APPENDIX 1

Habitat types and descriptions adapted from Bisson et al. 1982 and Upper Colorado River Basin Database

Habitat Category	Habitat Description
Riffles	Shallow (<20 cm deep), moderate current velocity (20-50 cm/sec), moderate turbulence, substrate gravel, pebble, and cobble-sized particles (2-256 mm), gradient <4%
Rapids	Gradient >4%, swiftly flowing water (>50 cm/sec), considerable turbulence, substrate largely composed of boulders
Pools	A portion of stream that is deep and less velocity than run; often lies between riffles
Eddies	Presence of counter- current; usually deep and less velocity than main-channel
Runs	Possess attributes of both riffles and pools; characterized by moderately shallow water (10-30 cm deep) with laminar flow; substrate gravel and cobble.

APPENDIX 2 - Habitat Suitability Criteria

Table 1. Habitat use curve for adult Colorado pikeminnow for daytime resting (bottom velocities); from Miller and Modde (1999).

Velocity (m/s)	HSI	Depth (m)	HSI
0.000	0.25	0.000	0.00
0.027	0.50	0.427	0.00
0.030	1.00	0.792	0.125
0.244	1.00	0.914	0.25
0.366	0.500	1.158	0.50
0.396	0.25	1.280	1.00
0.427	0.00	6.096	1.00

Table 2. Habitat use curve for adult Colorado pikeminnow for night foraging (mean column velocities; from Miller and Modde, Chapter 4, in Modde et al. 1999).

Velocity (m/s)	HSI	Depth (m)	HSI
0.000	0.25	0.000	0.00
0.003	0.50	0.304	0.00
0.030	1.00	0.366	0.25
0.671	1.00	0.427	0.50
0.914	0.50	0.487	1.00
1.097	0.25	1.280	1.00
1.280	0.00	1.283	0.50
2.743	0.00	1.402	0.25
		1.524	0.00
		6.096	0.00

APPENDIX 3

Table 1.-The location, description and length in river miles/kilometers (rm/rkm) of river strata, length in feet/meter (ft, m) of habitat cluster and transect, and habitat type sampled during the White River survey, Colorado and Utah, 1995 and 1996.

Strata[a]				Cluster[b]		Transect[c]		
		Start-End	Length	Length		Ft (m) From Top		
No.	Location, Description and Gradient	rm (rkm)	rm (rkm)	No.	rm (rkm)	No. of cluster	Habitat Type/Sequence[d]	
1	White River mouth - Mt. Fuel Bridge, Ut.	0-21.7 (0-34.9)	21.7 (34.9)	1	1.0 (1.6)	1 2	16 (5) 627 (191)	Run (R) Riffle (R)
	Wide open meandering floodplain with a 0.05% gradient.			2	7.5 (12.1)	1 2	276 (84) 407 (124)	Eddy, Run (R) Eddy, Run,Eddy (R)
				3	12.3 (19.8)	1 2	82 (25) 679 (207)	Run, Eddy (R) Riffle (R)
				4	16.2 (26.0)	1 2	131 (40) 282 (86)	Riffle (R) Run (R)
				5	17.2 (27.7)	1 2	305 (93) 338 (103)	Riffle (R) Pool, Riffle, Run (R)
				6	21.1 (34.0)	1 2	125 (38) 709 (216)	Run, Eddy (R) Riffle (R)
2	Mt. Fuel Bridge - Ignacio Bridge, Highway 45, Ut.	21.7-59.3 (34.9-95.4)	37.6 (60.5)	1	23.3 (37.5)	1 2	312 (95) 571 (174)	Run, Eddy (L) Run, Riffle, Run (R)
	Canyon bound area with a 0.10% gradient.			2	28.2 (45.4)	1 2	400 (122) 479 (146)	Eddy, Riffle (R) Riffle, Eddy (R)
				3	29.9 (48.1)	1 2	427 (130) 584 (178)	Run, Pool (R) Riffle (R)
				4	30.4 (48.9)	1 2	495 (151) 554 (169)	Eddy, Run (R) Riffle (R)
				5	32.3 (52.0)	1 2	66 (20) 466 (142)	Riffle (R) Riffle (R)
				6	33.6 (54.0)	1 2	62 (19) 394 (120)	Run (R) Riffle, Pool, Eddy (R)
				7	38.7 (62.3)	1 2	167 (51) 295 (90)	Run (R) Riffle, Pool (R)
				8	44.8 (72.1)	1 2	358 (109) 387 (118)	Run (R) Riffle, Pool (R)

Table 1.-Continued.

Strata[a] No.	Location, Description and Gradient	Start-End rm (rkm)	Length rm (rkm)	Cluster[b] No.	Length rm (rkm)	Transect[c] No. of cluster	Ft (m) From Top	Habitat Type/Sequence[d]
2	Mt. Fuel Bridge - Ignacio Bridge, Highway 45, Ut. Canyon bound area with a 0.10% gradient.	21.7-59.3 (34.9-95.4)	37.6 (60.5)	9	46.3 (74.5)	1 2	26 (8) 187 (57)	Run, Eddy (R) Riffle (R)
				10	47.7 (76.8)	1 2	197 (60) 548 (167)	Run, Eddy, Run, Pool (L) Run, Eddy, Riffle (R)
				11	50.8 (81.8)	1 2	26 (8) 614 (187)	Riffle, Eddy (R) Riffle, Pool, Eddy (R)
				12	54.1 (87.0)	1 2	174 (53) 210 (64)	Riffle (R) Riffle (R)
				13	57.7 (92.8)	1 2	75 (23) 545 (166)	Run, Pool (R) Riffle (R)
				14	59.2 (95.3)	1 2	3 (1) 394 (120)	Riffle (R) Run, Riffle (R)
3	Ignacio Bridge, Hiway 45, Ut. - Highway 64 Bridge, Rangely, Co. Some floodplain, but mostly canyon area, 0.16% gradient.	59.3-94.2 (95.4-151.6)	34.9 (56.2)	1	62.1 (99.9)	1 2	0 (0) 161 (49)	Riffle, Run (R) Riffle (R)
				2	67.3 (108.3)	1 2	394 (120) 535 (163)	Run, Eddy (R) Run (R)
				3	68.0 (109.5)	1 2	30 (9) 614 (187)	Run (R) Run, Eddy (R)
				4	69.0 (111.1)	1 2	318 (97) 617 (188)	Eddy, Run (R) Eddy, Run (R)
				5	71.8 (115.6)	1 2	387 (118) 607 (185)	Run (R) Run, Eddy (L)
				6	75.3 (121.2)	1 2	95 (29) 328 (100)	Riffle, Pool, Eddy (R) Eddy, Run, Pool, Eddy (R)
				7	75.9 (122.1)	1 2	98 (30) 322 (98)	Eddy, Riffle (R) Run, Eddy (R)
				8	77.1 (124.0)	1 2	138 (42) 358 (109)	Pool, Run, Eddy (R) Run, Riffle, Eddy (R)
				9	78.8 (126.8)	1 2	554 (169) 643 (196)	Eddy, Run (R) Run (R)

Table 1.-Continued.

Strata[a] No.	Location, Description and Gradient	Start-End rm (rkm)	Length rm (rkm)	Cluster[b] No.	Length rm (rkm)	Transect[c] No. of cluster	Ft (m) From Top	Habitat Type/Sequence[d]
3	Ignacio Bridge, Hiway 45, Ut. - Highway 64 Bridge, Rangely, Co. Some floodplain, but mostly canyon area, 0.16% gradient.	59.3-94.2 (95.4-151.6)	34.9 (56.2)	10	79.4 (127.8)	1 2	318 (97) 433 (132)	Run (R) Riffle, Run (R)
				11	80.0 (128.8)	1 2	20 (6) 486 (148)	Run, Eddy, Run (R) Run (R)
				12	80.5 (129.5)	1 2	358 (109) 551 (168)	Riffle, Eddy (R) Eddy, Riffle (R)
				13	82.4 (132.6)	1 2	187 (57) 285 (87)	Riffle, Pool (L) Riffle, Pool (R)
				14	83.9 (135.0)	1 2	220 (67) 299 (91)	Riffle (R) Riffle (R)
				15	87.0 (140.0)	1 2	125 (38) 636 (194)	Run (R) Riffle (R)
				16	89.7 (144.3)	1 2	148 (45) 361 (110)	Eddy, Riffle (R) Run (R)
				17	93.4 (150.3)	1 2	108 (33) 463 (141)	Run, Riffle, Pool (R) Pool, Riffle (R)
4	Highway 64 Bridge - Taylor Draw Dam, Rangely, Co. Open canyon with some open floodplain, 0.13% gradient.	94.2-104.5 (151.6-168.2)	10.3 (16.6)	1	94.6 (152.2)	1 2	66 (20) 295 (90)	Eddy, Run (R) Eddy, Riffle (R)
				2	96.1 (154.7)	1 2	269 (82) 377 (115)	Eddy, Run (R) Riffle, Eddy (R)
				3	100.5 (161.7)	1 2	75 (23) 341 (104)	Run (R) Run (R)
				4	103.3 (166.3)	1 2	95 (29) 256 (78)	Riffle (R) Riffle (R)
				5	104.2 (167.7)	1 2	131 (40) 531 (162)	Riffle (R) Riffle (R)
				6	104.4 (168.0)	1 2	266 (81) 502 (153)	Pool, Run (R) Pool, Run (R)

[a]Strata were selected to decrease variation in differences within the White River.
[b]Habitat Clusters = 10 * the mean width of each strata, and assumed to capture two representative pool-run-riffle sequences.
[c]Habitat Transect = a line randomly placed across the river perpendicular to the flow where habitat width, depth and water velocity

measurements were taken.
[d]Habitat Sequences = The sequence of habitat types across the habitat transect starting at either the right (R) or left (L) bank, looking downstream.

Appendix 4

Wetted perimeter and riffle coverage-discharge relations for riffle cross sections.

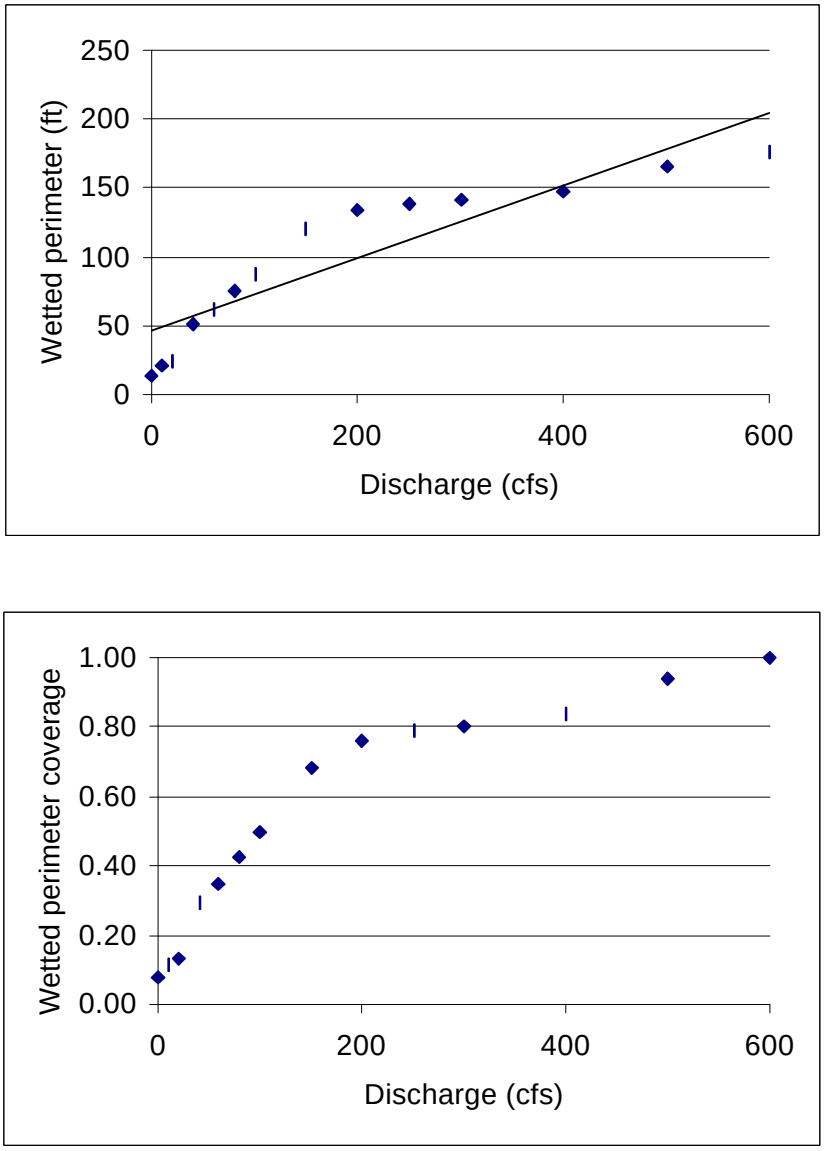
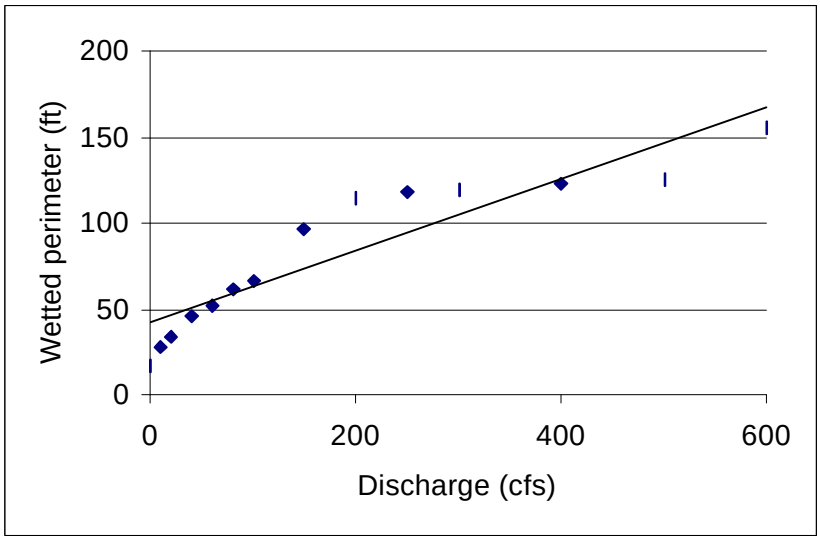


Figure A-1. Cross section 10102



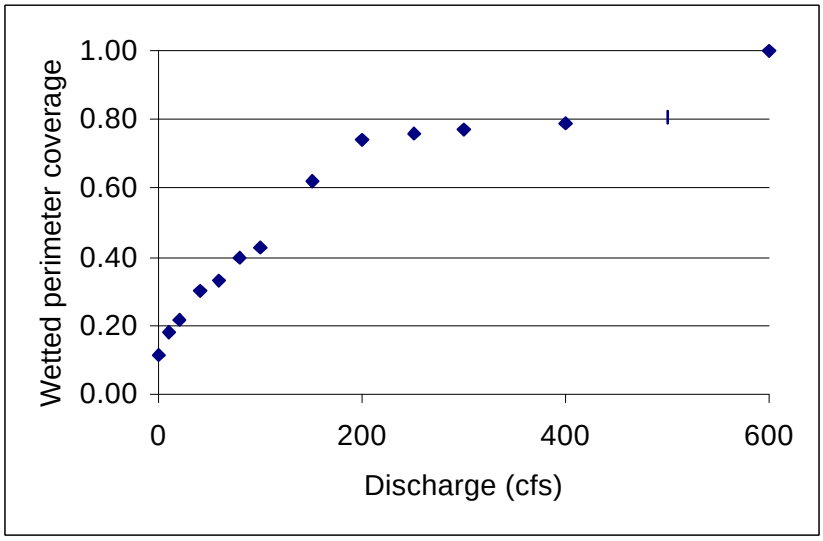
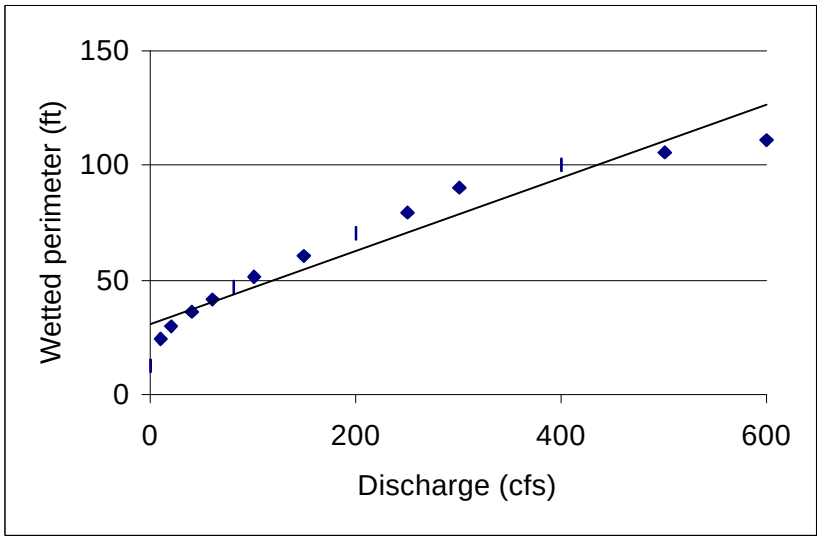


Figure A-2. Cross section 10302



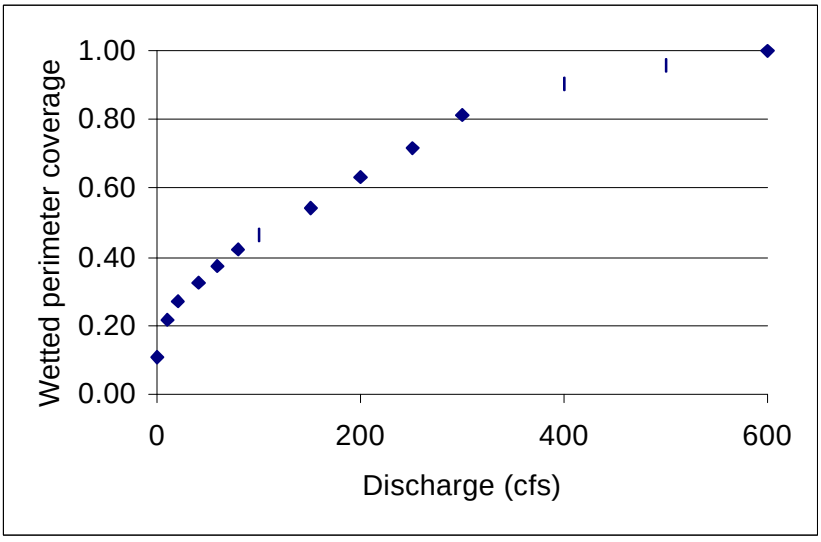
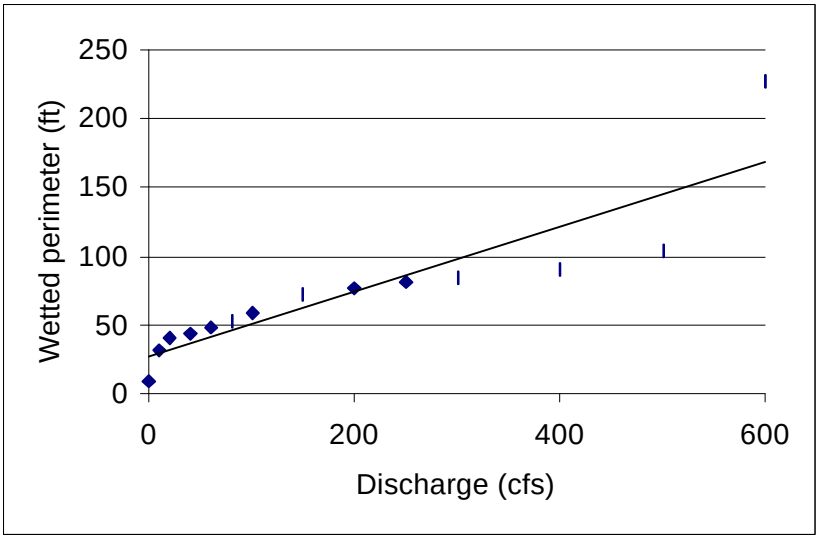


Figure A-3. Cross section 10401



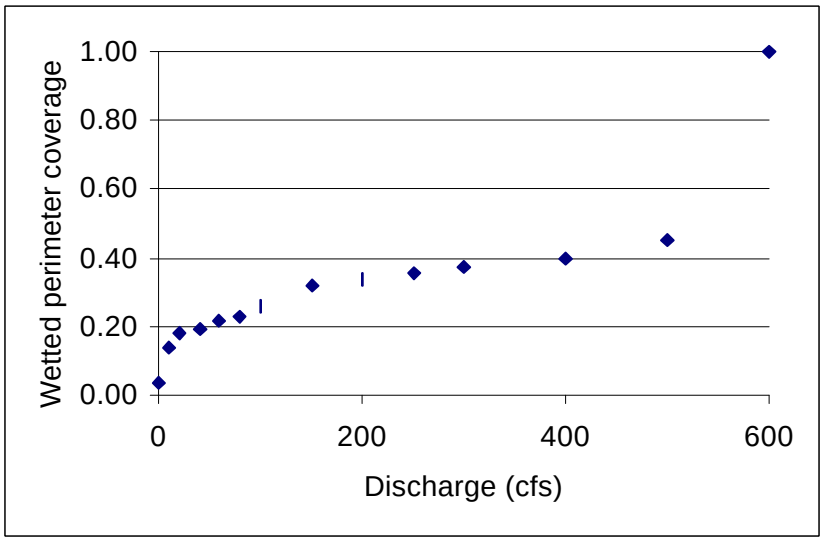
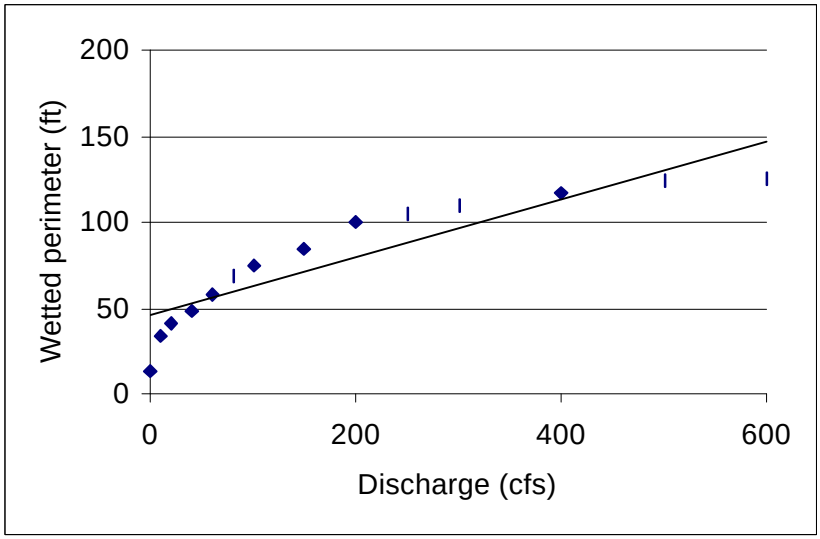


Figure A-4. Cross section 10501.



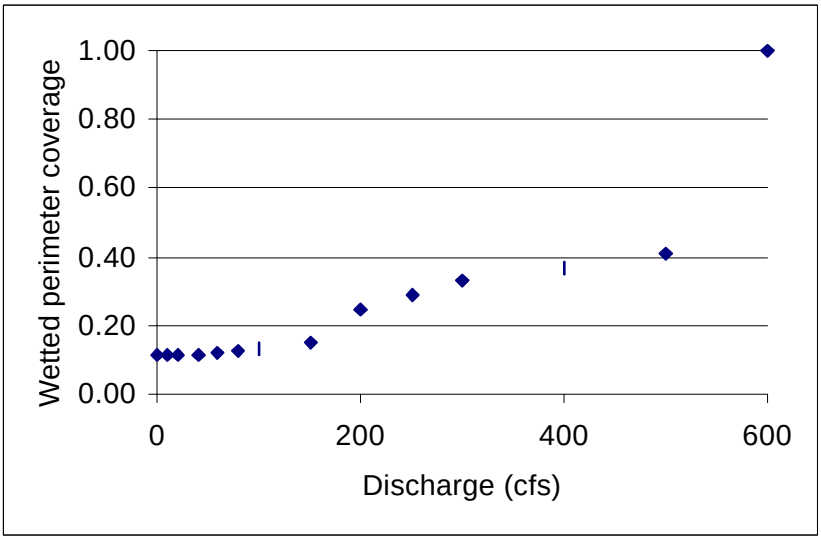
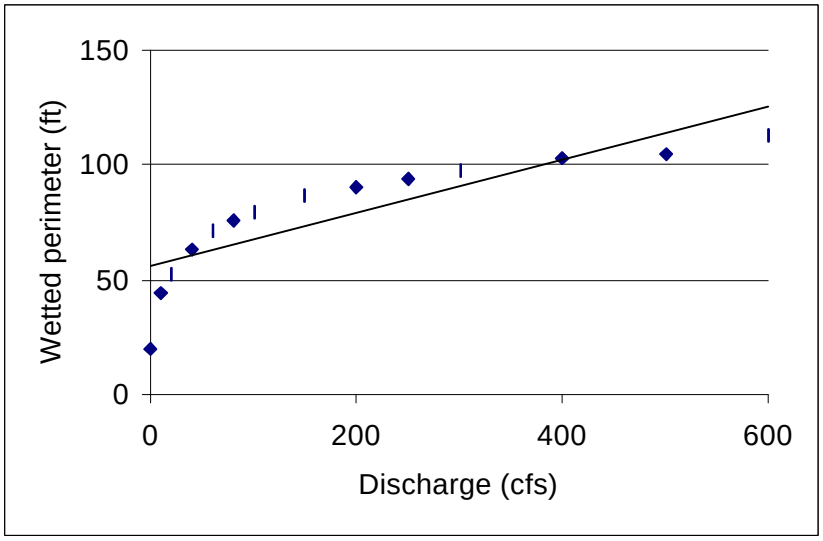


Figure A-5. Cross section 10602.



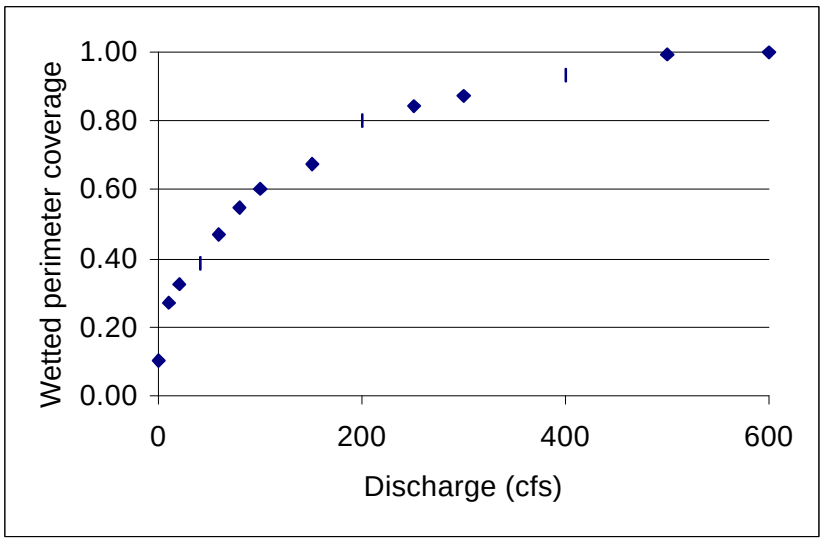


Figure A-6. Cross section 20201.

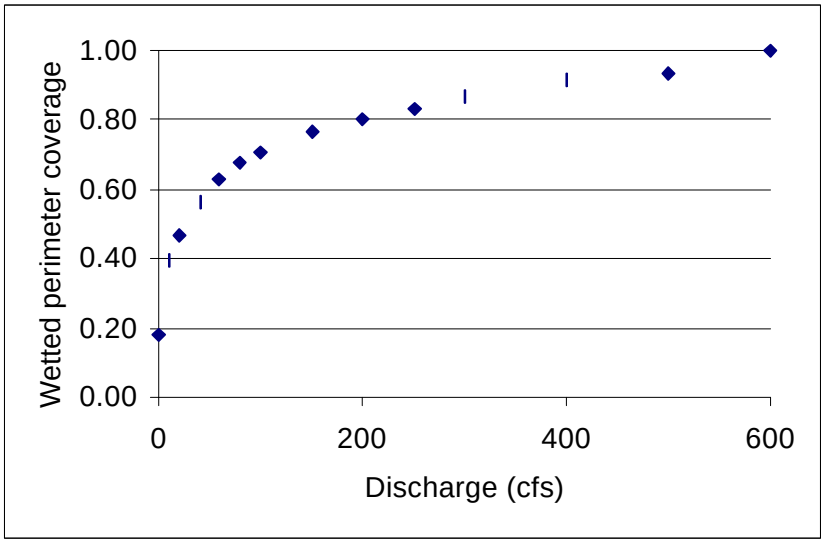
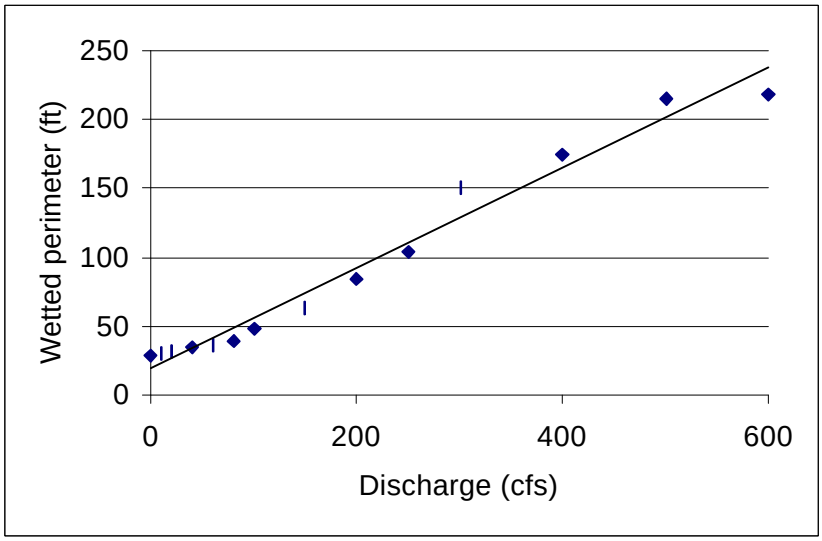


Figure A-7. Cross section 20202.



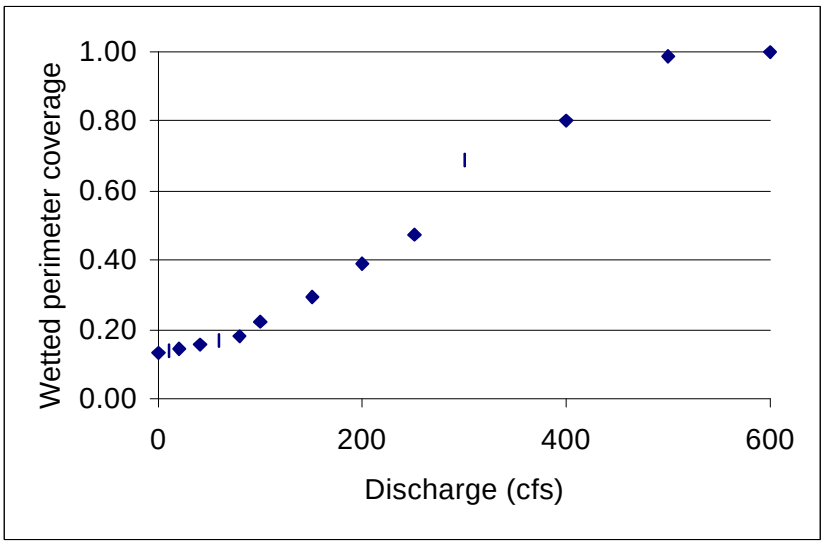
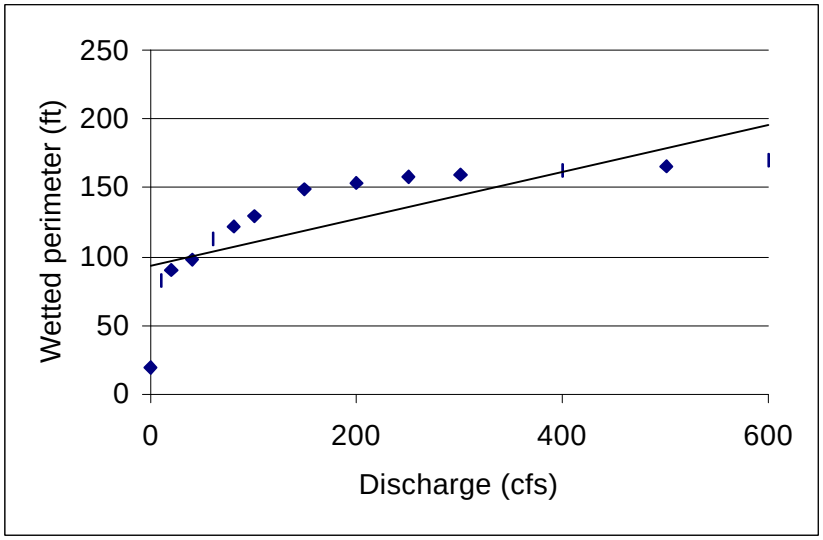


Figure A-8. Cross section 20302.



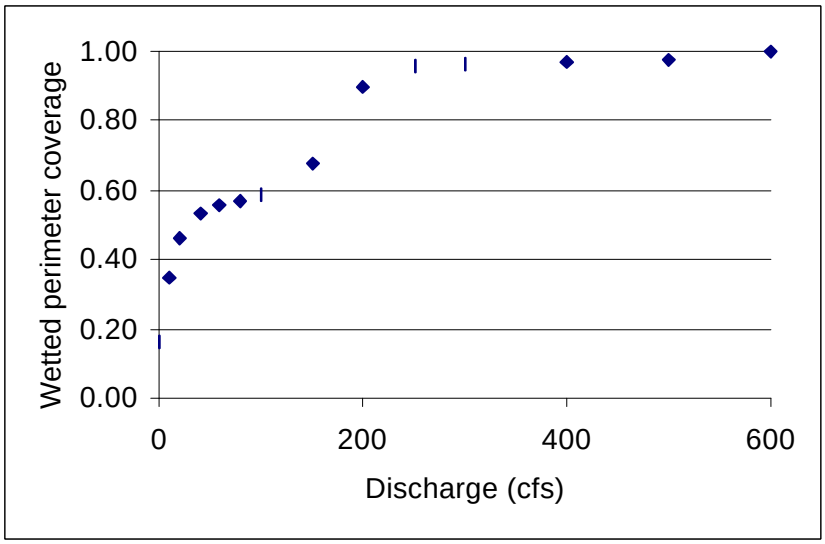


Figure A-9. Cross section 20402.

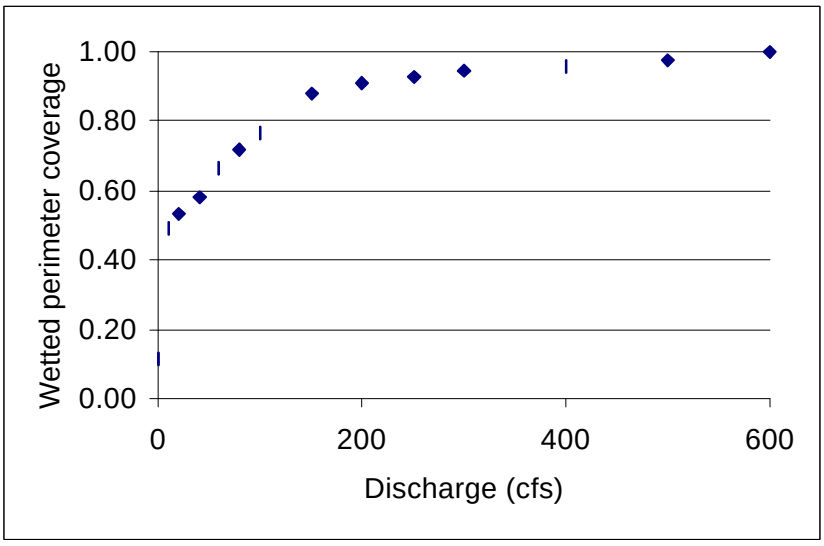
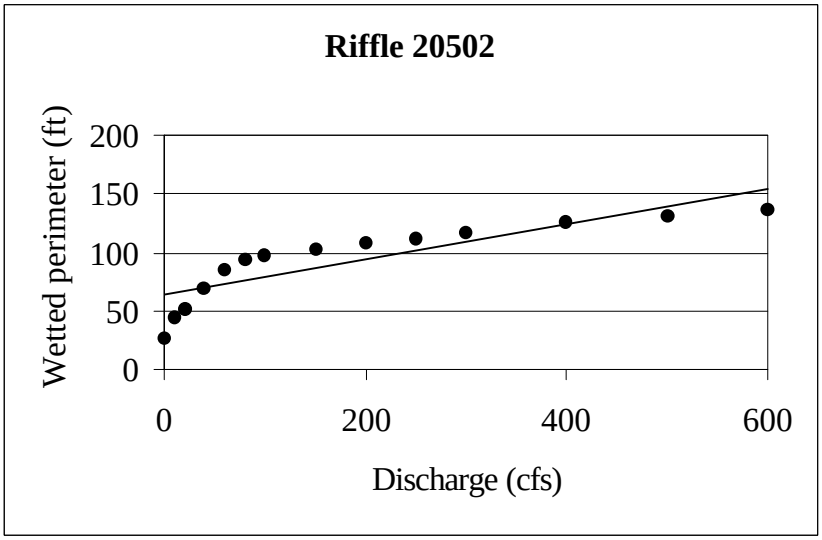


Figure A-10. Cross section 20501.



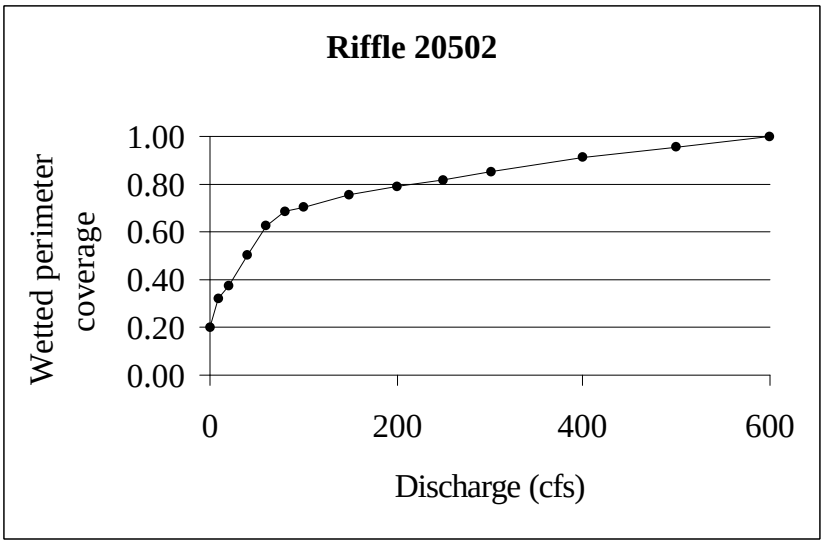
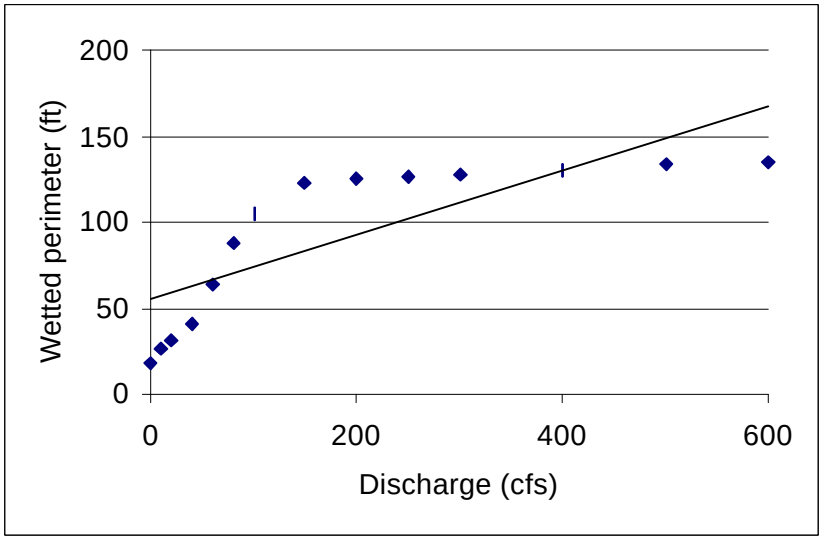


Figure A-11. Cross section 20502.



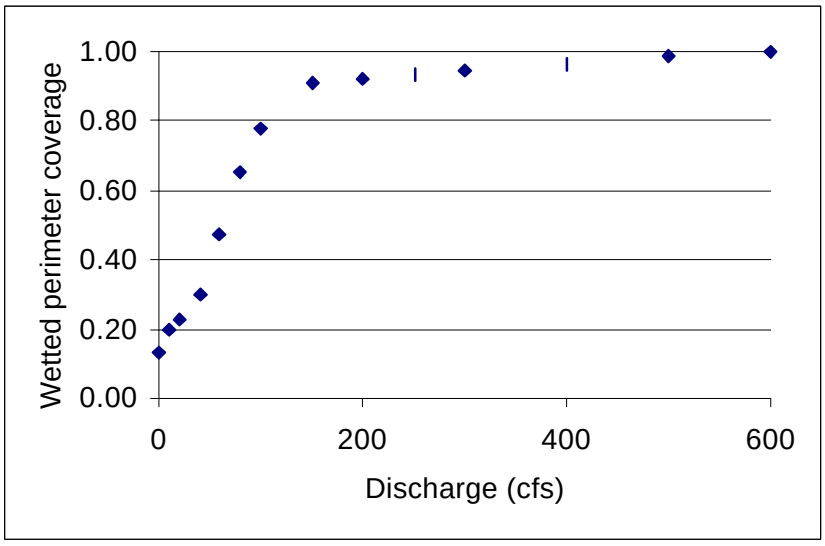
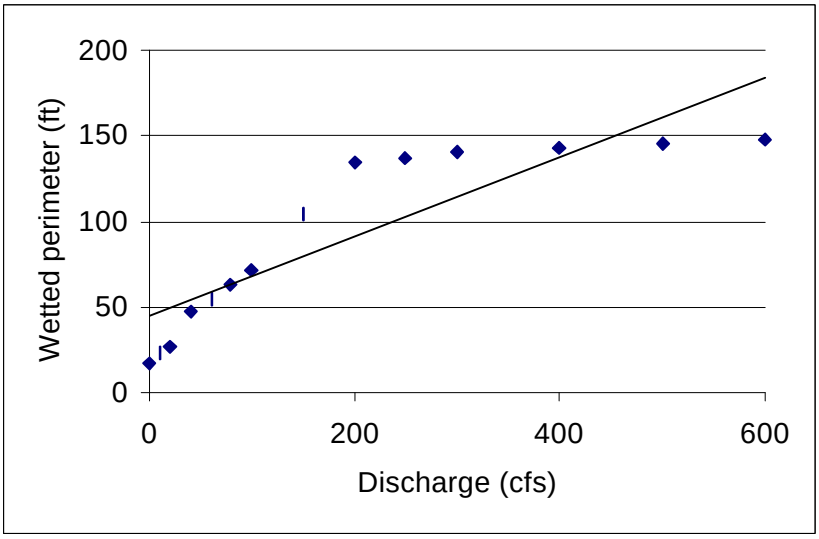


Figure A-12. Cross section 20701.



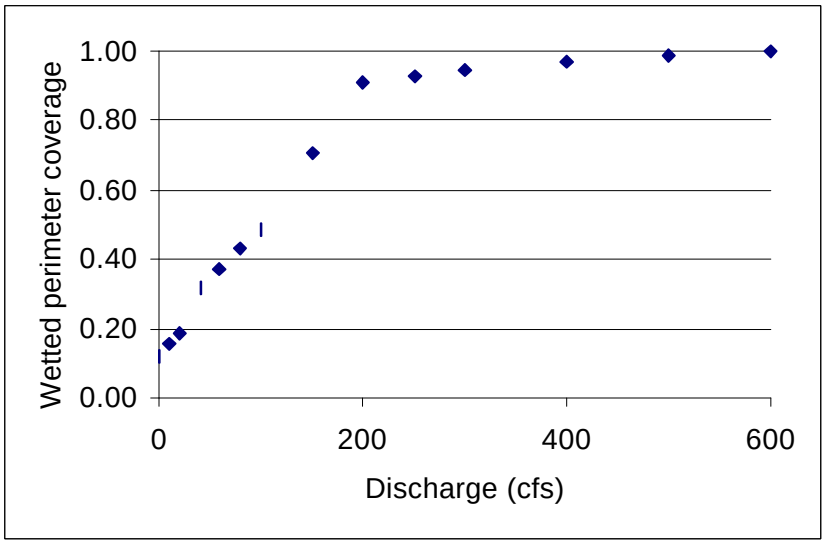
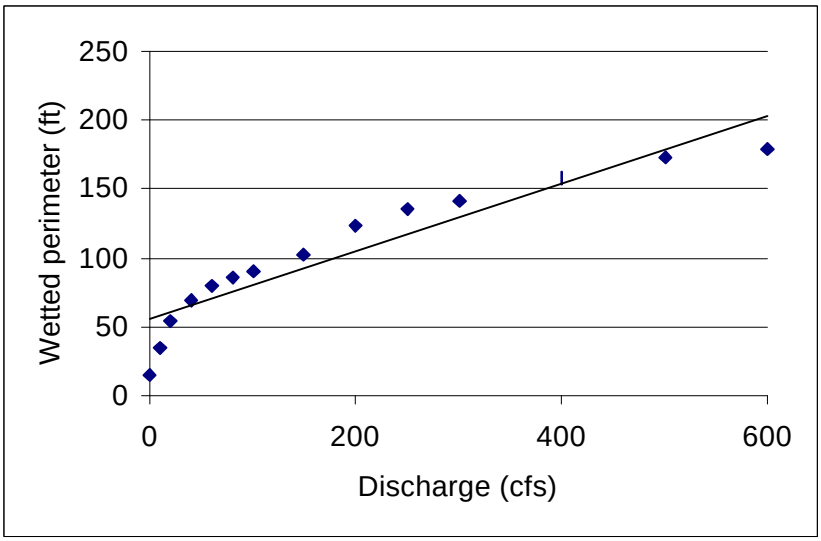


Figure A-13. Cross section 20802.



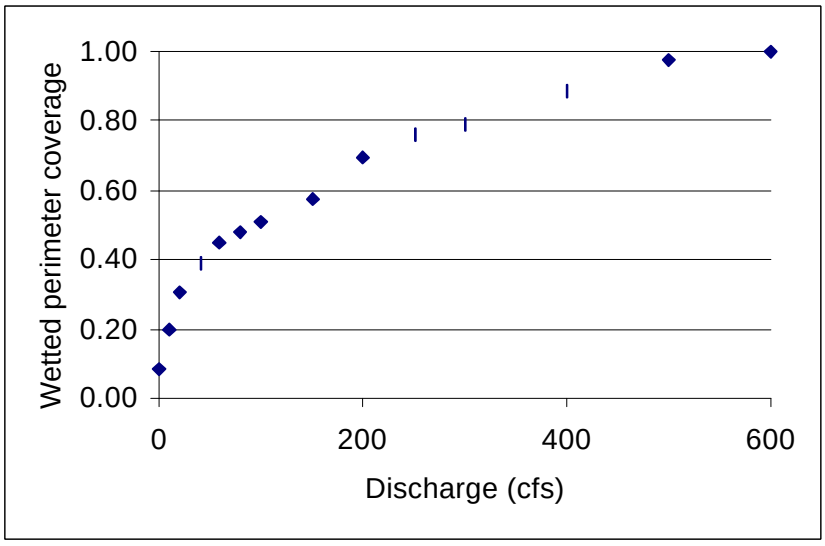
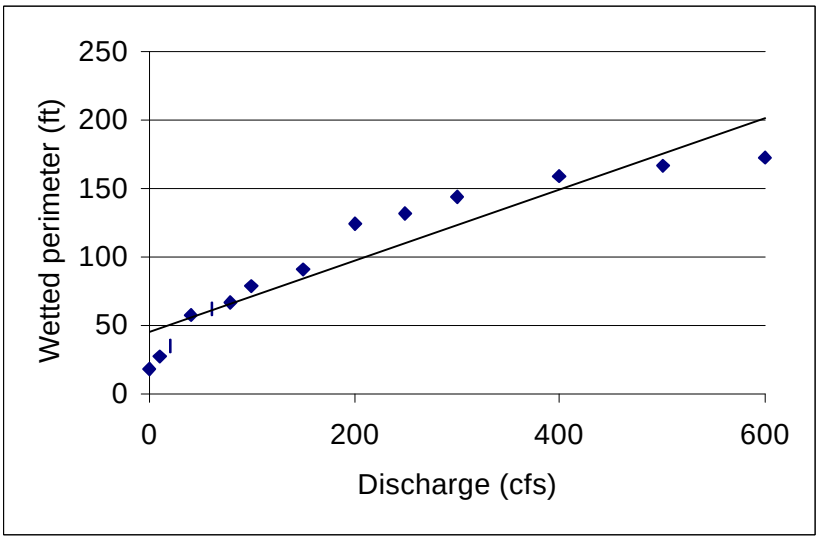


Figure A-14. Cross section 20902.



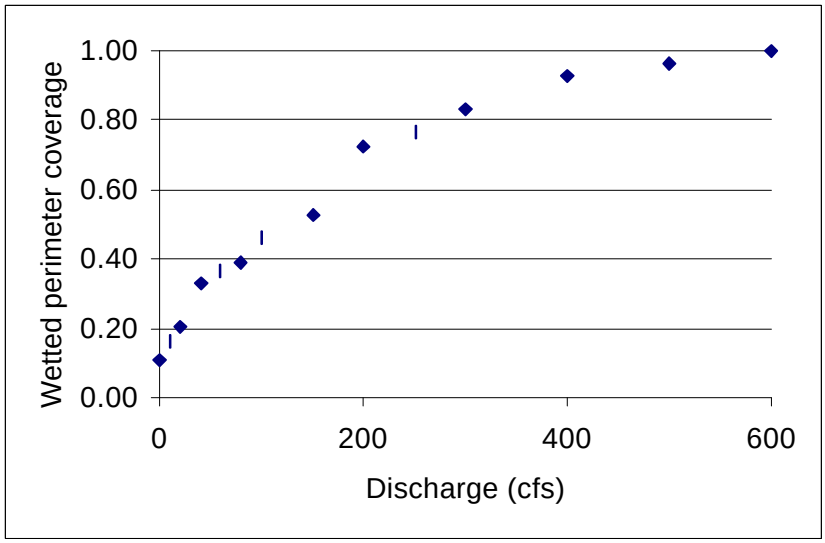
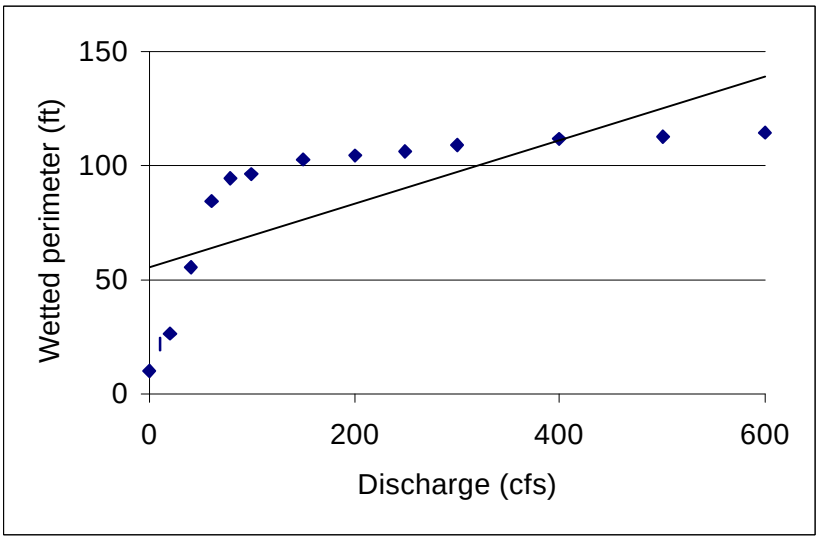


Figure A-15. Cross section 21002.



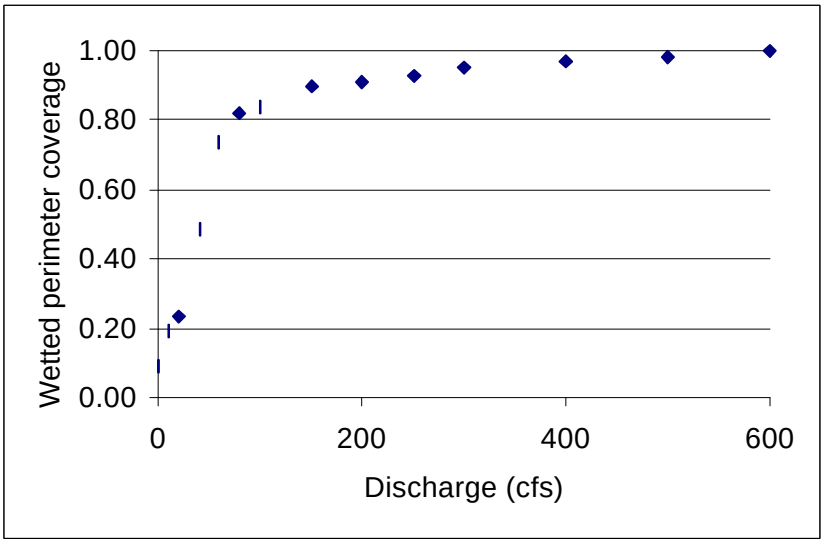
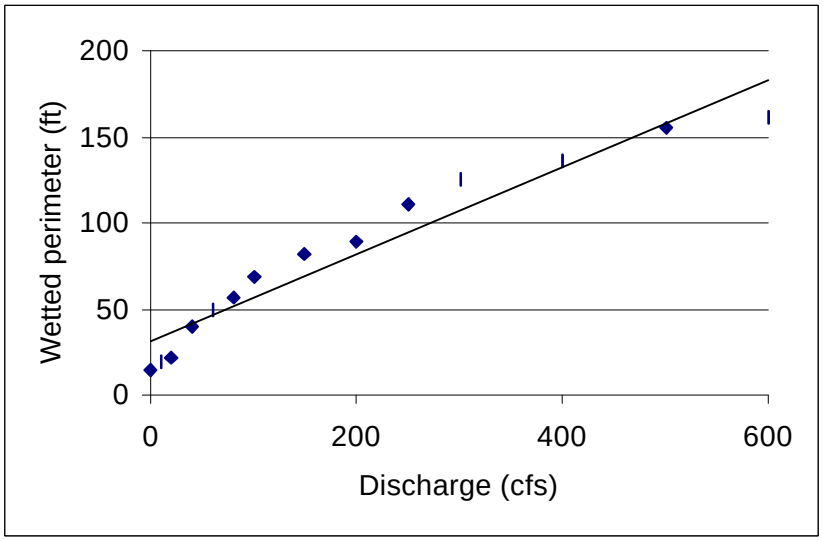


Figure A-16. Cross section 21101.



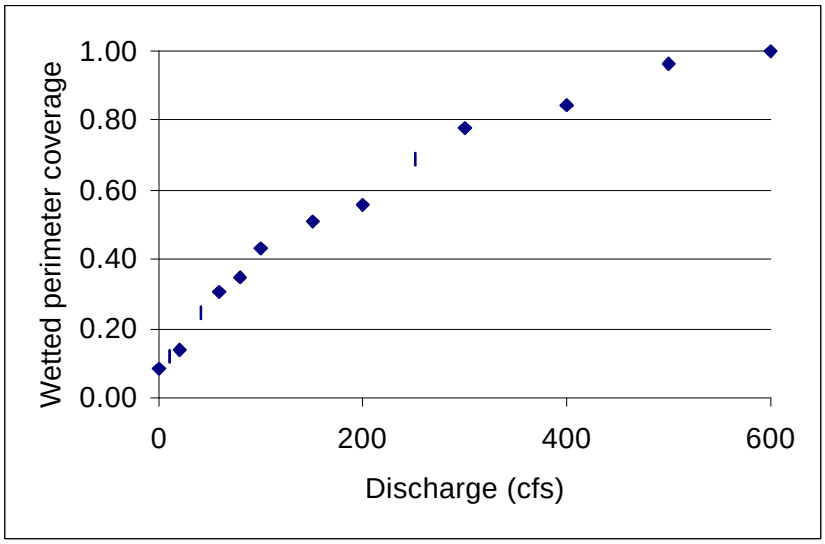
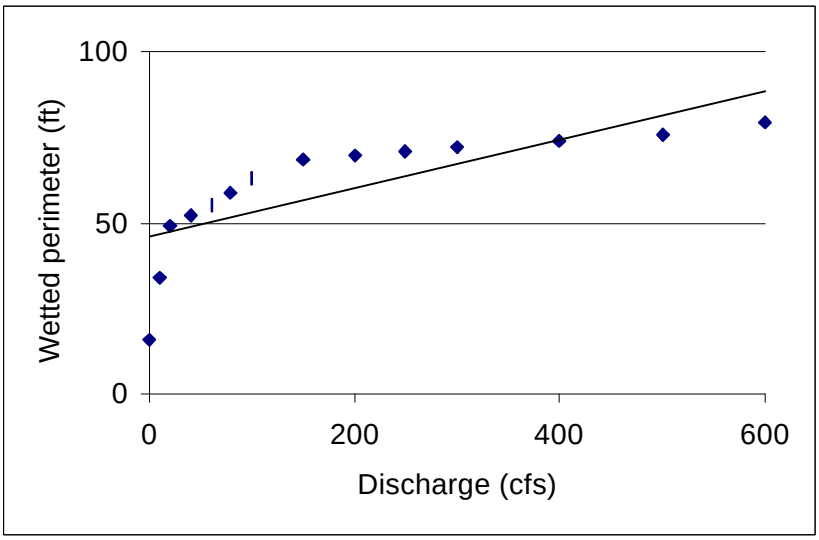


Figure A-17. Cross section 21102.



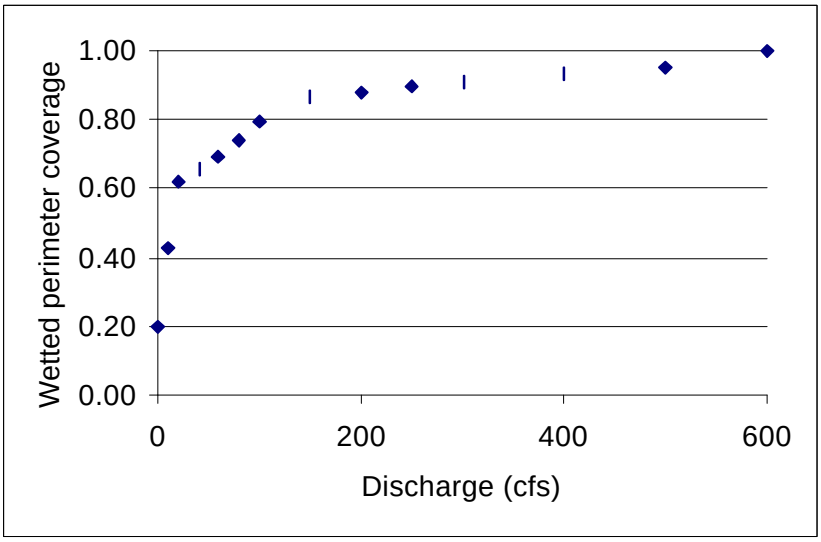
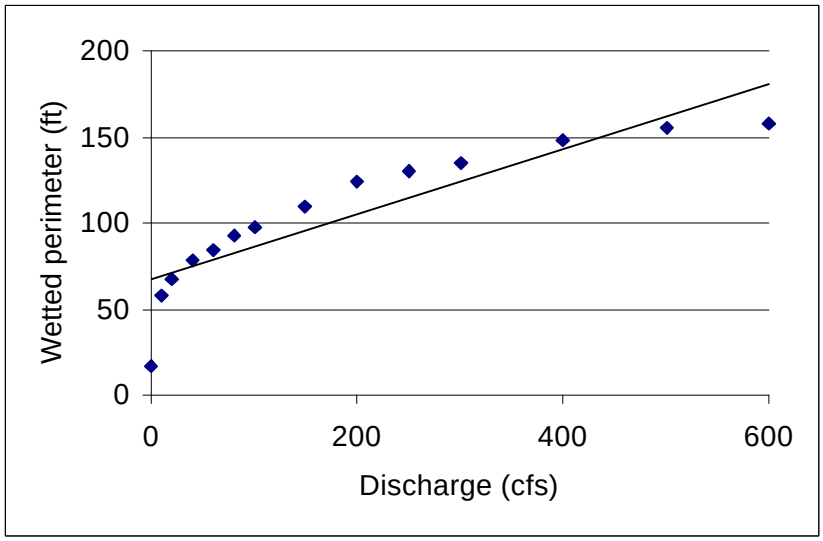


Figure A-18. Cross section 21201.



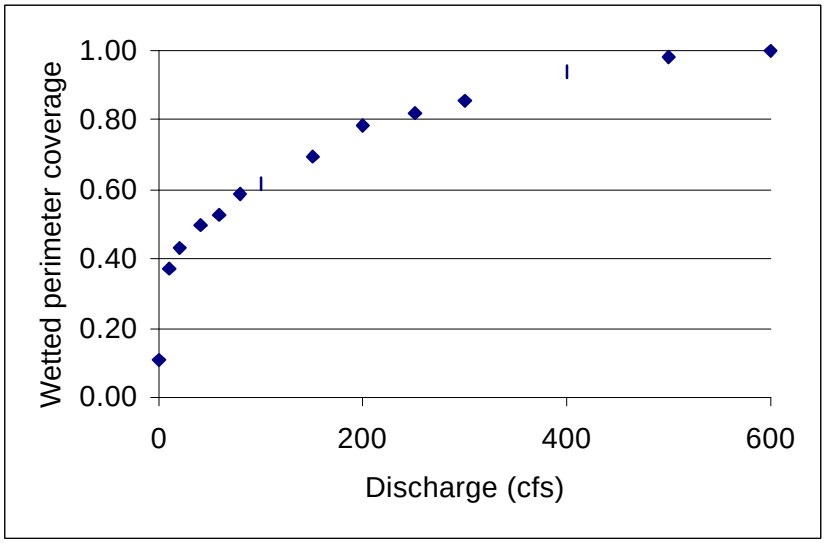
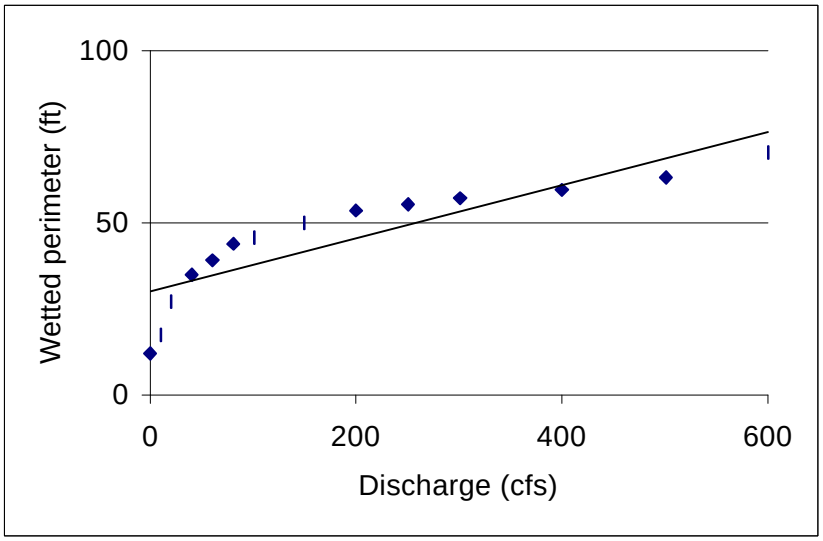


Figure A-19. Cross section 21202.



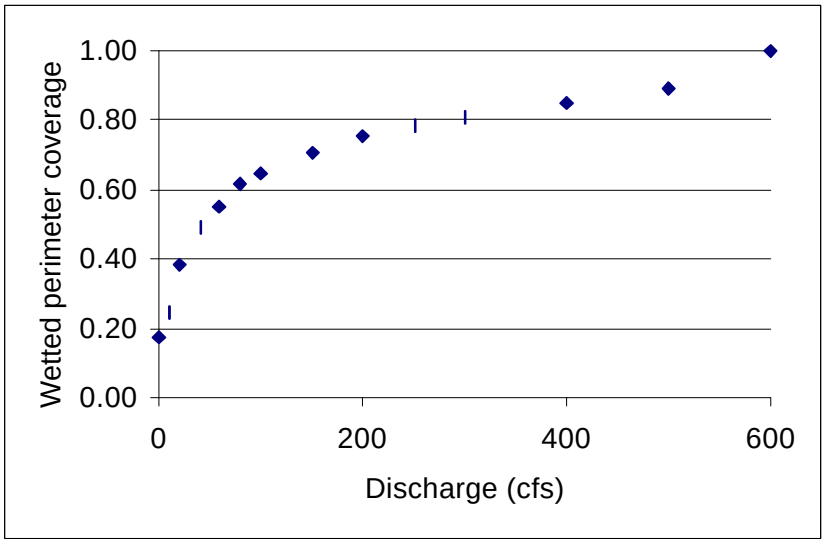
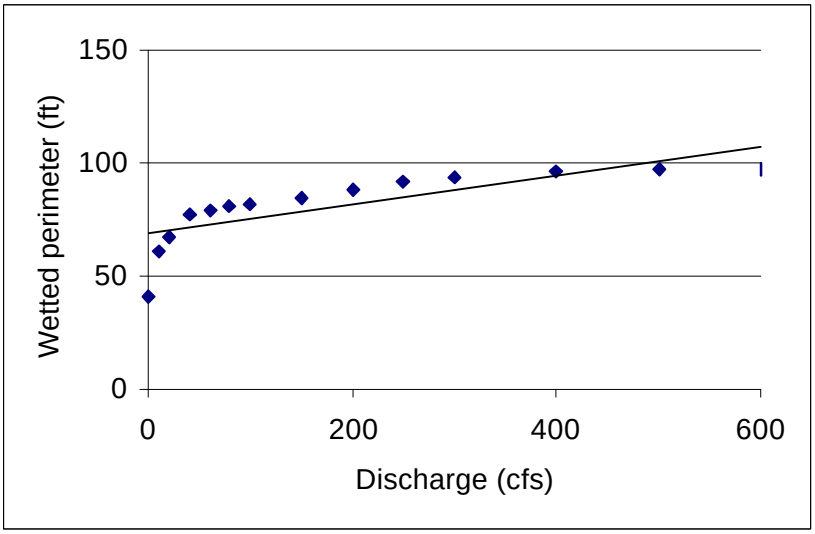


Figure A-20. Cross section 21302.



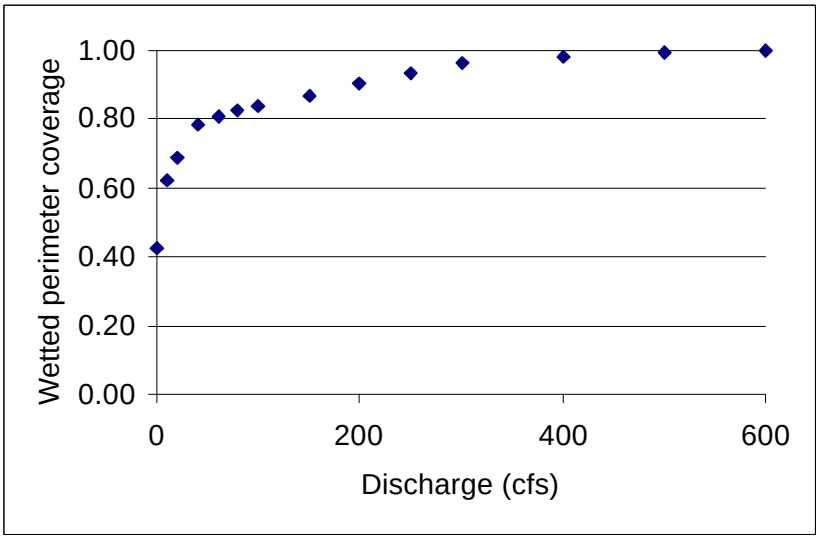
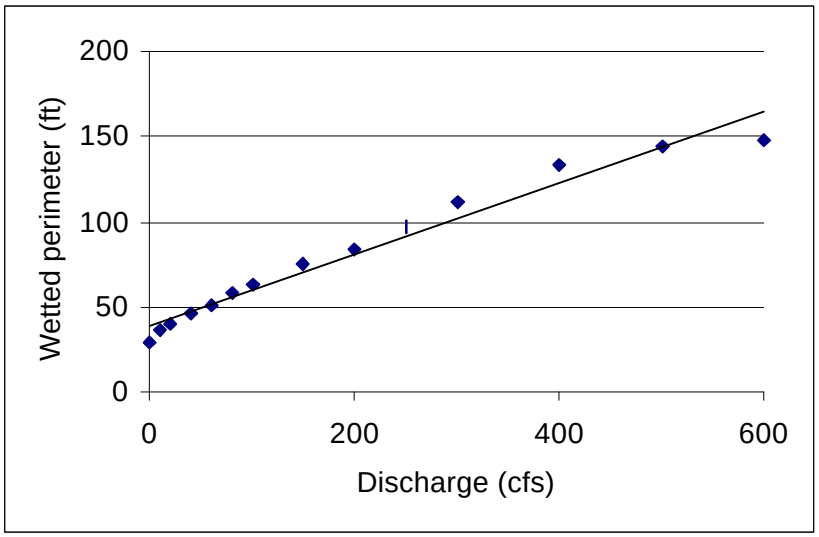


Figure A-21. Cross section 21401.



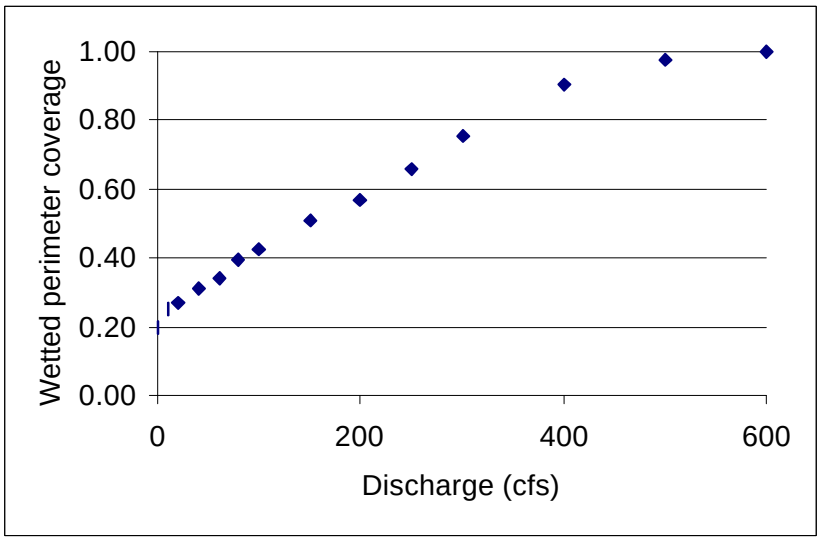
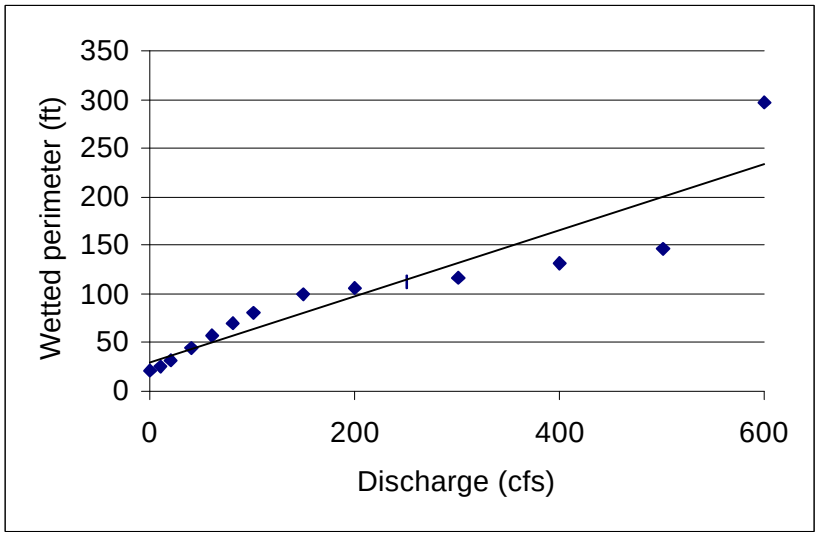


Figure A-22. Cross section 21402.



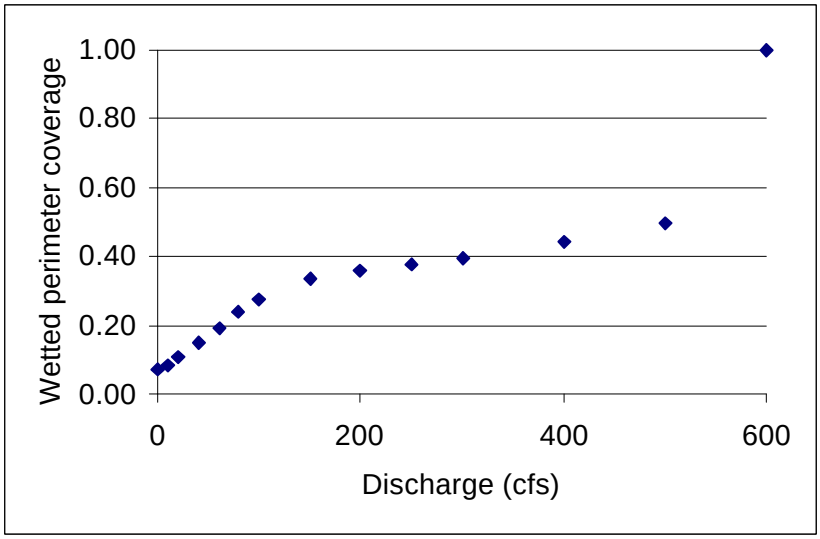
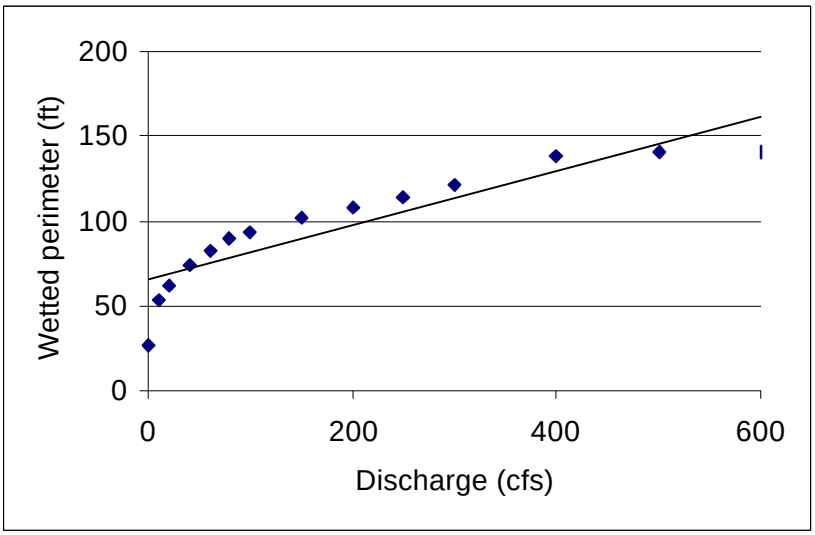


Figure A-23. Cross section 30102.



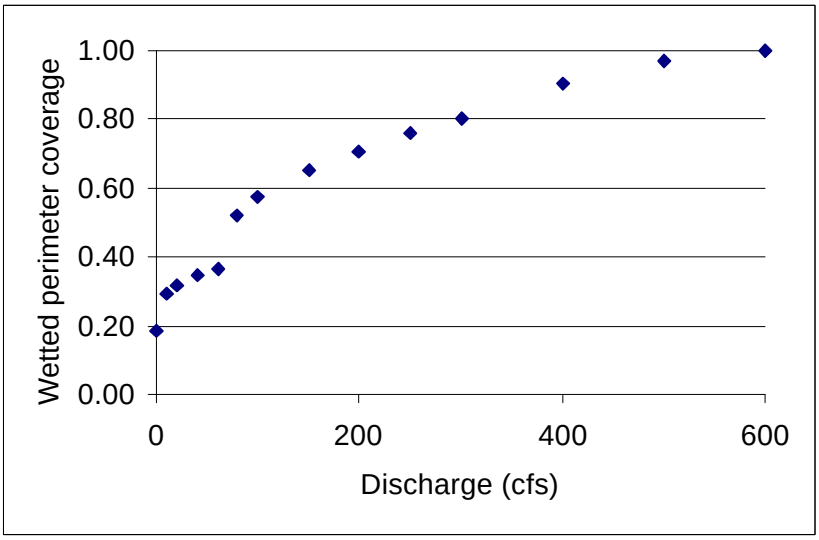


Figure A-24. Cross section 30701.

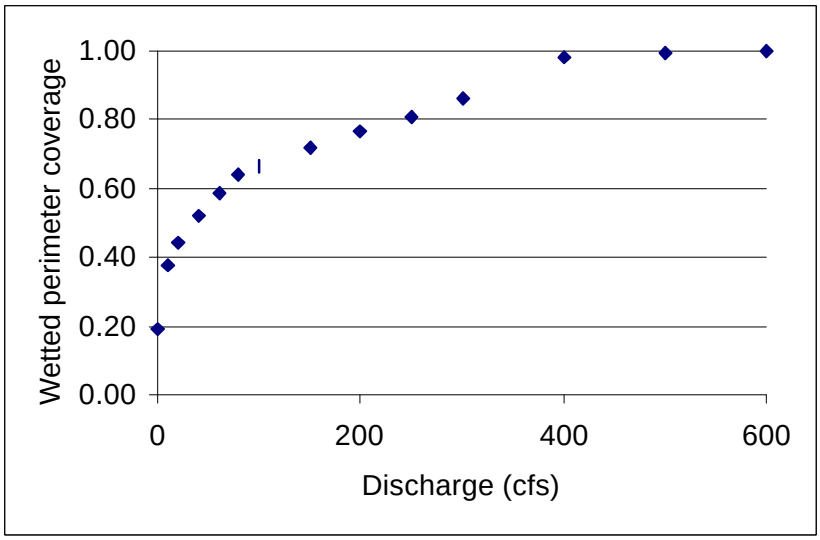
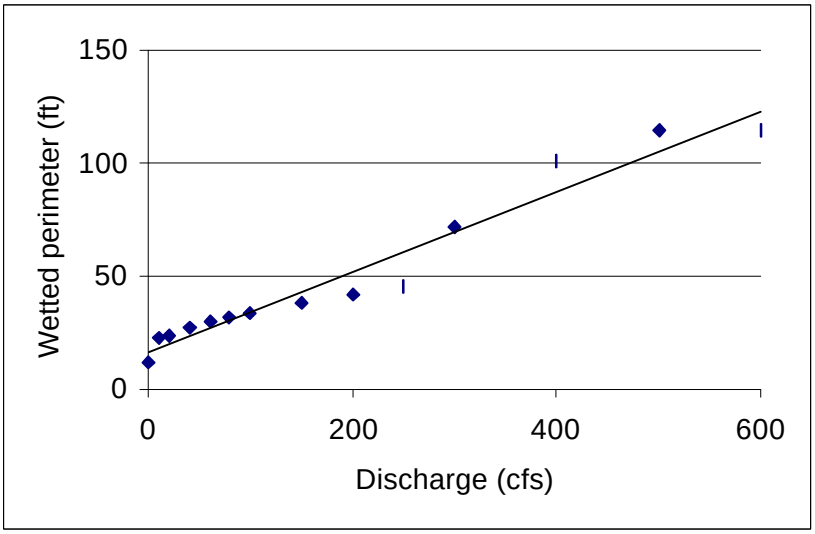


Figure A-25. Cross section 30802.



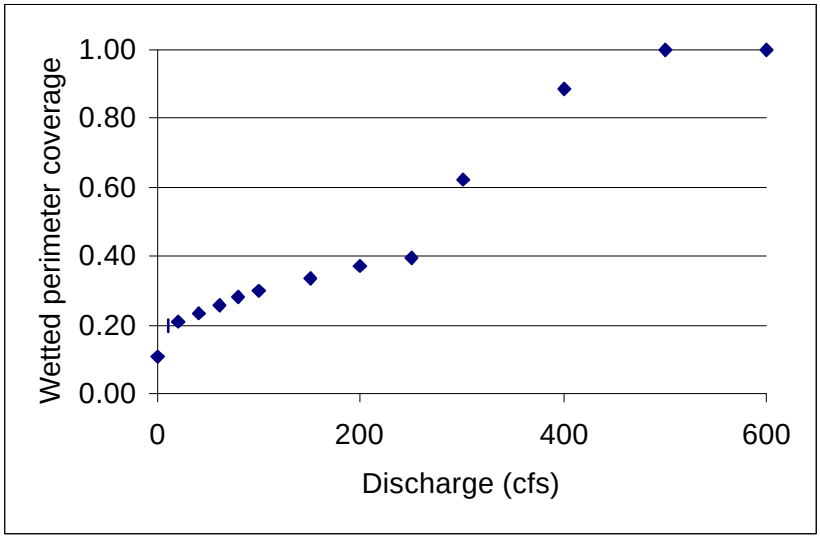


Figure A-26. Cross section 31001.

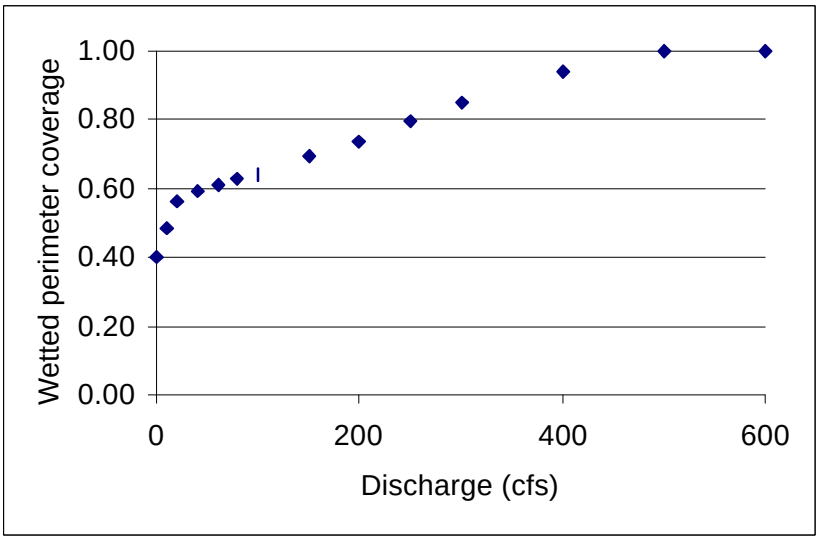
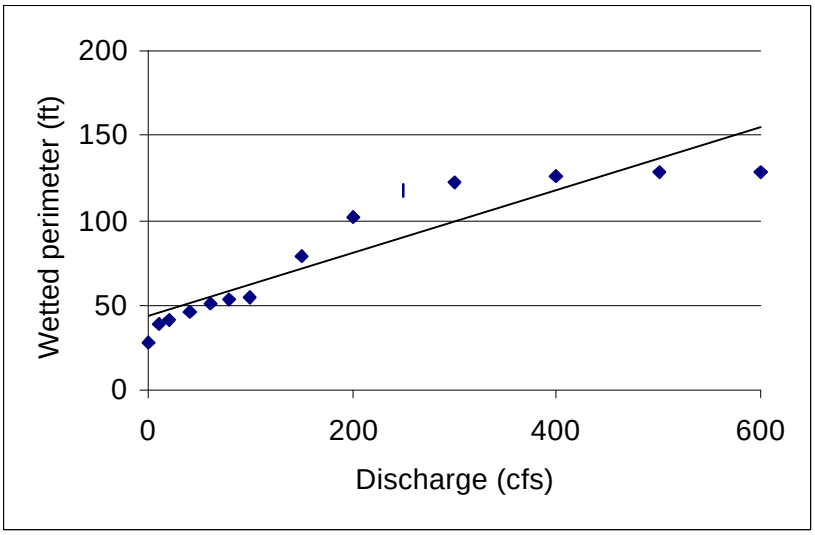


Figure A-27. Cross section 31201.



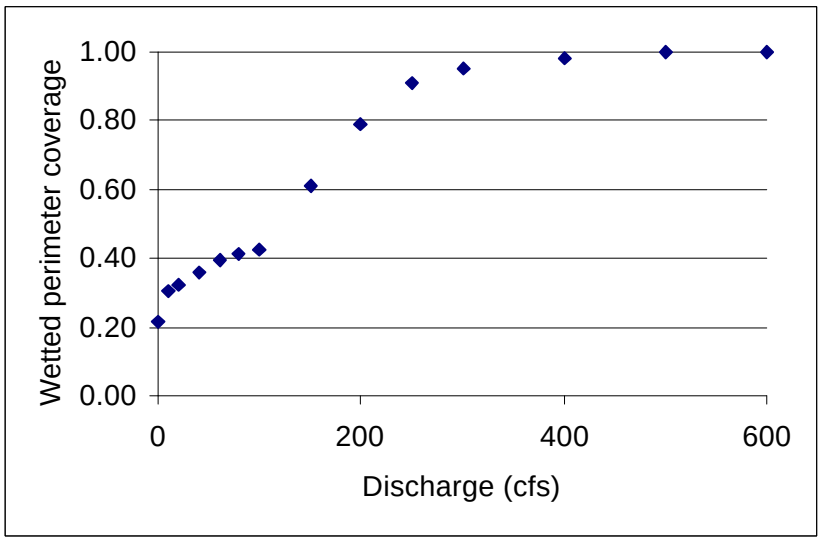


Figure A-28. Cross section 31202.

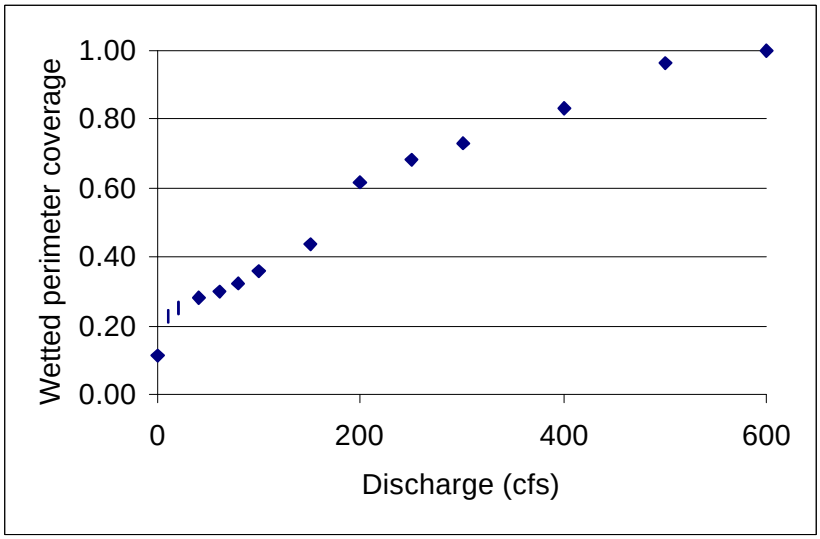
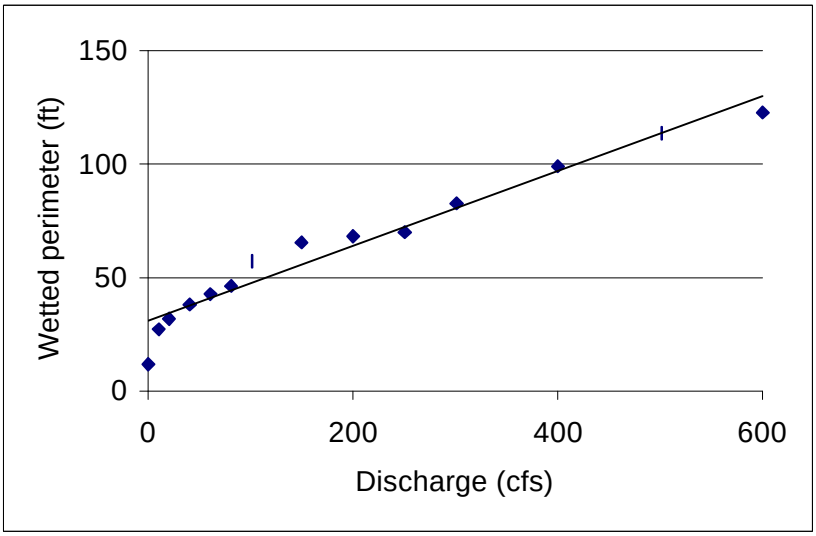


Figure A-29. Cross section 31303.



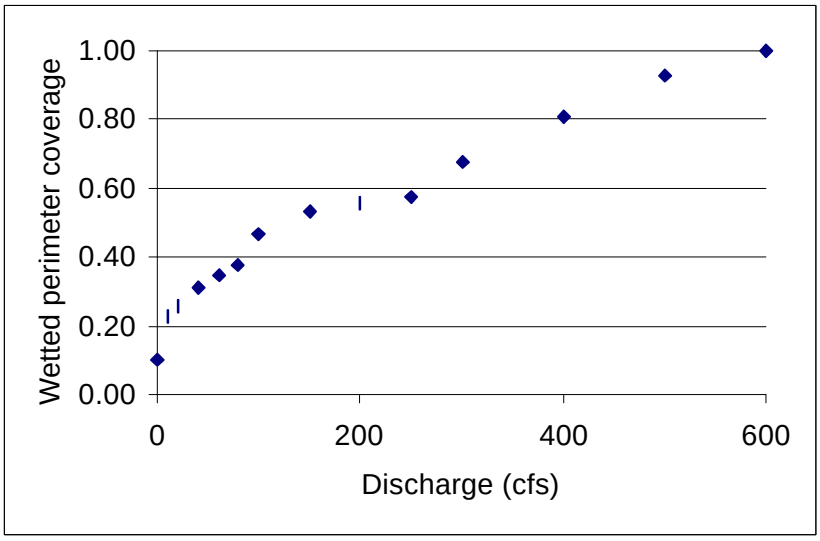


Figure A-30. Cross section 31302.

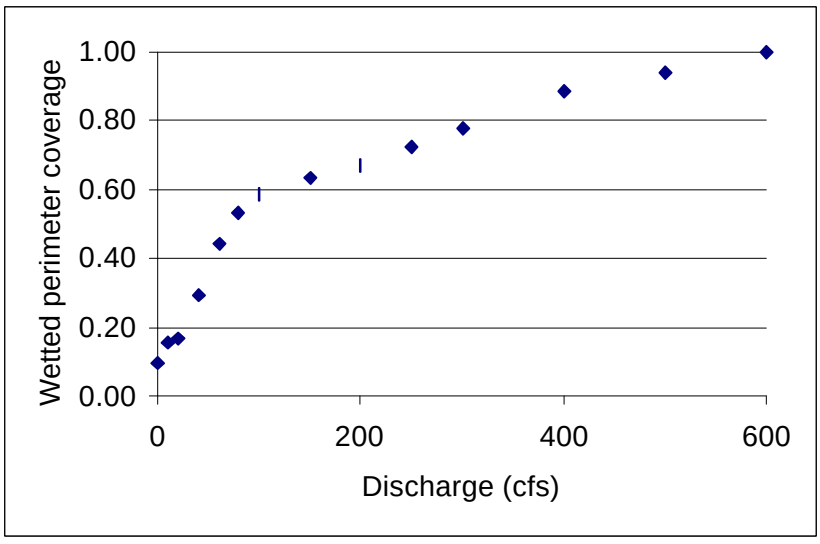


Figure A-31. Cross section 31401.

APPENDIX 5

Table 1. Discharge at break points for hydraulic parameters width, depth, and velocity by strata, and habitat type, White River, 1995 and 1996. **(note print from excel)**

APPENDIX 6

Weighted usable area for each habitat cluster for three habitat use curves (day[a], night[b], suit[c]) at discharge 339 cfs.

Stratum	Cluster	Area (m^2 per100 m^2 surface area) Day	Night	Suit
1.0	1.0	19.3	60.0	57.3
1.0	2.0	4.6	46.9	42.4
1.0	3.0	0.2	47.1	47.7
1.0	4.0	0.8	43.9	44.7
1.0	5.0	0.1	48.3	44.5
1.0	6.0	0.6	34.7	39.3
	ave	4.3	46.8	46.0
	SD	7.5	8.1	6.2
2.0	1.0	0.6	75.3	70.6
2.0	2.0	0.0	68.8	63.0
2.0	3.0	0.1	23.8	33.3
2.0	4.0	0.1	66.5	58.3
2.0	5.0	0.0	23.9	53.6
2.0	6.0	0.1	67.0	62.4
2.0	7.0	0.4	42.7	53.0
2.0	8.0	1.7	67.8	65.6
2.0	9.0	0.0	71.9	67.1
2.0	10.0	0.3	46.0	59.4
2.0	11.0	0.0	59.0	54.9
2.0	12.0	0.5	48.2	47.3
2.0	13.0	2.9	33.4	37.9
2.0	14.0	0.0	40.8	39.2
	ave	0.5	52.5	54.7
	SD	0.8	17.9	11.5
3.0	1.0	2.2	83.0	86.3
3.0	2.0	35.8	127.2	103.3
3.0	3.0	21.7	87.3	75.2
3.0	4.0	11.0	93.8	82.0
3.0	5.0	2.5	84.5	73.4
3.0	6.0	0.1	39.8	38.3
3.0	7.0	28.7	65.2	61.0
3.0	8.0	0.2	53.1	56.8
3.0	9.0	0.1	74.4	65.1
3.0	10.0	4.0	36.2	45.0

3.0	11.0	5.5	73.3	75.2
3.0	12.0	7.4	54.6	56.9
3.0	13.0	0.0	29.1	38.2
3.0	14.0	0.0	29.3	41.8
3.0	15.0	5.4	63.4	63.5
3.0	16.0	0.0	59.1	60.3
3.0	17.0	0.0	59.0	61.2
	ave	7.3	65.4	63.8
	SD	11.0	25.5	17.7
4.0	1.0	1.0	72.6	68.8
4.0	2.0	1.7	72.4	68.8
4.0	3.0	1.0	66.7	60.5
4.0	4.0	1.0	66.7	26.5
4.0	5.0	0.2	39.6	50.6
4.0	6.0	0.1	33.3	40.3
	ave	0.8	58.6	52.6
	SD	0.6	17.4	16.9