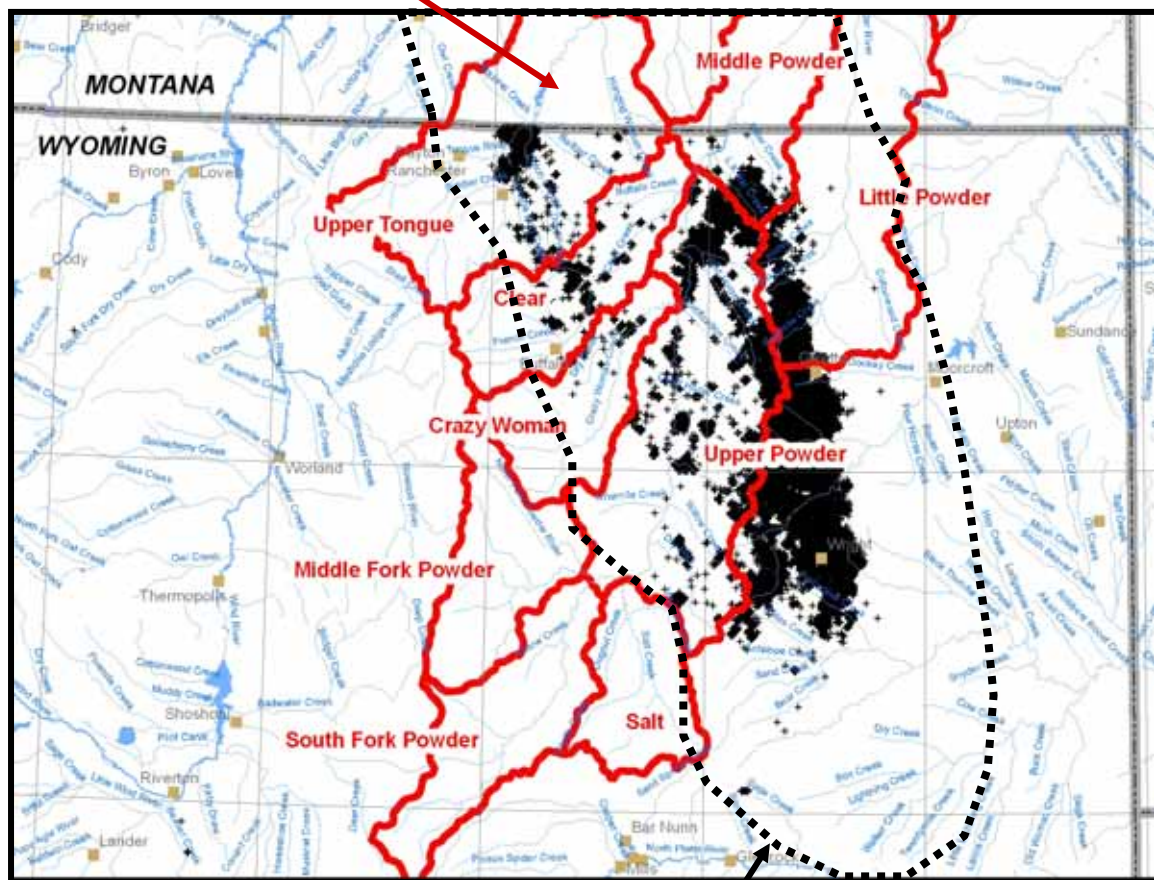


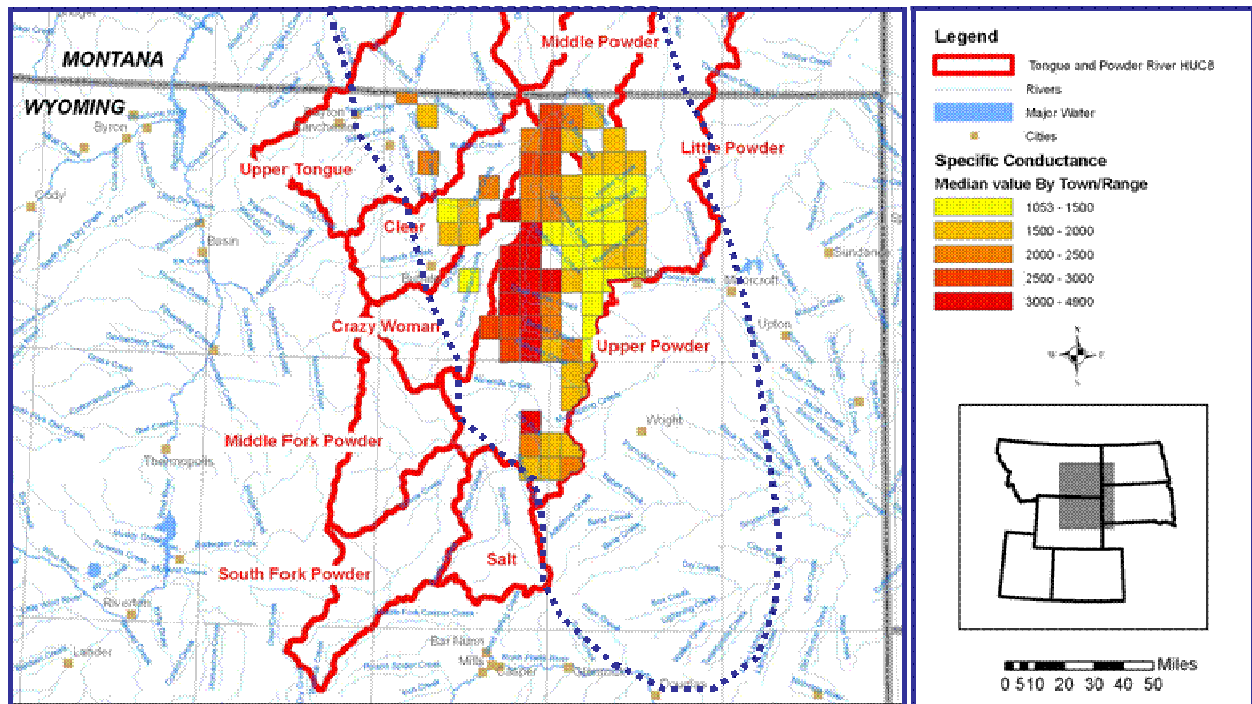
**Upper Tongue
River Watershed**



**Powder River
Structural Basin**

Figure 1. Map showing location of Upper Tongue River watershed relative to Powder River Structural Basin and Montana-Wyoming Stateline. (+ symbol indicates the location of permitted CBNG discharge)

SC



SAR

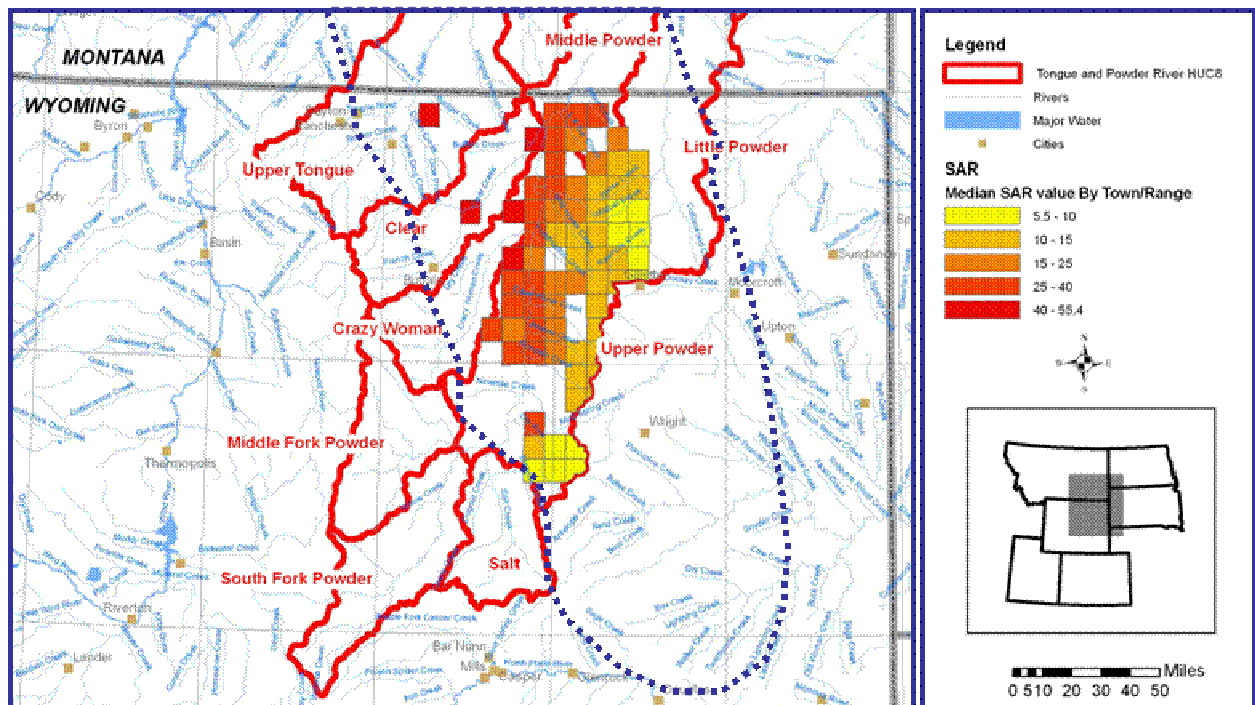


Figure 2. SC and SAR of CBNG produced water in the Powder River structural Basin and Powder River and Tongue River watersheds.

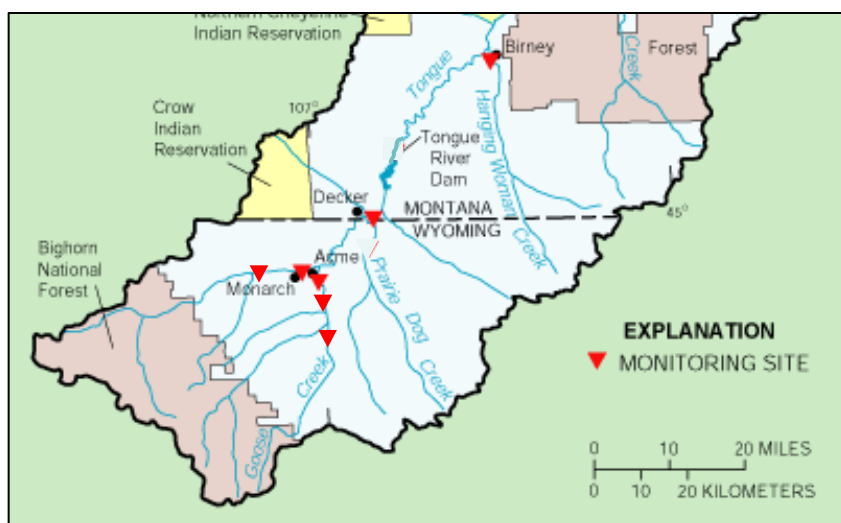
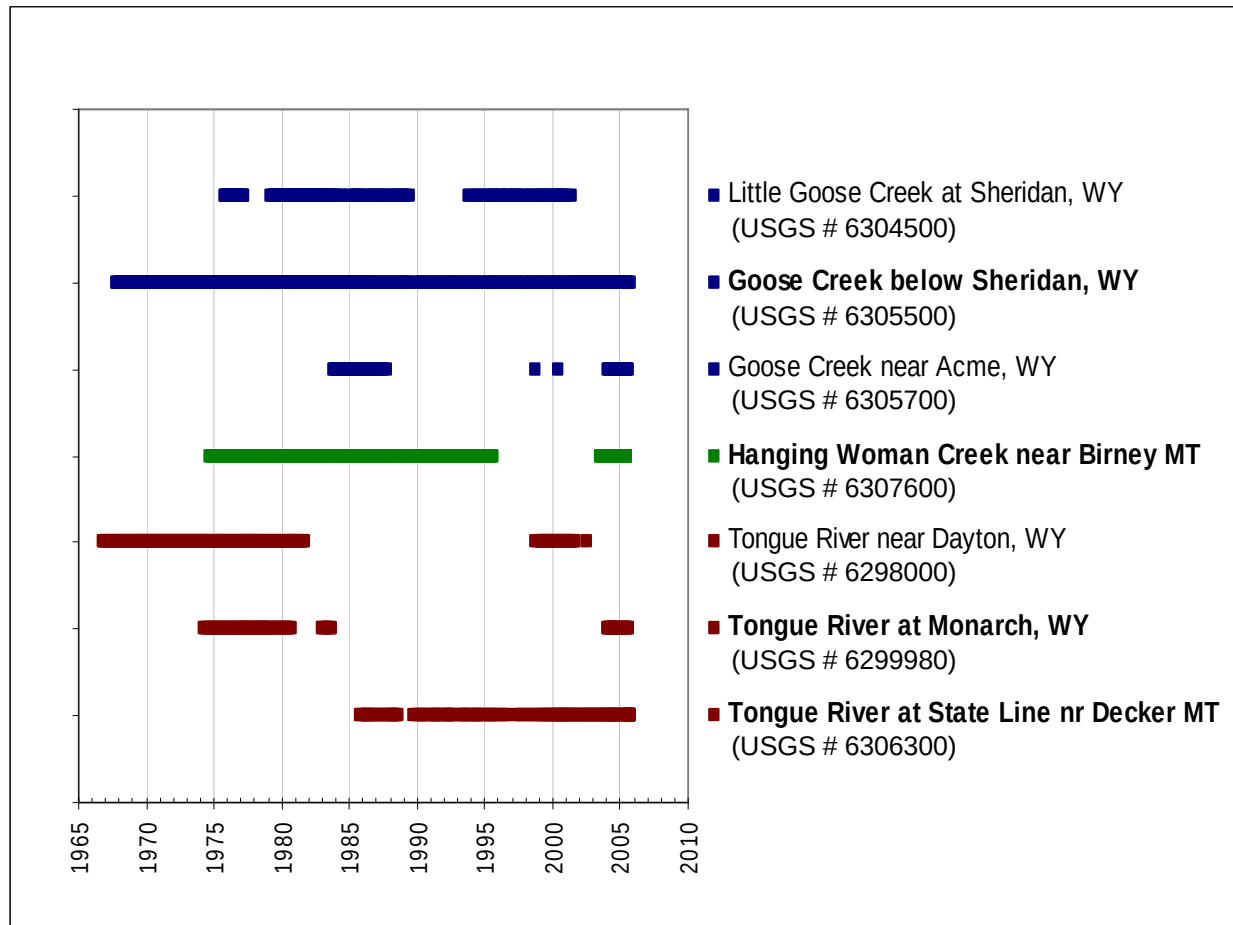


Figure 3. Location and period of available discrete sample water quality data for selected USGS surface water monitoring stations in the Upper Tongue River watershed.

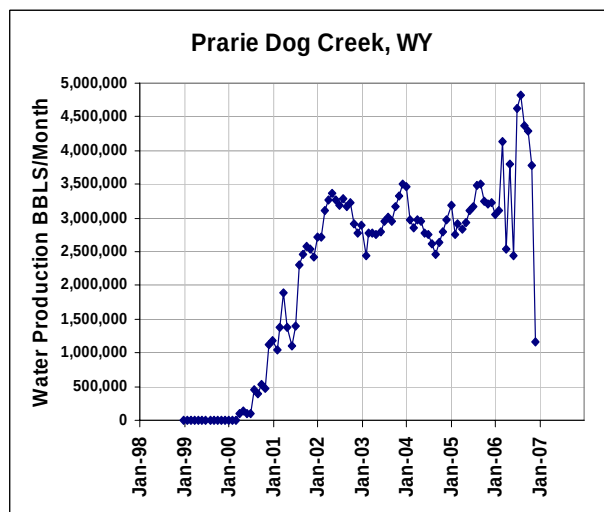
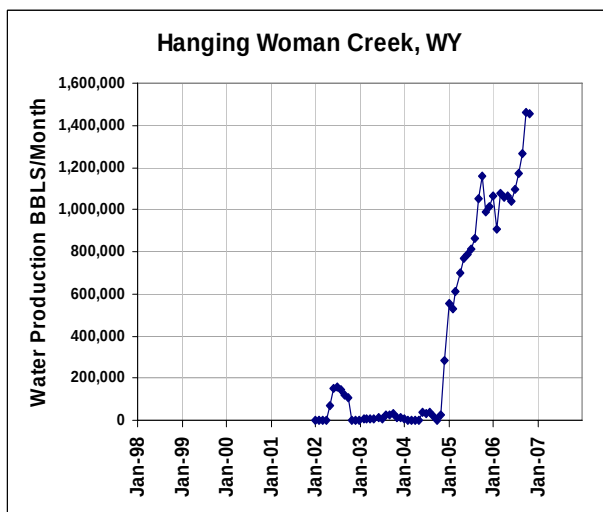
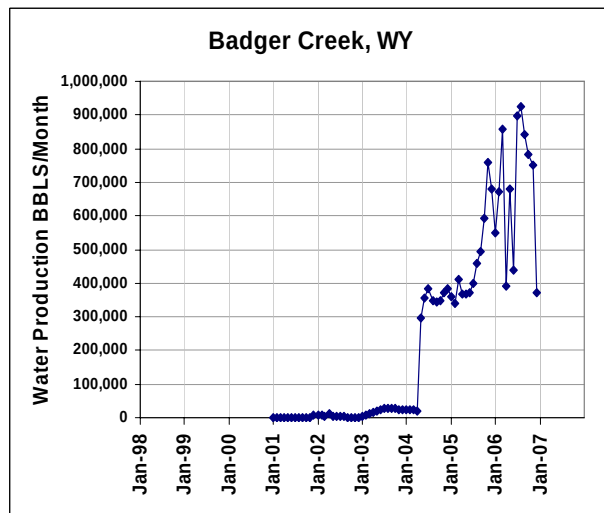
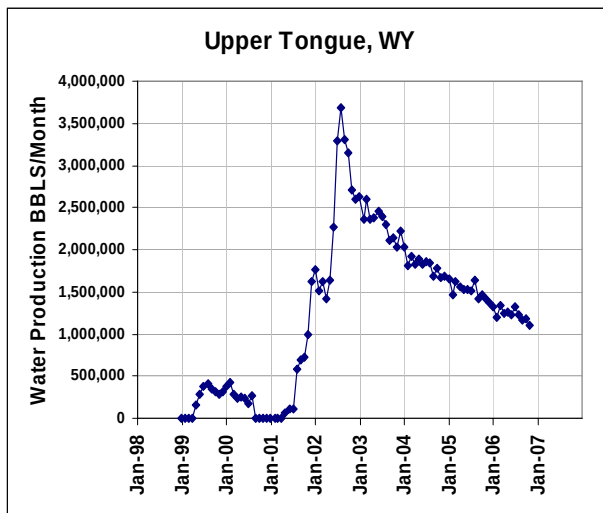
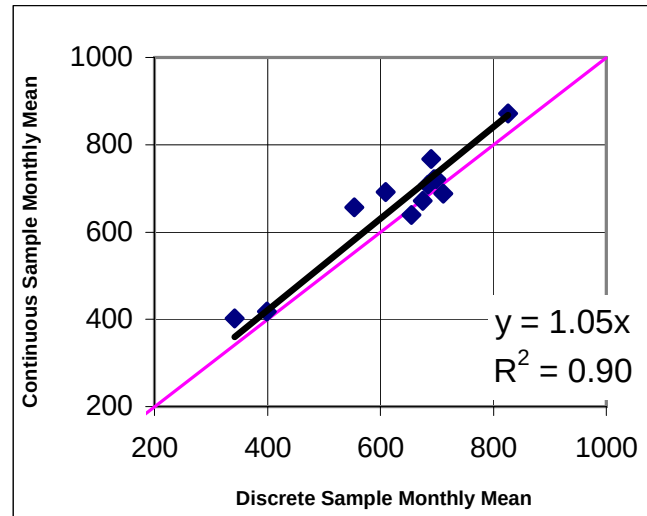


Figure 4. Monthly CBNG water production in the Upper Tongue River watershed (WYOGCC, 2006).

	Discrete	Continuous
Month	SC	SC
January	609	692
February	675	672
March	695	722
April	655	639
May	399	418
June	342	402
July	554	657
August	826	872
September	690	768
October	711	688
November	699	722
December	684	708



	Discrete	Continuous
Month	SAR	SAR
January	0.69	0.87
February	0.78	0.84
March	0.83	0.92
April	0.84	0.79
May	0.58	0.52
June	0.47	0.54
July	0.85	0.90
August	1.32	1.36
September	0.86	0.92
October	0.89	0.86
November	0.80	0.93
December	0.74	0.90

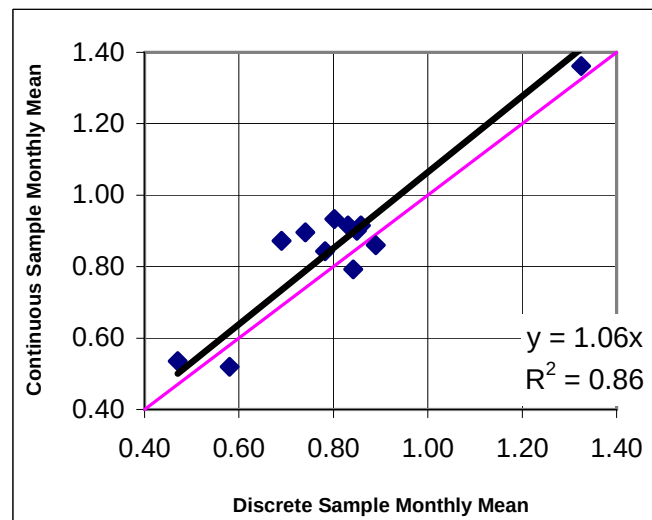


Figure 5. Correspondence between monthly statistics calculated from discrete samples and continuous measurements of SC and SAR at the Tongue River at Stateline station (USGS # 6306300).

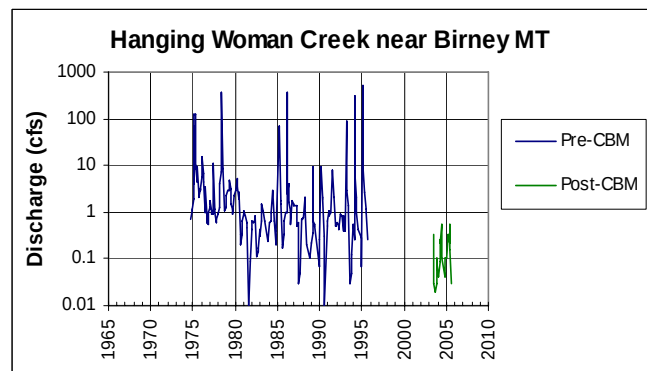
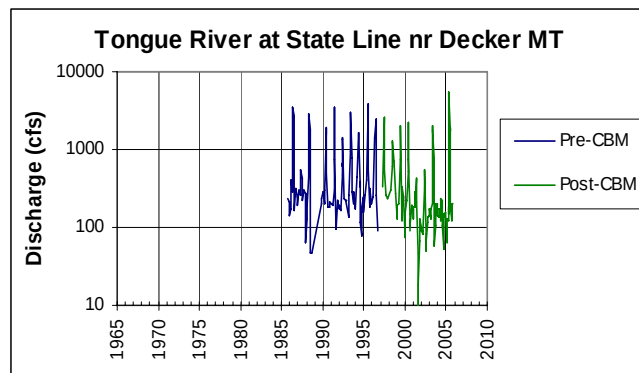
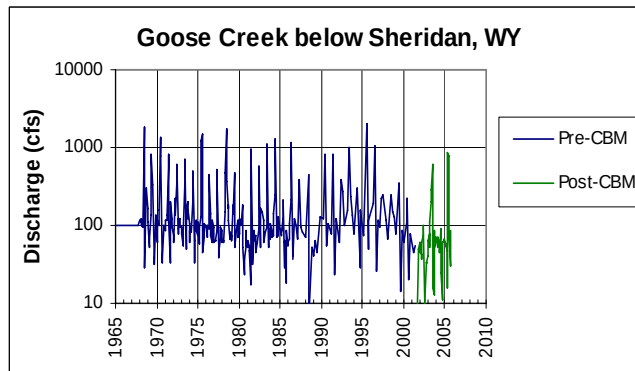
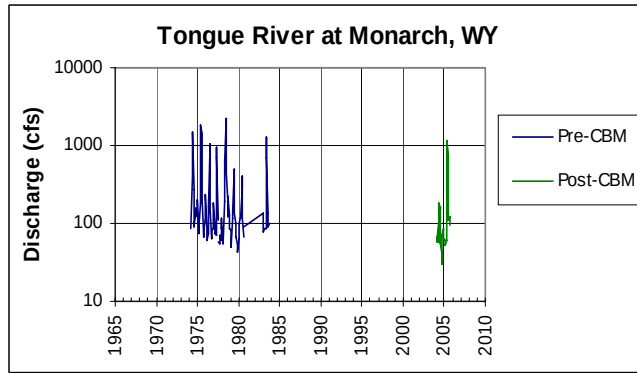
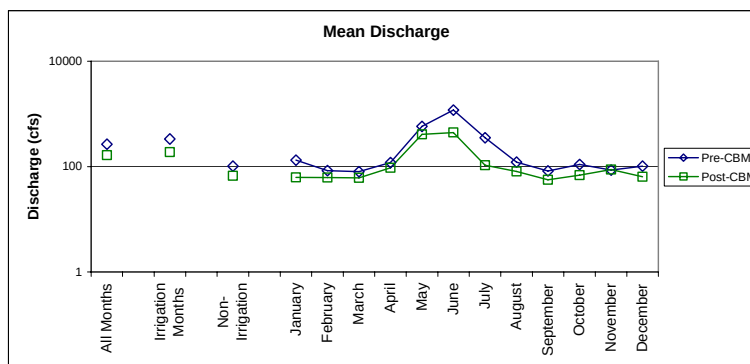


Figure 6. Instantaneous stream discharge for selected USGS monitoring stations in the Upper Tongue River watershed.

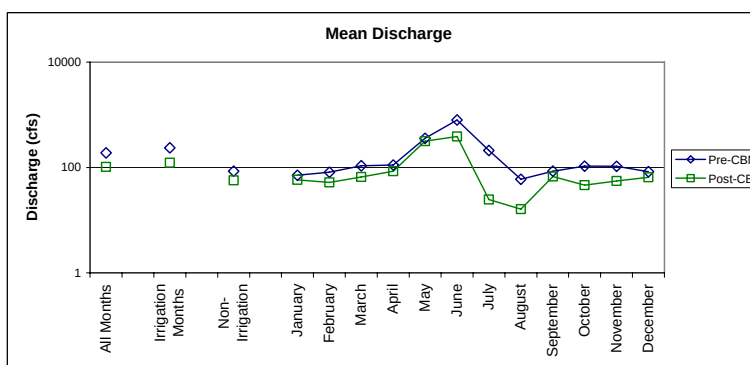
Tongue River at Monarch, WY

Mean Discharge (cfs)	< 7/1/2001		> 7/1/2001	
	N	Mean	N	Mean
All Months	89	266	32	165
Irrigation Months	63	333	26	187
Non-Irrigation Months	26	102	6	67
January	7	132	1	62
February	6	84	3	62
March	6	80	3	61
April	8	119	4	95
May	8	577	4	409
June	8	1183	4	443
July	8	353	3	106
August	10	121	5	81
September	8	82	2	56
October	7	109	1	69
November	6	86	1	88
December	7	102	1	64



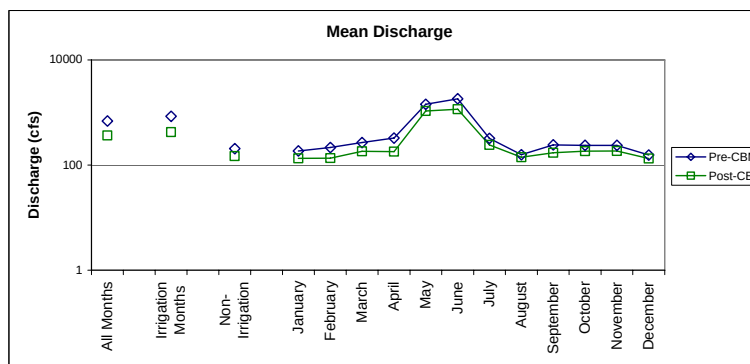
Goose Creek below Sheridan, WY

Mean Discharge (cfs)	< 7/1/2001		> 7/1/2001	
	N	Mean	N	Mean
All Months	326	190	48	103
Irrigation Months	227	236	33	123
Non-Irrigation Months	99	85	15	57
January	28	71	4	59
February	25	81	4	52
March	27	108	4	66
April	21	111	4	85
May	31	359	4	316
June	30	795	4	389
July	27	211	5	25
August	34	60	4	16
September	24	85	4	68
October	33	106	4	46
November	25	105	4	55
December	21	83	3	65



Tongue River at State Line nr Decker MT

Mean Discharge (cfs)	< 1997		> 1997	
	N	Mean	N	Mean
All Months	98	687	122	365
Irrigation Months	74	843	96	423
Non-Irrigation Months	24	205	26	148
January	6	185	7	134
February	5	215	7	135
March	9	268	10	183
April	4	326	9	179
May	16	1422	13	1068
June	16	1822	12	1158
July	8	322	10	242
August	10	157	10	140
September	6	241	22	171
October	5	236	10	184
November	9	235	7	185
December	4	155	5	133



Hanging Woman Creek near Birney MT

Mean Discharge (cfs)	< 2002		> 2002	
	N	Mean	N	Mean
All Months	193	18.1	25	0.18
Irrigation Months	130	13.8	20	0.21
Non-Irrigation Months	63	26.8	5	0.08
January	14	6.4	0	
February	17	92.5	2	0.07
March	31	40.6	2	0.21
April	15	2.7	4	0.26
May	19	21.2	4	0.38
June	19	2.8	4	0.16
July	11	1.5	2	0.19
August	14	0.6	1	0.03
September	11	0.8	0	
October	10	0.8	3	0.03
November	17	0.8	1	0.10
December	15	1.0	2	0.09

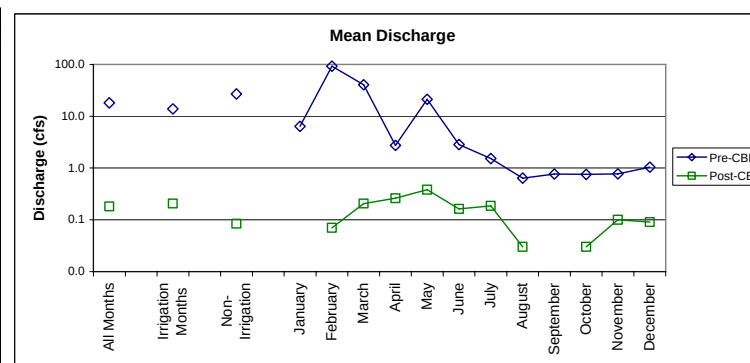


Figure 7. Mean stream discharge selected USGS monitoring stations in the Upper Tongue River watershed.

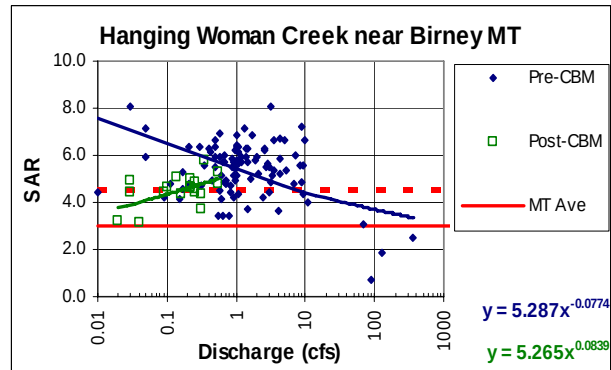
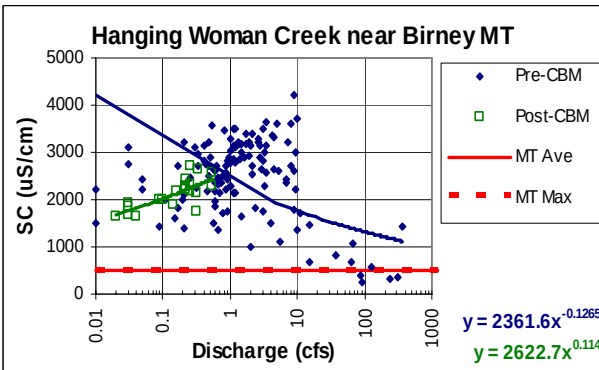
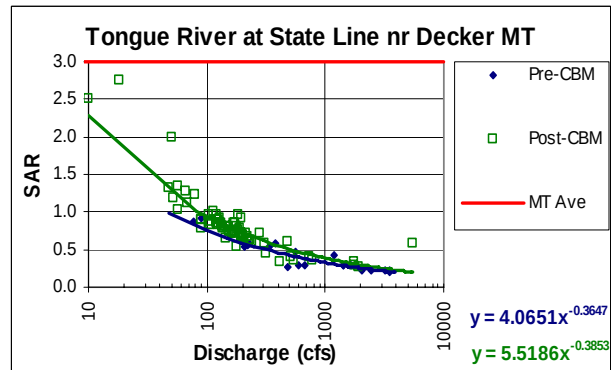
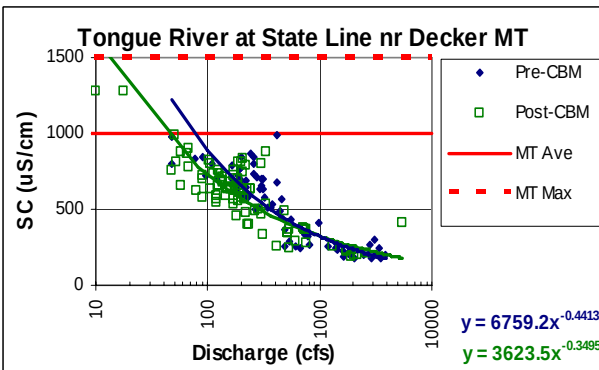
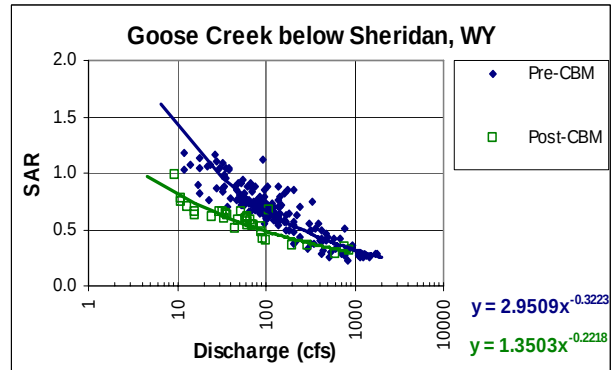
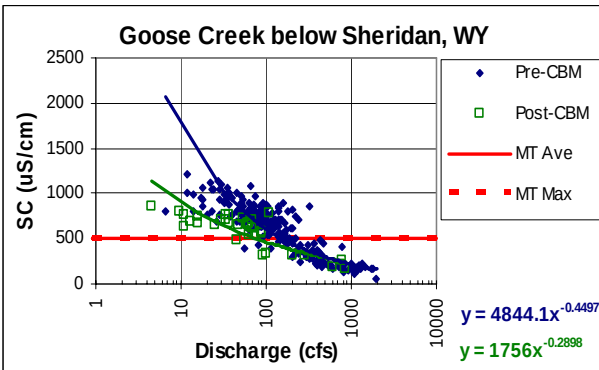
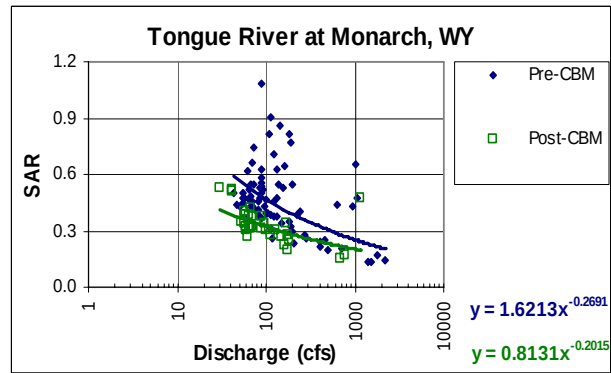
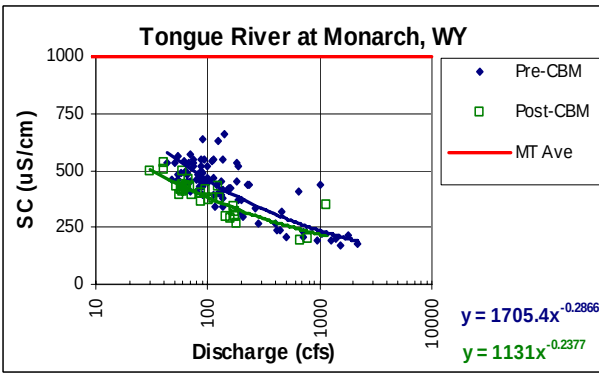


Figure 8. Irrigation season discharge versus SC and SAR at selected USGS monitoring stations in the Upper Tongue River watershed.

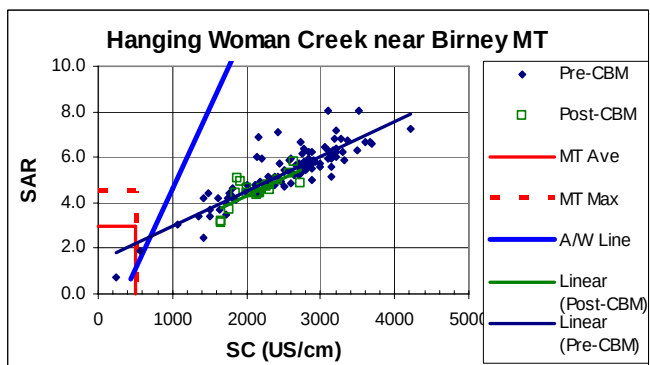
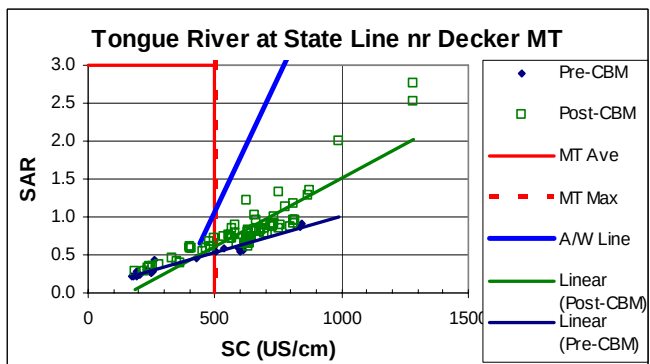
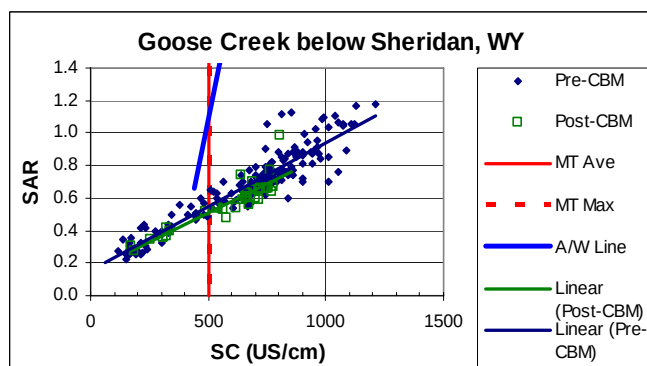
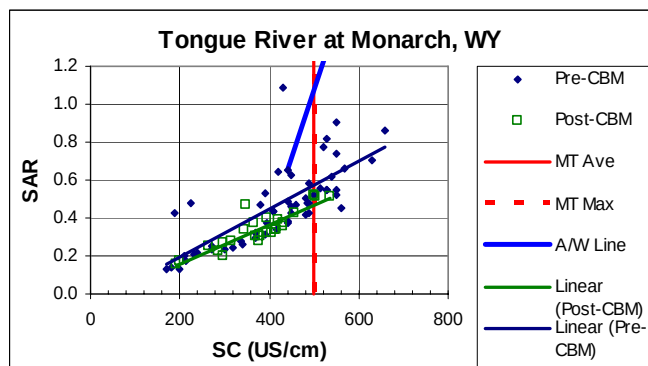


Figure 9. Irrigation season SC versus SAR at selected USGS monitoring stations in the Upper Tongue River watershed.

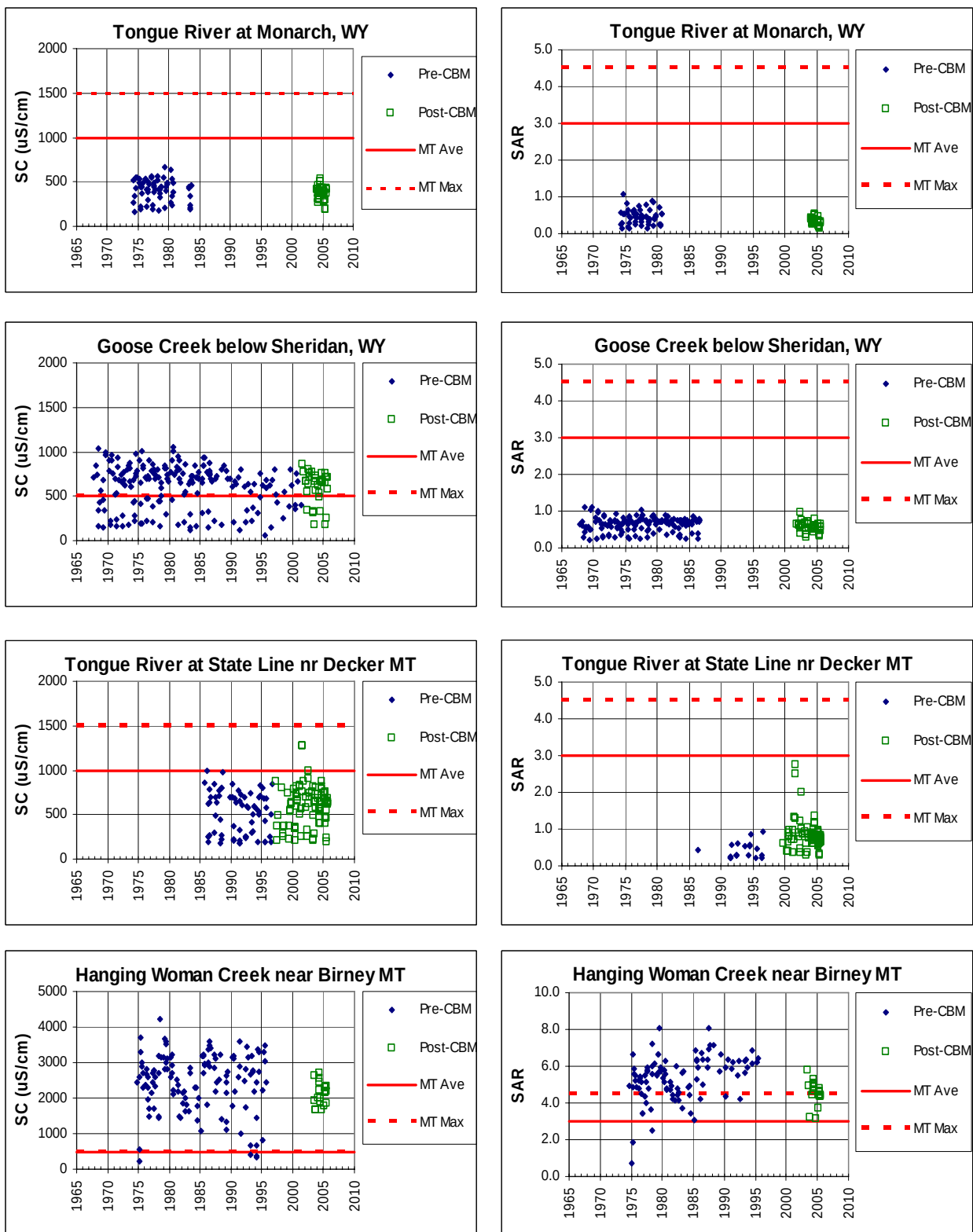
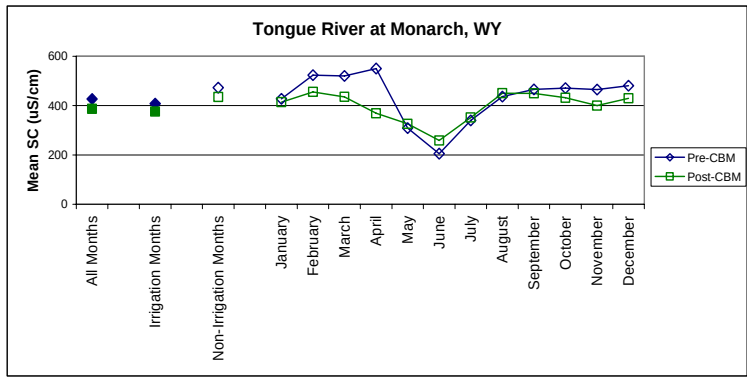
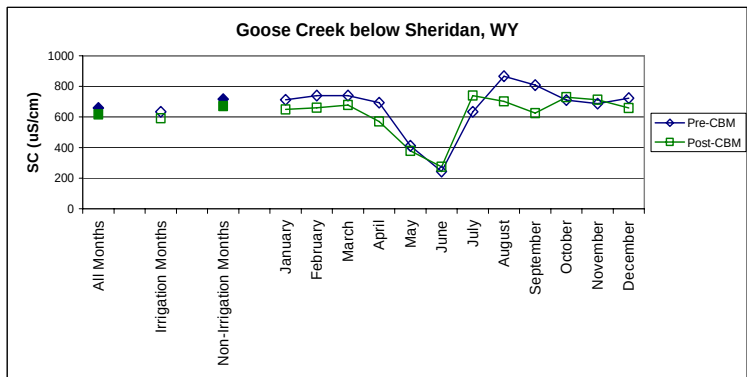


Figure 10. Irrigation season SC and SAR versus time at selected USGS monitoring stations in the Upper Tongue River watershed.

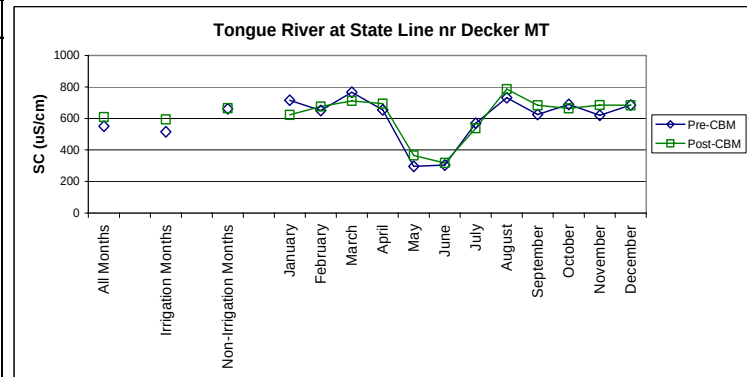
Mean SC (uS/cm)	< 7/1/2001		> 7/1/2001		Rank Sum Test Prob. M1=M2
	N	Mean	N	Mean	
All Months	91	426	32	387	-0.0044
Irrigation Months	65	408	26	375	-0.032
Non-Irrigation Months	26	473	6	435	-0.062
January	7	427	1	414	-
February	6	523	3	456	-
March	6	520	3	436	-
April	8	551	4	369	-
May	8	309	4	326	+
June	8	205	4	258	+
July	9	340	3	352	+
August	11	436	5	450	+
September	8	466	2	450	-
October	7	471	1	432	-
November	6	465	1	400	-
December	7	481	1	430	-



Mean SC (uS/cm)	< 7/1/2001		> 7/1/2001		Rank Sum Test Prob. M1=M2
	N	Mean	N	Mean	
All Months	333	658	48	617	-0.0022
Irrigation Months	234	634	33	592	-0.067
Non-Irrigation Months	99	716	15	671	-0.0006
January	28	713	4	650	-
February	25	740	4	660	-
March	27	739	4	678	-
April	21	693	4	570	-
May	31	411	4	379	-
June	30	244	4	275	+
July	34	633	5	740	+
August	34	866	4	702	-
September	24	807	4	626	-
October	33	710	4	729	+
November	25	687	4	713	+
December	21	723	3	659	-



Mean SC (uS/cm)	< 1999		> 1999		Rank Sum Test Prob. M1=M2
	N	Mean	N	Mean	
All Months	98	552	123	609	0.18
Irrigation Months	74	516	97	594	0.073
Non-Irrigation Months	24	661	26	665	-0.67
January	6	715	7	622	-
February	5	650	7	675	+
March	9	766	10	711	-
April	4	654	9	694	+
May	16	296	13	365	+
June	16	304	12	318	+
July	8	570	10	537	-
August	10	731	11	786	+
September	6	624	22	683	+
October	5	689	10	664	-
November	9	621	7	685	+
December	4	685	5	684	-



Mean SC (uS/cm)	< 2002		> 2002		Rank Sum Test Prob. M1=M2
	N	Mean	N	Mean	
All Months	192	2457	25	2176	-0.0057
Irrigation Months	129	2453	20	2118	-0.0016
Non-Irrigation Months	63	2466	5	2408	-0.84
January	14	2567	0		-
February	17	1986	2	2745	+
March	30	1670	2	1880	+
April	15	2855	4	2368	-
May	19	2892	4	2340	-
June	19	2761	4	2093	-
July	11	2854	2	2245	-
August	14	2384	1	1920	-
September	11	2631	0		-
October	10	2244	3	1663	-
November	17	2538	1	1880	-
December	15	2836	2	2335	-

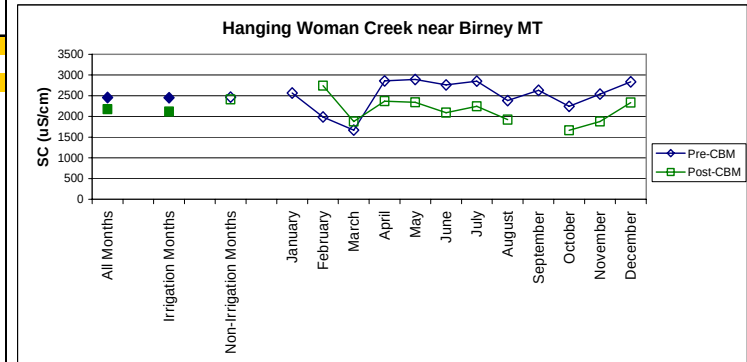
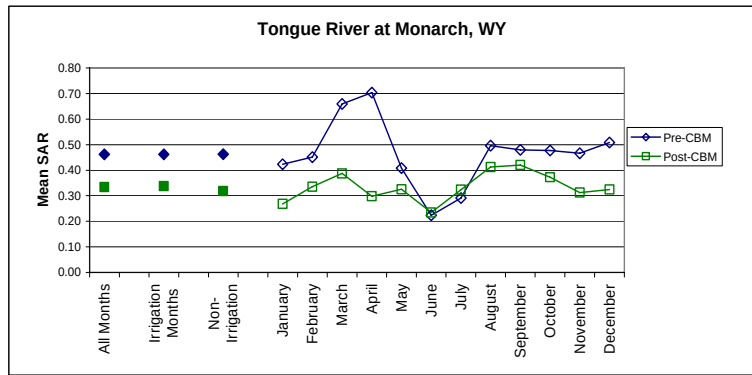
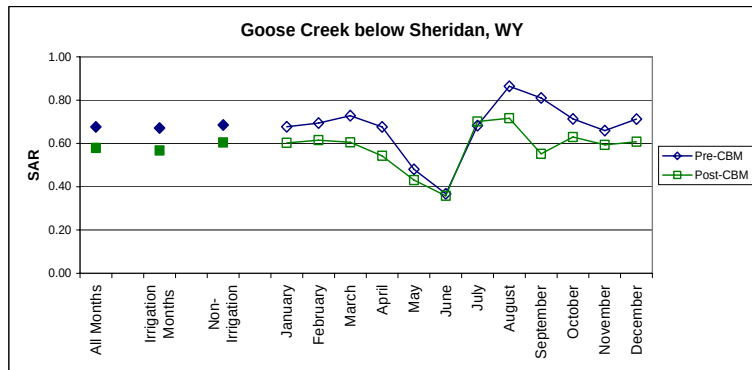


Figure 11. SC statistics pre- and post-CBNG development at selected USGS monitoring stations in the Upper Tongue River watershed.

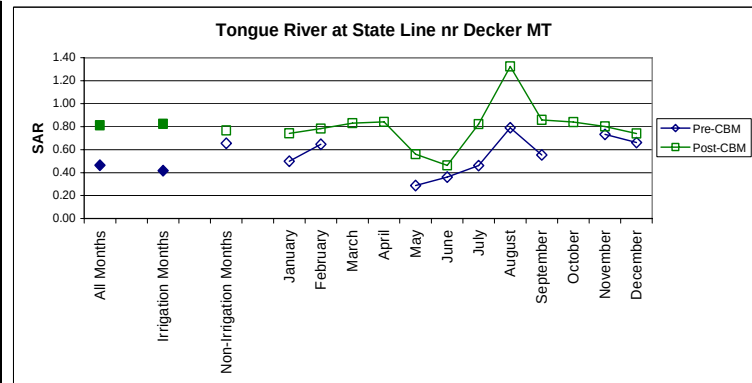
Mean SAR	< 7/1/2001		> 7/1/2001		Rank Sum Test Prob. M1=M2
	N	Mean	N	Mean	
All Months	79	0.46	31	0.33	-0.00000018
Irrigation Months	55	0.46	25	0.34	-0.0024
Non-Irrigation Months	24	0.46	6	0.32	-0.0000043
January	6	0.42	1	0.27	-
February	6	0.45	3	0.33	-
March	5	0.66	3	0.39	-
April	7	0.70	4	0.30	-
May	7	0.41	4	0.33	-
June	6	0.22	4	0.23	+
July	8	0.29	3	0.32	+
August	8	0.50	4	0.41	-
September	7	0.48	2	0.42	-
October	7	0.48	1	0.37	-
November	6	0.47	1	0.31	-
December	6	0.51	1	0.32	-



Mean SAR	< 7/1/2001		> 7/1/2001		Rank Sum Test Prob. M1=M2
	N	Mean	N	Mean	
All Months	269	0.68	47	0.58	-0.0000041
Irrigation Months	183	0.67	32	0.57	-0.002
Non-Irrigation Months	86	0.69	15	0.60	-0.0000013
January	23	0.68	4	0.60	-
February	22	0.69	4	0.61	-
March	21	0.73	4	0.60	-
April	18	0.68	4	0.54	-
May	24	0.48	4	0.43	-
June	21	0.37	4	0.36	-
July	27	0.68	4	0.70	+
August	28	0.86	4	0.72	-
September	22	0.81	4	0.55	-
October	22	0.71	4	0.63	-
November	21	0.66	4	0.59	-
December	20	0.71	3	0.61	-



Mean SAR	< 1999		> 1999		Rank Sum Test Prob. M1=M2
	N	Mean	N	Mean	
All Months	25	0.46	93	0.81	0.0000001
Irrigation Months	20	0.42	72	0.82	0.0000002
Non-Irrigation Months	5	0.65	21	0.77	0.054
January	1	0.50	5	0.74	+
February	1	0.65	6	0.78	+
March	0		7	0.83	-
April	0		7	0.84	-
May	9	0.29	8	0.56	+
June	5	0.36	8	0.46	+
July	1	0.46	8	0.82	+
August	3	0.79	8	1.32	+
September	2	0.55	20	0.86	+
October	0		6	0.84	-
November	2	0.73	5	0.80	+
December	1	0.66	5	0.74	+



Mean SAR	< 2002		> 2002		Rank Sum Test Prob. M1=M2
	N	Mean	N	Mean	
All Months	145	5.24	24	4.53	-0.00014
Irrigation Months	99	5.37	19	4.54	-0.000077
Non-Irrigation Months	46	4.96	5	4.51	-0.36
January	12	4.82	0		-
February	9	4.59	2	4.97	+
March	17	4.30	2	4.07	-
April	15	5.74	4	4.65	-
May	15	5.70	4	4.86	-
June	16	5.88	4	4.66	-
July	11	5.84	2	5.09	-
August	8	5.15	1	4.93	-
September	8	5.40	0		-
October	9	4.95	2	3.16	-
November	15	5.10	1	3.74	-
December	10	5.24	2	4.44	-

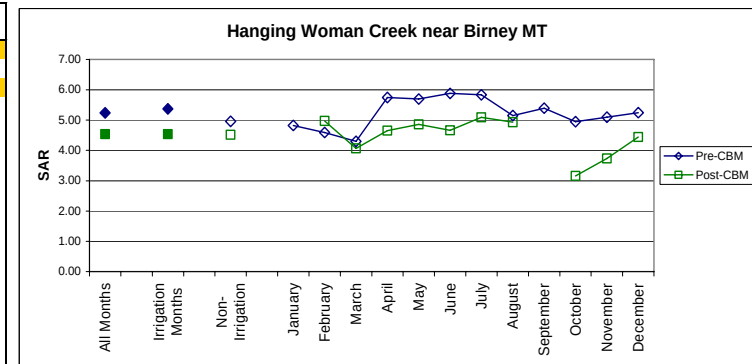


Figure 12. SAR statistics pre- and post-CBNG development at selected USGS monitoring stations in the Upper Tongue River watershed.