creek and the reference streams) showed statistical significance.

We conclude from these data that sedimentation in the SF CWR Subbasin is increased over the level in Upper Meadow and Bargamin Creeks watersheds. Cobble embeddedness is the one parameter where the differences approach statistical significance in every comparison.

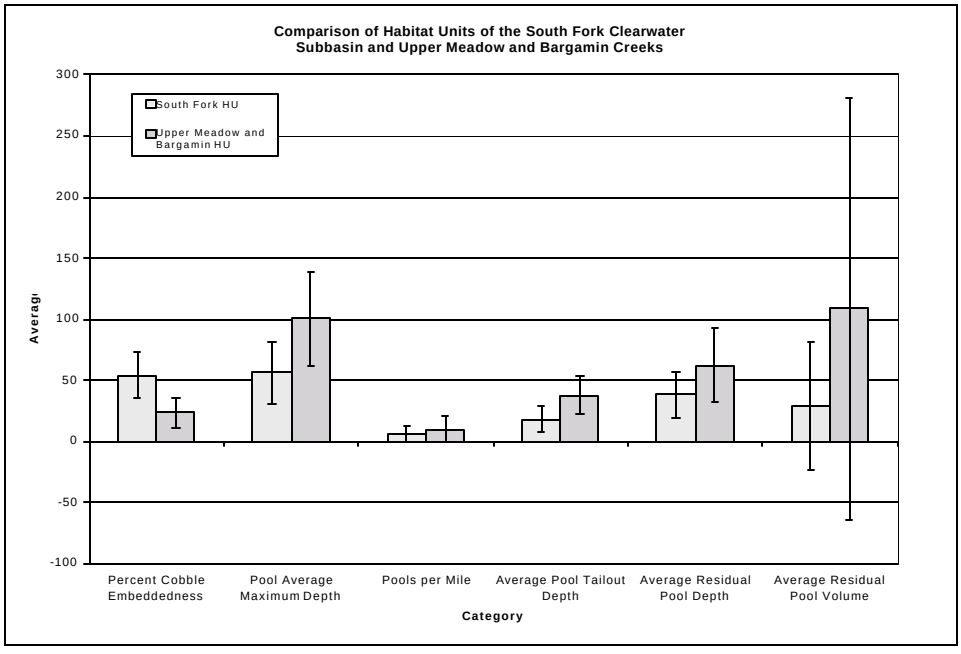

Figure N-2. Comparison of Stream Habitat Data from the SF CWR Subbasin Against Similar Data from Upper Meadow and Bargamin Creeks

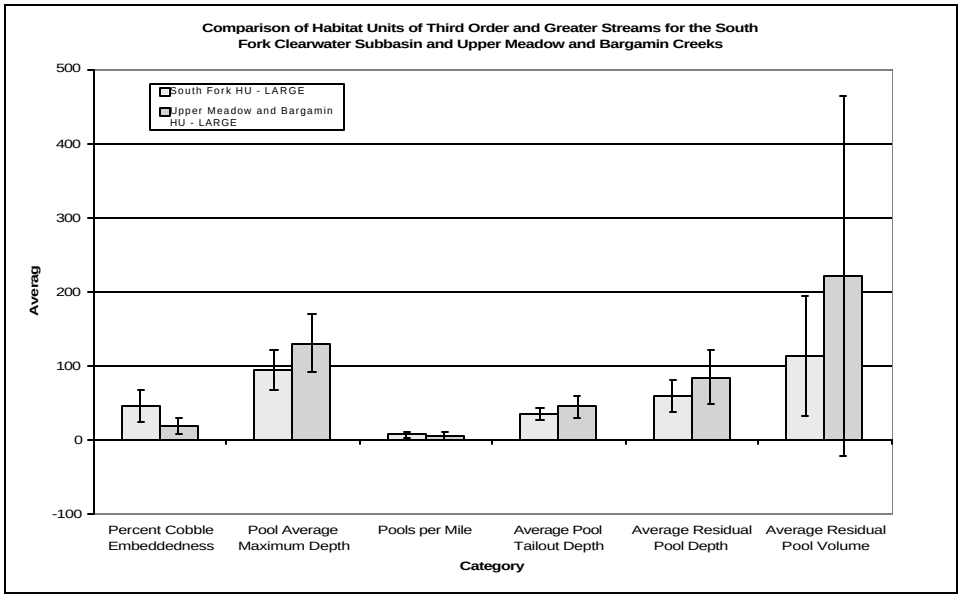

Figure N-3. Comparison of Third and Fourth Order Stream Habitat Data from the SF CWR Subbasin Against Similar Data from Upper Meadow and Bargamin Creeks

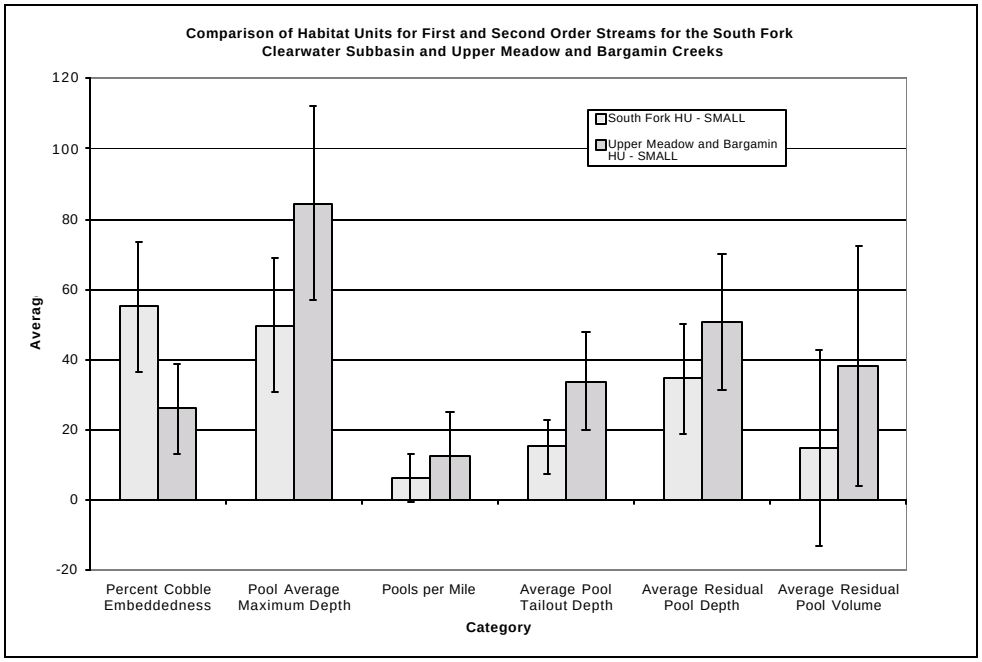

Figure N-4. Comparison of First and Second Order Stream Habitat Data from the SF CWR Subbasin Against Similar Data from Upper Meadow and Bargamin Creeks

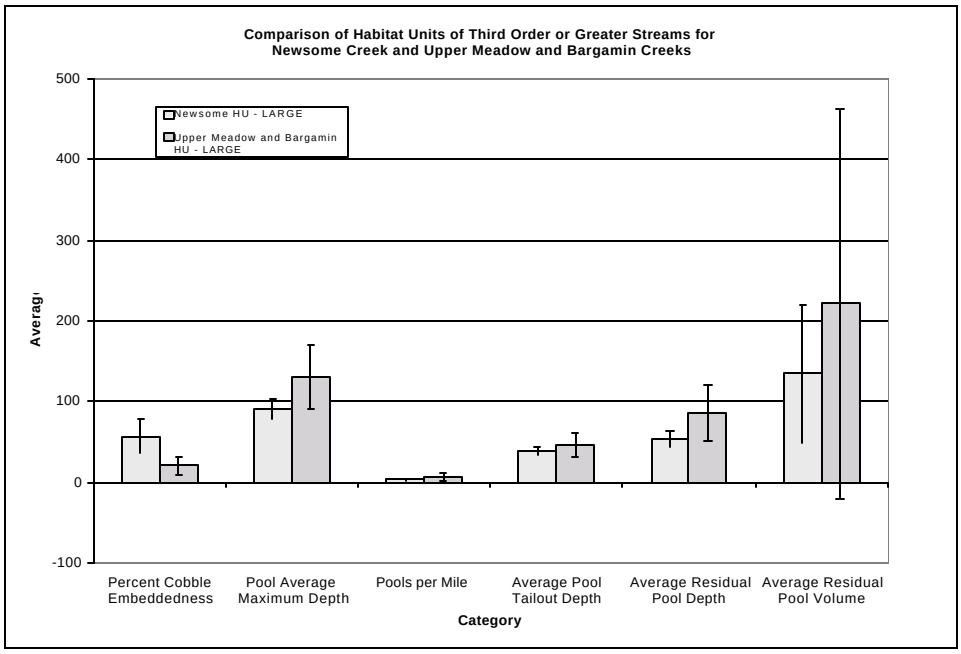

Figure N-5. Comparison of Third and Fourth Order Stream Habitat Data from Newsome Creek Against Similar Data from Upper Meadow and Bargamin Creeks

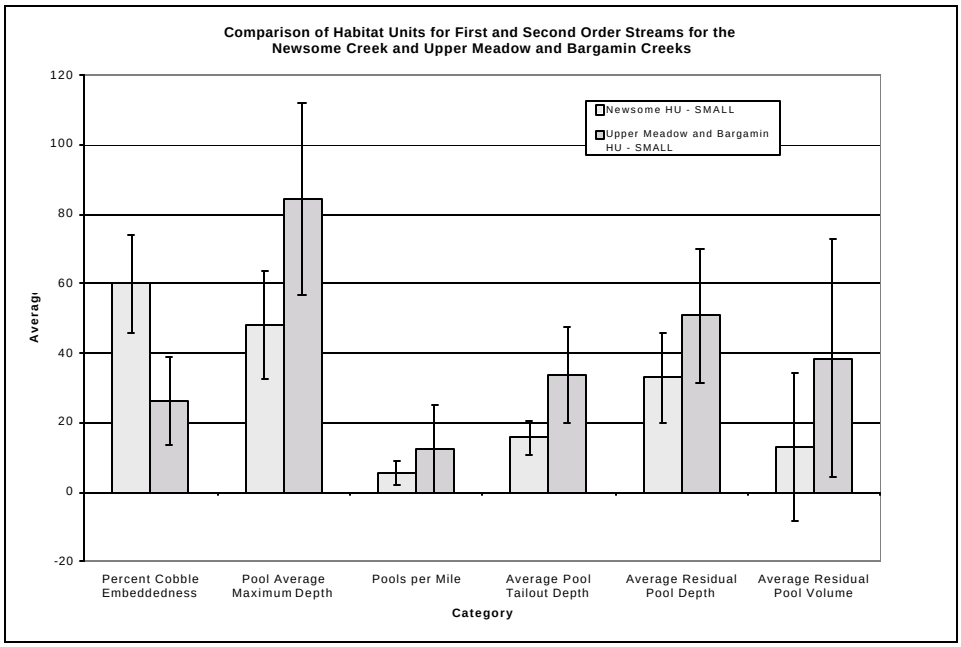

Figure N-6. Comparison of First and Second Order Stream Habitat Data from Newsome Creek Against Similar Data from Upper Meadow and Bargamin Creeks

Table N-1 presents the data from which the above graphs were developed and includes the number of data points and the calculations of standard deviations.

Generally, our conclusions from these data are that bedload in the SF CWR upper basin is resulting in significant increases in CE throughout the area in addition to some reduction of pool volume and size.

Analysis of the data, however, shows that while CE is elevated in the SF CWR Subbasin in comparison to the reference watersheds, the condition is fairly widespread throughout the basin and not specific to the 303(d) listed water bodies, or even to water bodies that exhibit high levels of human impact. Table N-2 shows the data set distributed among water bodies, along with some other conditions of each water body. Shaded water bodies are those with low road densities; and therefore, little impact from human activities. Average CE in those water bodies ranges from 12% in the Gospel-Hump Wilderness up to 72% Silver Creek. Many of the water bodies exhibiting greater than 30% CE have been assessed using Beneficial Use Reconnaissance Program techniques and evaluated according to the Department of Environmental Quality's *Water Body Assessment Guidance* (Grafe et al. 2002), and show full support of their beneficial uses. The only 303(d) listed streams with CE data are Cougar Creek and Lower Newsome Creek. Lower Newsome Creek exhibits very good macroinvertebrate index scores (Chapter 2). Cougar Creek drains a highly weathered granitic watershed, which may account for high CE here.

From these data, therefore, we cannot conclude that the reference stream data indicate impairment of beneficial uses of the 303(d) listed streams. Rather, the reference stream data seem to indicate more of an upper basin-wide issue of elevated sediment levels. This is consistent with the conclusions of the Fisheries Technical Advisory Group (Appendix D).

Table N-1. Stream habitat data for Upper Meadow and Bargamin Creek watersheds and various streams in the SF CWR subbasin.

Habitat Units	Statistic	Count	Percent Cobble Embedded-ness	Pool Average Maximum Depth	Pools per Mile	Average Pool Tailout Depth	Average Residual Pool Depth	Average Residual Pool Volume
Upper Meadow and Bargamin - LARGE	Average	65	20.25	130.69	5.57	45.36	85.45	221.34
Upper Meadow and Bargamin - LARGE	Standard Deviation	65	10.74	39.20	5.45	15.23	35.67	242.18
Upper Meadow and Bargamin - SMALL	Average	85	26.06	84.51	12.43	33.81	50.76	38.36
Upper Meadow and Bargamin - SMALL	Standard Deviation	85	12.70	27.75	12.57	13.92	19.16	34.23
South Fork Clearwater - LARGE	Average	69	46.06	94.95	7.29	35.88	59.24	113.45
South Fork Clearwater - LARGE	Standard Deviation	69	20.90	25.75	5.11	7.92	21.51	81.64
South Fork Clearwater - SMALL	Average	661	55.01	49.77	6.29	15.25	34.56	14.94
South Fork Clearwater - SMALL	Standard Deviation	661	18.62	19.15	6.67	7.57	15.52	27.83
Newsome - LARGE	Average	3	56.67	90.67	3.00	38.00	53.33	134.59
Newsome - LARGE	Standard Deviation	3	21.13	12.50	1.00	5.57	10.02	85.80
Newsome - SMALL	Average	45	60.04	48.38	5.60	15.72	32.85	12.82
Newsome - SMALL	Standard Deviation	45	14.07	15.56	3.65	4.97	12.87	21.41

Table N-2. Cobble embeddedness data for the SF CWR.

Water Body Name	WBID*	CE** Count	CE Mean	CE Max	CE Min	CE*** STD	BURP****	Road Density	Sediment	Dredge Mined	303(d) Listed	
			%	%	%		(?)	(mi/mi^2)	(t/WB/yr)	(?)	(?)	Comments
Mill	13	82	45	95	10	20	No	3.0	145	No	No	
Lower Johns	14	45	48	84	13	20	Yes	1.9	23	No	No	Bull Trout Spawning
Middle Johns	17	8	38	62	14	19	No	0.6	0.64	No	No	Wilderness & Bull Trout Spawning
Upper Johns	18	3	29	29	29	0	No	0.7	0	No	No	Wilderness & Bull Trout Spawning
Moores	19	2	12	12	12	0	Yes	1.5	0.09	No	No	Wilderness & Bull Trout Spawning
Hagen	21	2	12	12	12	0	No	0.4	0	No	No	Wilderness
Lower Crooked	31	34	52	100	23	17	Yes	3.2	29	Yes	No	
Upper Crooked	32	50	58	95	0	22	Yes	2.0	20	Yes	No	Bull Trout Spawning
Middle Red	38	6	64	76	45	10	Yes	5.2	217	Yes	No	Includes Dawson Creek
Lower SF Red	40	5	43	48	29	8	Yes	4.2	18	No	No	Bull Trout Spawning
Middle SF Red	41	5	44	58	34	10	No	4.3	20	No	No	Bull Trout Spawning
Upper Red	45	51	54	94	29	16	Yes	3.8	116	No	No	
Otterson	48	14	40	61	14	13	Yes	0.8	0.23	No	No	BURP Reference
Red Horse	51	25	50	60	36	7	Yes	2.4	17	Yes	No	
Lower American	52	19	72	84	64	8	No	3.4	55	No	No	Side Channels Only
Kirks Fork	53	24	54	19	35	11	Yes	1.7	7	No	No	

Water Body Name	WBID*	CE** Count	CE Mean	CE Max	CE Min	CE*** STD	BURP****	Road Density	Sediment	Dredge Mined	303(d) Listed	
			%	%	%		(?)	(mi/mi^2)	(t/WB/yr)	(?)	(?)	Comments
Upper American	55	31	55	63	42	5	Yes	2.6	7.3	Yes	No	
Little Elk	57	2	86	86	86	0	Yes	3.4	49	Yes	No	Listed for Temperature
Big Elk	58	14	62	79	37	14	Yes	2.9	88	Yes (lower)	No	Listed for Temperature
Lower Newsome	62	3	57	81	43	21	Yes	4.8	49	Yes	Yes	
Nugget	64	1	48	48	48	0	Yes	4.6	6	Yes	No	
Baldy	70	11	56	94	34	16	Yes	4.7	9	Yes (lower)	No	Bull Trout Spawning
Pilot	71	15	64	82	45	13	Yes	1.1	4	Yes (lower)	No	Bull Trout Spawning
Leggett	75	25	59	86	39	13	Yes	4.4	18	Y	No	
Silver	77	11	72	91	44	16	Yes	1.5	15	No	No	Mostly Roadless
Peasley	78	21	77	91	63	9	Yes	4.7	44	No	No	
Cougar	79	9	94	97	92	4	Yes	4.3	50	No	Yes	Granitics
SF sidewall streams		19	42	85	22	15	No	NA	NA	Yes	Yes	
SF Totals		545	54	100	0	19						
Upper Meadow Reference		10	49	68	39	8						

Water Body Name	WBID*	CE** Count	CE Mean	CE Max	CE Min	CE*** STD	BURP****	Road Density	Sediment	Dredge Mined	303(d) Listed	
			%	%	%		(?)	(mi/mi^2)	(t/WB/yr)	(?)	(?)	Comments
Bargamin		18	43	73	19	14						

* Water body identification number
** cobble embeddedness
*** cobble embeddedness standard deviation
**** Beneficial Use Reconnaissance Program (has stream been surveyed by?)

Reference Comparisons of the Main Stem SF CWR

For the main stem SF CWR, we compared data from the Imnaha River across the border in Oregon and from lower Meadow Creek. It was assumed that the Imnaha River and lower Meadow Creek have similar flow volumes to the SF CWR, although Figure N-7 in conjunction with the pool volume data to follow indicate that the SF CWR probably is a somewhat larger river. Lower Meadow Creek is a steeper, more confined system (Figure N-8). The Imnaha River was chosen particularly as representative of a river system in the Columbia River basalt plateau. The following sets of figures (Figures N-7 through N-9) show the comparisons for different river habitat parameters.

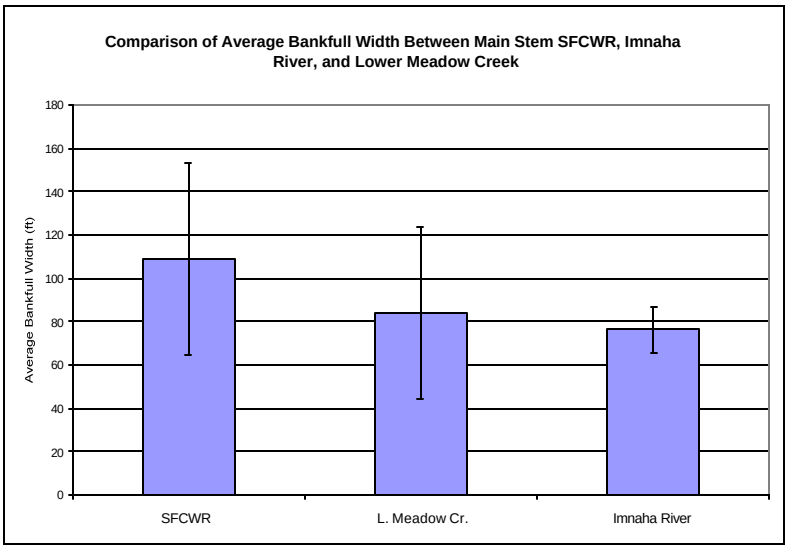

Figure N-7. Comparison of Average Bankfull Width of the SF CWR, Lower Meadow Creek, and the Imnaha River

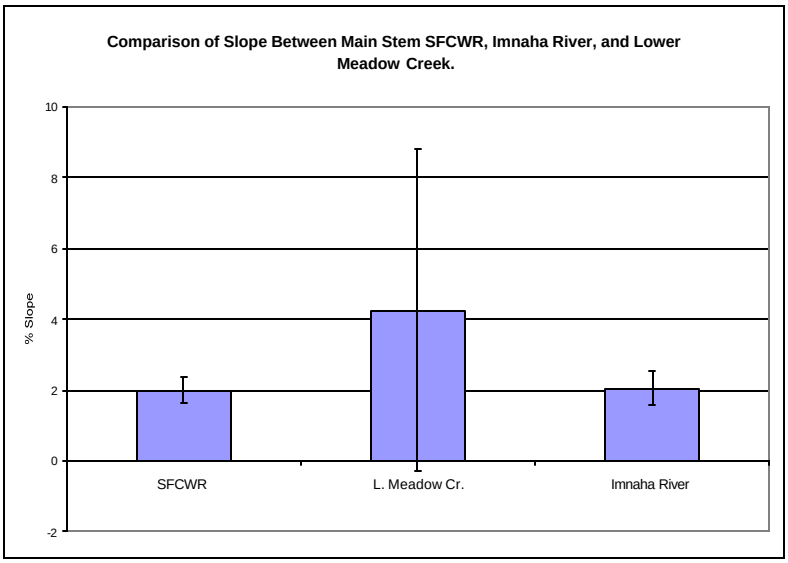

Figure N-8. Comparison of Average Slopes of the SF CWR, Lower Meadow Creek, and the Imnaha River

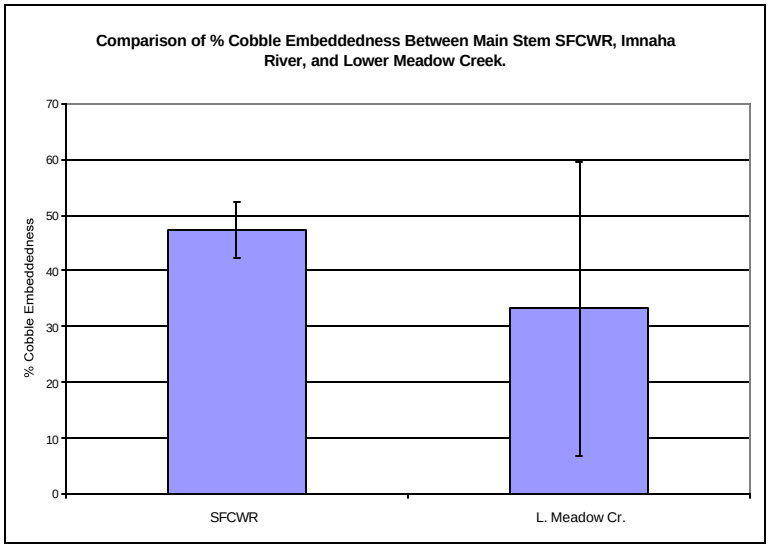

Figure N-9. Comparison of Cobble Embeddedness of the SF CWR and Lower Meadow Creek

Cobble embeddedness data were not available for the Imnaha River. The level of CE in the main stem SF CWR is elevated by comparison to lower Meadow Creek, but not by as much as for the smaller streams. There is also some question as to the validity of CE measurements in larger rivers.

The SF CWR has larger residual pool volume than either lower Meadow Creek or the Imnaha River (Figure N-10). Figures N-11 through N-15 show that the SF CWR also has

larger pool width, pool length, bank full depth, bank full width, and width-to-depth ratio than either the Imnaha River or lower Meadow Creek.

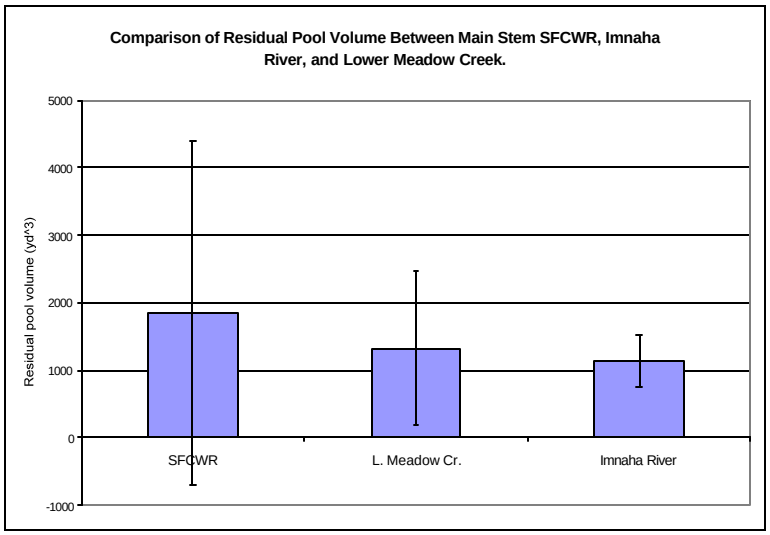

Figure N-10. Residual Pool Volume Comparisons of the SF CWR, Lower Meadow Creek, and the Imnaha River

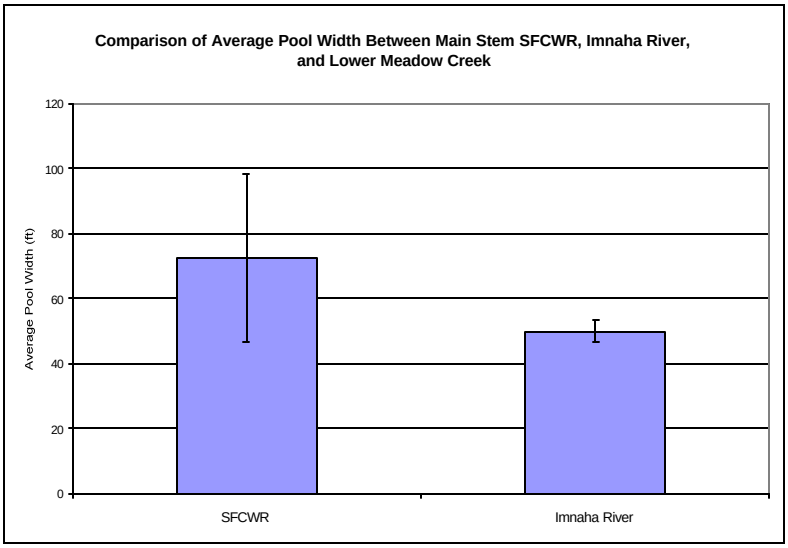

Figure N-11. Comparison of Pool Widths of the SF CWR and the Imnaha River

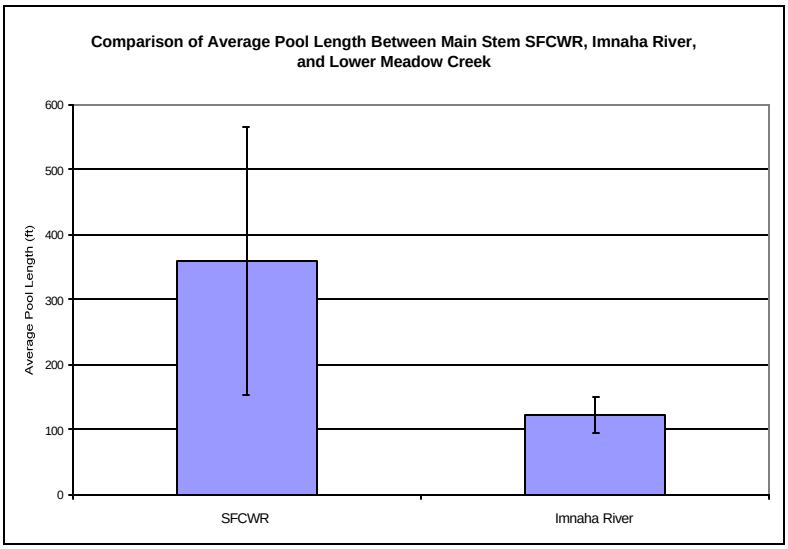

Figure N-12. Comparison of Pool Lengths of the SF CWR and the Imnaha River

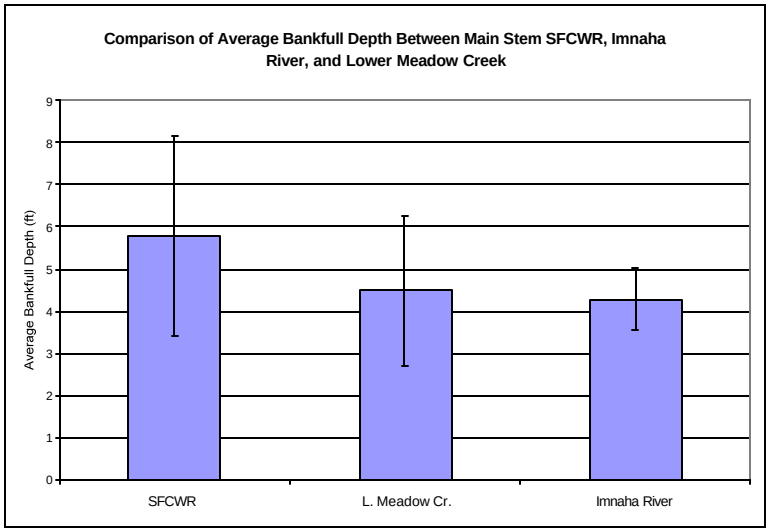

Figure N-13. Comparison of Bankfull Depths of the SF CWR, Lower Meadow Creek, and the Imnaha River

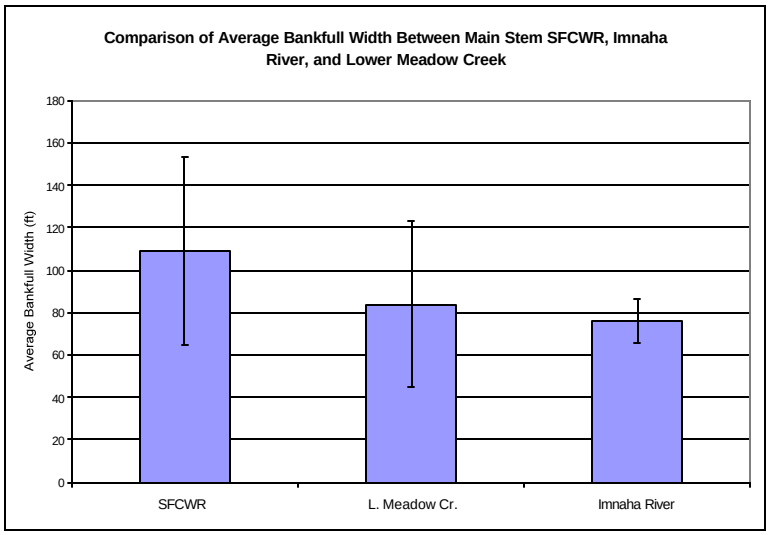

Figure N-14. Comparison of Bankfull Widths of the SF CWR, Lower Meadow Creek, and the Imnaha River

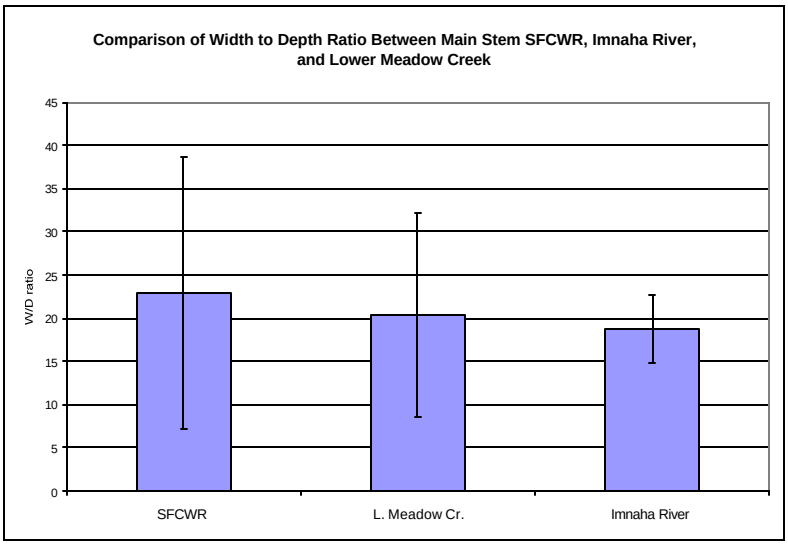

Figure N-15. Comparison of Width-to-Depth Ratios of the SF CWR, Lower Meadow Creek, and the Imnaha River

The SF CWR has the lowest number of pools per mile of any of the three systems (Figure N-16). Lower Meadow Creek, with a steeper, more confined channel, may not be a good comparison for pools per mile. The Imnaha River is more comparable in consideration of slope, and does have more pools per mile than the SF CWR, but the pools are smaller.

In general, given the variability of these data and the differences between the river systems, we cannot conclude that habitat in the main stem SF CWR is impaired in comparison to these other systems. It does appear that CE in the SF CWR is elevated in comparison to these reference river systems.

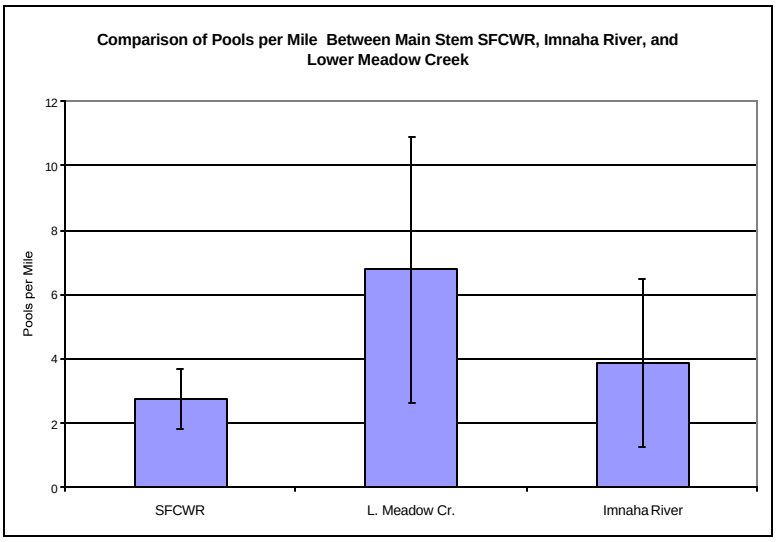

Figure N-16. Comparison of Number of Pools per Mile of the SF CWR, Lower Meadow Creek, and the Imnaha River

The above data indicate that the sizes of the rivers may be significantly different and this may be affecting the comparisons. We stratified the reaches by pool size and ran the comparisons again (Figure N-17). Some small part of the differences among the systems could be accounted for with this stratification, but the patterns remain the same.

In the end, however, we cannot conclude that the reference rivers indicate any significant impairment of habitat conditions in the main stem SF CWR.

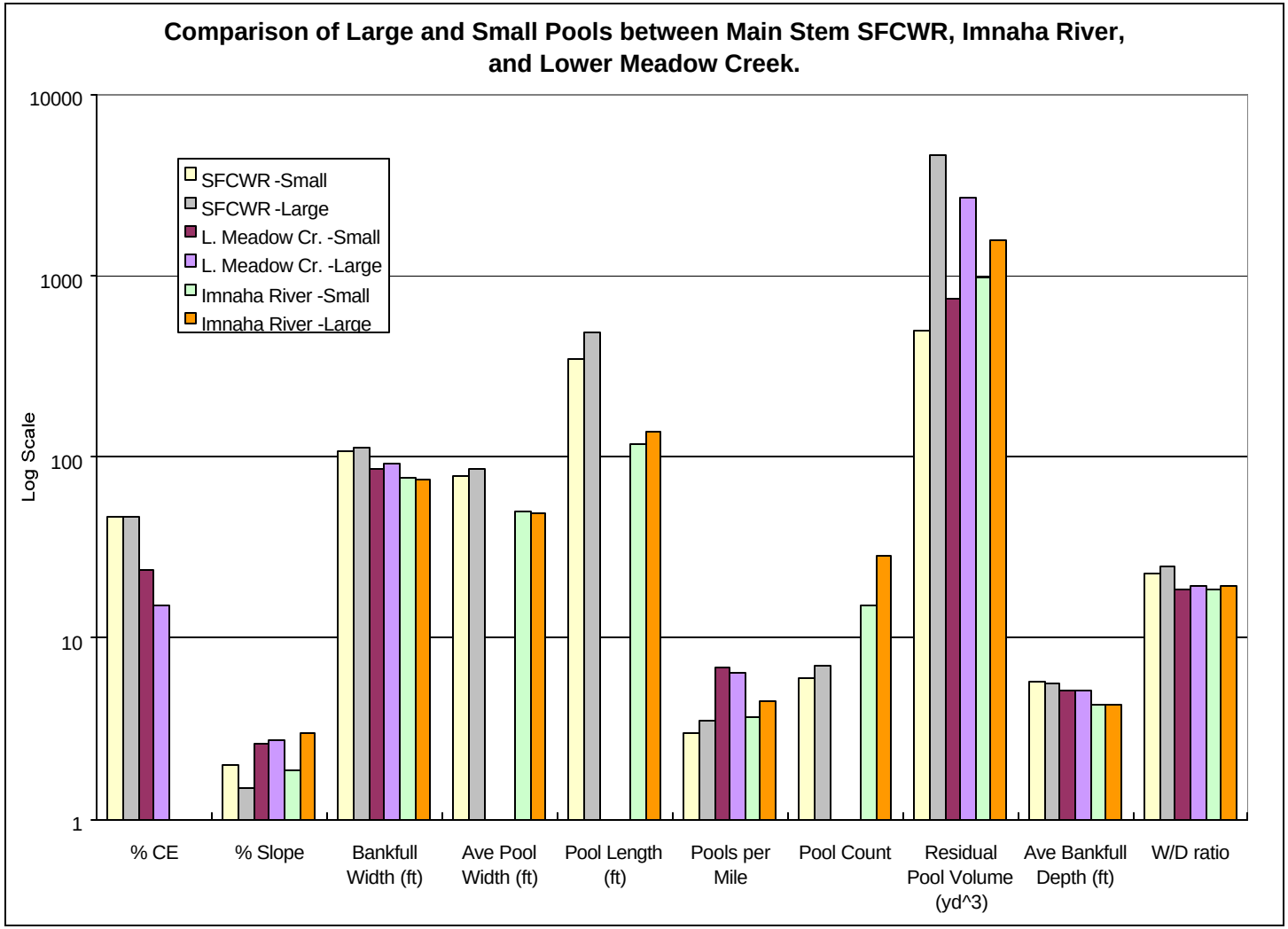

Figure N-17. Comparisons of the Main Stem SF CWR with the Imnaha River and Lower Meadow Creek