

APPENDIX 2.6-2A

HISTORICAL WATER CHEMISTRY DATA  
FOR USGS 06342890  
SOUTH BRANCH HEART RIVER BELOW BULL CREEK

Sample date/time	Water Temperature deg C	Air temperature deg C	BP mm Hg	Instantaneous discharge cfs	Specific conductance µS/cm 25 deg C	Dissolved oxygen mg/L	pH std s.u.	Ammonia mg/L as N	Ammonia + org-N mg/L as N	Nitrite + Nitrate mg/L as N	Phosphorus unfltrd mg/L	Calcium mg/L as CaCO <sub>3</sub>	Magnesium mg/L	Sodium mg/L	Potassium mg/L	Chloride mg/L
1995-06-03 19:30	21.5	20.5		23	1130		7.8		1.2	.088	.244	39	21.4	187	8.6	7.3
1995-07-12 18:45	27.0	28.5		8.1	301	4.4	7.8	.058		.340	1.88	60	87.1	126	79.9	
1995-07-13 16:40	25.0	27.0		11	390	6.6	7.5	.068	.50	.449	1.82	43	68.0	143	49.4	3.5
1995-07-14 13:15	22.0	21.0		13	415	3.7	7.9	.018	.34	.189	1.32	24	40.2	117	33.1	5.3
1995-07-18 13:50	23.0	30.5		1.1	1660	7.6	7.8	.027	1.4		.067	44	28.6	238	7.0	8.3
1995-08-24 17:00	21.0	28.5		172	200	4.2	7.5	.031	.72	.630	.860	15	4.3	24.2	7.9	< 3.0
1995-08-25 16:00	20.3		693	533	202	4.0	7.4	.066	.95	.506	.275	9.2	2.7	31.5	6.5	3.5
1996-03-11 14:15	2.0	13.8	705	57	227	11.2	7.7	.344	1.6	.760	.608	14	5.1	29.3	11.3	< 3.0
1996-03-12 11:50	.9	13.0	703	360	227	10.9	7.4	.317	1.6	.570	.379	14	8.5	24.1	10.2	3.1
1996-03-14 13:30	1.4	13.0	705	56	313	11.5	7.7	.192	1.3	.450	.254	14	8.2	42.3	9.3	3.8

<: Actual value is known to be less than the value shown.

-mg/L: milligrams per liter

-µg/L: micrograms per liter

-µS/cm: microSiemens per centimeter

-s.u.: standard units

-std: standard

deg C: Degree Celsius

cfs: Cubic feet per second

as N: as Nitrogen

ANC - acid neutralization capacity

BP: barometric pressure

M: Presence of material verified but not quantified  
(USGS 1997)

APPENDIX 2.6-2A

HISTORICAL WATER CHEMISTRY DATA  
FOR USGS 06342890  
SOUTH BRANCH HEART RIVER BELOW BULL CREEK

Sample date/time	Sulfate mg/L	Arsenic µg/L	Barium µg/L	Cadmium µg/L	Chromium µg/L	Copper µg/L	Iron µg/L	Lead µg/L	Manganese µg/L	Zinc µg/L	Selenium µg/L	Fecal coliform M-FC 0.7µMF/col/ 100 mL	ANC, fixed end point lab mg/L as CaCO <sub>3</sub>
1995-06-03 19:30	313						7890		210				231
1995-07-12 18:45	5.0	56	3000	M	237	220	220000	200	2030	510	M	1600	112
1995-07-13 16:40	70.0						73400		910			16	104
1995-07-14 13:15	78.0						165000		1440			16	112
1995-07-18 13:50	477						380		100			120	331
1995-08-24 17:00	26.0						13700		1090				79
1995-08-25 16:00	31.0						550	M					69
1996-03-11 14:15	49.0						29100		460			70	66
1996-03-12 11:50	49.0						13600		280			380	61
1996-03-14 13:30	95.0						7700		200			110	69

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deg C: Degree Celsius

cfs: Cubic feet per second

as N: as Nitrogen

ANC - acid neutralization capacity

BP: barometric pressure

M: Presence of material verified but not quantified  
(USGS 1997)

APPENDIX 2.6-2B

HISTORICAL WATER CHEMISTRY DATA  
USGS 06342900 SOUTH BRANCH HEART RIVER NEAR SOUTH HEART

Sample date/time	Water temperature deg C	Air temperature deg C	BP mm Hg	Instantaneous discharge cfs	Specific conductance µS/cm 25 degC	Dissolved oxygen mg/L	Dissolved oxygen % sat	pH std s.u.	Carbon dioxide mg/L	ANC, fixed end point mg/L as CaCO <sub>3</sub>	Water unfiltered Carbonate mg/L as CaCO <sub>3</sub>	ANC, wat unf mg/L as CaCO <sub>3</sub>	Bicarbonate water unfiltered fixed end point field mg/L	Carbonate water unfiltered fixed end point field mg/L	Total nitrogen water unfiltered mg/L	Total nitrogen water filtered mg/L	Organic nitrogen water unfiltered mg/L	Ammonia water filtered mg/L as N	Ammonia water unfiltered mg/L as N	Ammonia + org-N, water filtered mg/L as N	Ammonia + org-N, sus sed total mg/L as N	Ammonia + org-N, water unfiltered mg/L as N	Organic carbon suspend sediment total, mg/L	Cyanide water unfiltered mg/L	Hardness water mg/L as CaCO <sub>3</sub>	Noncarb hardness-water unfiltered mg/L as CaCO <sub>3</sub>	Calcium water unfiltered mg/L as CaCO <sub>3</sub>	Calcium water filtered mg/L	Magnesium, water filtered mg/L
1979-03-27 09:40	.0	-2.0		202	500	11.2	85	7.4	5.4	69			84	.0	3.0		1.1		.080			1.2			93	24		19.0	11.0
1979-04-10 16:55	1.5	1.0		517													.79		.090			.88	1.9		79	5		17.0	8.90
1979-04-13 10:30	.0	1.0		68	448	12.4	95	7.9	1.8	74			90	.0	1.2		.75		.010			.76	.6		400	93		87.0	45.0
1979-05-15 09:15	8.0	17.0		2.1	2050	12.2	113	8.4	2.4	310			372	1	.76		.75		.010			.76	.6		400	93		87.0	45.0
1979-06-12 16:00	19.0	30.5		.02	2460	5.4	64	8.4	2.7	350			422	2	1.1		1.0		.080			1.1	.7		470	120		94.0	56.0
1979-08-07 14:10	19.5	26.0		.01	695	9.3	109	8.8	.5	170			185	10	1.2		1.1		.060			1.2			16	.0		4.70	1.00
1979-09-05 12:15	15.5	22.0		.08	892	8.1	84	8.3	1.6	163			199	.0	.14		.09		.050			.14	1.1		56	.0			
1980-03-18 10:00	.0	10.0		5.7	572	11.3	85	7.6	4.6	94			115	.0	3.2		2.6		.380			3.0	1.0		91	.0		21.0	9.30
1980-04-08 11:50	3.0	3.5		1.4	1100	11.6	94	8.1	2.8	180			220	.0	1.3		1.2		.150			1.3	1.2		110	.0		25.0	12.0
1980-07-08 14:15	18.5	23.5		.02	1520	4.5	52	8.4	2.2	286			340	4	2.7		2.6		.060			2.7	1.3		76	.0			5.60
1980-08-21 11:50	21.0	16.0		1.6																									
1980-11-11 12:45	3.0	5.5		.25	665	11.4	92	8.8	.5	168	170	190	7		1.7	2.6		.120	1.2	1.5	2.7	2.7		15	.0		5.20	.50	
1981-02-18 09:05	.0	5.0		.30	651	13.0	99	8.0		140					2.1	1.6		.090	1.4	.30	1.7	1.1	.00	31	.0		8.10	2.60	
1981-03-16 15:10	.0	17.5		.10	910	12.0	90	8.3		200														38	.0		11.0	2.60	
1981-03-26 10:50	1.0	8.5		.04	705	10.9	83	8.2	2.1	170			207	.0															
1981-06-23 10:30	16.0	24.0		.14	618	6.6	73	8.1		150					.97	1.5	73.0	.110	.95	.65	1.6	4.3	.00	26	.0		7.60	1.60	
1981-07-27 14:55	18.0	22.5		2.1	470	6.2	70	8.8		360					2.1	8.4		.050	1.2	7.2	8.4	14.0	.00	6	.0		1.90	.30	
1981-08-18 13:00	20.0	26.0		151	465	4.8	56	7.7		90														90	.0		22.0	8.60	
1981-08-31 12:30	14.0	17.0		.08	850	7.8	82	8.3		180														150	.0		36.0	15.0	
1982-02-20 00:00	2.5			1210	222																								
1982-03-17 09:35																													
1982-03-17 10:00	1.0			50	400	13.1		7.0																					
1982-03-31 08:05																													
1982-03-31 10:50	1.0	2.0	737	680	320	13.4	97	6.9							4.5	2.5		.390	3.0	.00	2.9	2.2	< .01	58			14.0	5.70	
1982-05-24 12:20	12.5	22.5	740	38	1070	9.3	90	7.2																					
1982-06-24 11:10	18.0	12.0	743	1.1	1480	6.7	75	8.4									1.6		.120	1.8	.00	1.7	.9		300			67.0	31.0
1982-10-27 11:20	8.5	8.5		.16	1150																								
1983-02-16 14:15	1.5	8.0		100	710																								
1983-04-19 15:15	12.0	13.0	690	3.1	1890	11.5	117	E 8.4										.090	1.2	.00	1.2	.5					62.0	39.0	
1983-06-14 15:50	16.0	21.0		.06	2500																								
1983-08-01 14:40	23.0	29.0	695	.50	1300	8.1		8.3											.010	1.3	.60	1.9	2.1	< .01				44.0	17.0
1983-10-05 16:35	8.5	12.0		.43																									
1995-06-03 16:55	22.0	27.0		26	932			8.1																					
1995-07-13 12:50	23.8			20	338	6.5		7.4																					
1995-07-13 18:10	27.0	25.0		47	381	6.7		8.7											.025										
1995-07-14 10:50	21.0	20.0		8.4	319	5.6		7.7											.054										
1995-07-18 15:50	23.0	24.5		1.7	1650	7.9		8.3											.051										
1995-08-24 15:30	20.1	28.0		453	255	4.3		8.2											.059										
1995-08-25 13:45	19.7		692	486	251	5.5		7.7											.110										
1996-02-09 17:20	1.0	11.0	790	178	228	10.1		7.7											.272										
1996-03-11 16:30	.3	13.3	705	96	331	10.1		7.7											.375										
1996-03-12 09:00	.2	12.0	705	275	336	11.1		7.5											.447										
1996-03-14 11:46	.8	13.5	705	93	305	11.2		7.0											.172										

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 as N: as Nitrogen  
 ANC - acid neutralization capacity  
 BP: barometric pressure  
 M: Presence of material verified but not quantified  
 (USGS 1997)

APPENDIX 2.6-2B

HISTORICAL WATER CHEMISTRY DATA  
USGS 06342900 SOUTH BRANCH HEART RIVER NEAR SOUTH HEART

Sample date/time	Magnesium, water unfiltered mg/L	Sodium water unfiltered mg/L	Sodium water filtered mg/L	Sodium absorption ratio	Sodium fraction of cations percent	Sodium + Potassium water filtered mg/L	Potassium water filtered mg/L	Potassium water unfiltered mg/L	Chloride water filtered mg/L	Sulfate water filtered mg/L	Sulfate water unfiltered mg/L	Flouride, water filtered mg/L	Silica water filtered mg/L	Arsenic water filtered µg/L	Arsenic suspended sediment tot ug/L	Arsenic water unfiltered µg/L	Arsenic bed sediment tot ug/g	Barium, water filtered µg/L	Barium suspended sed recoverable ug/L	Barium water unfiltered recoverable µg/L	Barium bed sediment recoverable ug/g	Beryll-, water filtered ug/L	Beryll-suspended sed recoverable ug/L	Beryll- water unfiltered recoverable ug/L	Beryll-bed sediment recoverable ug/g	Boron-wat filtered ug/L	Cadmium water filtered µg/L	Cadmium- water unfiltered µg/L	Cadmium-bed sediment recoverable ug/g	Chromium-bed sediment recoverable ug/g	Chromium water filtered µg/L	Chromium suspd sed recoverable ug/L	Chromium water unfiltered recoverable µg/L	Cobalt water filtered ug/L				
1979-03-27 09:40			65.0	3	58		8.20		4.8	150		.10	6.50	2.0		2		< 100		< 100		< 10		< 10			120	U	< 2			U		< 20	U			
1979-04-10 16:55																																						
1979-04-13 10:30			65.0	3	63		4.50		5.5	140		.10	6.90															110										
1979-05-15 09:15			320	7	63		7.50		15.0	770		.30	6.30															310										
1979-06-12 16:00			380	8	63	390	10.0		13.0	910		.30	1.60														420											
1979-08-07 14:10			160	17	94	160	3.50		3.8	200		.40	20.0	17.0		14		50.0	50	< 100		< 1	.0	< 10			120					U	.0	U	< 3			
1979-09-05 12:15					89	170	4.90		4.2	280		.30															190											
1980-03-18 10:00			78.0	4	62		12.0		4.2	170		.10	6.30	5.0	< 1	5	14	70.0	100	200	230	< 1	.0	< 10	1	140	M	< 2	.0	8.0	< 2	.0	< 2	< 3				
1980-04-08 11:50			190	8	77		7.00		4.7	350		.20	7.10														200											
1980-07-08 14:15			310	17	89		8.00		4.1	460		.80	16.0		< 1	26	10	< 100	.0	100	2400	< 1		< 10	1	280			1.0	10	10	.0	10	< 3				
1980-08-21 11:50																																						
1980-11-11 12:45			140	16	94		2.50		3.2	140			130					< 100	800	800						230												
1981-02-18 09:05			140	11	90		3.40		3.0	220		.20	12.0	5.0	< 1	5						< 1		< 10		50	< 1	< 2			< 2	.0	< 2	< 3				
1981-03-16 15:10			190	13	91		2.70		1.6	250		.40	7.60													140												
1981-03-26 10:50																																						
1981-06-23 10:30			130	11	90		3.30		2.1	170		.30	14.0	9.0	1	10	66	< 100	.0	100		< 1		< 10		220	< 1	< 2	.0	2.0	10	10	20					
1981-07-27 14:55			86.0	16	96		2.20		1.9	8.0		.50	39.0	13.0	< 1	13						< 1		10	220	< 1	M				10	80	90					
1981-08-18 13:00			64.0	3	58		8.20		7.7	130		.20	9.10													80												
1981-08-31 12:30			130	5	63		8.80		14.0	230		.20	10.0													130												
1982-02-20 00:00																																						
1982-03-17 09:35																																						
1982-03-17 10:00																																						
1982-03-31 08:05																																						
1982-03-31 10:50			35.0	2	54		5.60		3.5	81.0		.10	7.00	2.0	2	4						< 3		< 10		70	< 3	< 1			< 10		20					
1982-05-24 12:20																																						
1982-06-24 11:10			230	6	62		7.90		9.7	470		.30	10.0													240												
1982-10-27 11:20																																						
1983-02-16 14:15																																						
1983-04-19 15:15			330				5.80		8.5	750		.20	2.40													270												
1983-06-14 15:50																																						
1983-08-01 14:40			220				7.80		7.8	500		.40	11.0	6.0	< 1	6						< .5		< 10		290	< 1	< 1			< 10		< 10					
1983-10-05 16:35																																						
1995-06-03 16:55	19.3	130					7.6	6.9		254																												
1995-07-13 12:50	58.8	109					41.7	16.9		38.0																												
1995-07-13 18:10	29.7	46.5					13.9	47.0		53.0																												
1995-07-14 10:50	69.2	110					48.4	15.0		29.0																												
1995-07-18 15:50	25.9	235					8.6	5.0		518																												
1995-08-24 15:30	2.4	57.0					5.7	3.8		57.0																												
1995-08-25 13:45	6.8	24.1					7.4	4.3		39.0																												
1996-02-09 17:20	6.4	20.9					11.8	6.7		42.0																												
1996-03-11 16:30	9.0	37.5					13.0	3.6		85.0																												
1996-03-12 09:00	11.6	36.4					13.7	3.7		83.0																												
1996-03-14 11:46	10.1	40.1					9.9	39.0		87.0																												

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 -s.u.: standard units  
 -std: standard  
 deg C: Degree Celsius  
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 ANC - acid neutralization capacity  
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 (USGS 1997)

APPENDIX 2.6-2B

HISTORICAL WATER CHEMISTRY DATA  
USGS 06342900 SOUTH BRANCH HEART RIVER NEAR SOUTH HEART

Sample date/time	Cobalt suspd sed recoverable ug/L	Cobalt water unfiltered recoverable ug/L	Cobalt bed sediment recoverable ug/g	Copper water filtered µg/L	Copper water unfiltered recoverable µg/L	Iron water unfiltered µg/L	Iron water filtered µg/L	Lead water filtered µg/L	Lead water unfiltered µg/L	manganese susp sed ug/L	Manganese water unfiltered µg/L	Manganese water filtered µg/L	molybdenum water filtered ug/L	molybdenum suspended sed ug/L	molybdenum water unfiltered ug/L	Nickel water filtered ug/L	Nickel, susp sed ug/L	Nickel water unfiltered ug/L	Strontium wat fit ug/L	Strontium susp sed ug/L	Strontium wat unfit ug/L	Vanadium wat fit ug/L	Zinc wat fit µg/L	Zinc susp sed ug/L	Zinc wat unfit. Recoverable µg/L	Aluminum fit ug/L	Lithium fit ug/L	Lithium suspend sed ug/L	Lithium unfit ug/L	Selenium wat filtered µg/L	Selenium suspend sed ug/L	Selenium wat unfiltered µg/L	Gross Alpha radioactive wat fit U-nat, pCi/L	Gross Alpha radioactive suspend sed U-nat, pCi/L	Gross Beta radioactive wat fit Cs-137, pCi/L	Gross Beta radioactive susp sed Cs-137, pCi/L				
1979-03-27 09:40		U		20	30		320				120	80	< 1		2	U		M					1.9	30		30	80	M		M	1		1	< 2.9	1.8	11.0	3.2			
1979-04-10 16:55																																								
1979-04-13 10:30							250																																	
1979-05-15 09:15							20																																	
1979-06-12 16:00							20																																	
1979-08-07 14:10	.0	M		20	20		70			60	60	M	< 10	.0	< 1	M	4	M					28.0	< 3	M	< 20	50	< 10	.0	< 10	4	.0	3	6.1	11	7.0	8.3			
1979-09-05 12:15																																								
1980-03-18 10:00	.0	M	10	< 10	M		180	M	M	20	250	230	< 10	.0	1	< 2	10	M	170				< 6.0	10	10	20	40	M	M	10	< 1	.0	< 1	< 4.1	6.8	11.0	5.5			
1980-04-08 11:50							80																																	
1980-07-08 14:15		M	20	< 10	M		70			120	120	M	< 10		2	M	.0	M	200				15.0	< 3		10	10	< 10	M	20	1	.0	1	12	1.3	8.1	2.6			
1980-08-21 11:50																																								
1980-11-11 12:45						43000	150			520	530	10							< 10	480	480						10	40	50											
1981-02-18 09:05				M	M	2700	130	< 2	M	60	80	20				M	5	M						M	M	10				1	.0	1								
1981-03-16 15:10						690	90			10	20	10																												
1981-03-26 10:50																																								
1981-06-23 10:30			.0	M	20	6300	230	M	M	140	140	M				M	10	M	80	50	130			M	20	30			10	.0	10	1	.0	1		12	6.9	14.0		
1981-07-27 14:55				M	130	90000	140	< 2	M	2400	2400	M				M	80	M						M	280	290					2	2	4							
1981-08-18 13:00						19000	120			400	410	M																												
1981-08-31 12:30						620	60			60	60	M																												
1982-02-20 00:00																																								
1982-03-17 09:35																																								
1982-03-17 10:00																																								
1982-03-31 08:05																																								
1982-03-31 10:50				10	30	18000	320	M	M	260	350	90				M	24	M						90	40	130											16	6.2	16.0	
1982-05-24 12:20																																								
1982-06-24 11:10						950	70			130	140	10																												
1982-10-27 11:20																																								
1983-02-16 14:15																																								
1983-04-19 15:15						500	20			50	80	30																												
1983-06-14 15:50																																								
1983-08-01 14:40				M	10	2700	20	< 1	< 1	90	120	30				M	15	M						M	10	20											5.0	13.0	7.4	
1983-10-05 16:35																																								
1995-06-03 16:55						6660					180																													
1995-07-13 12:50						6340					760																													
1995-07-13 18:10						76500					1170																													
1995-07-14 10:50						16200					1500																													
1995-07-18 15:50						450					80																													
1995-08-24 15:30						11500					1360																													
1995-08-25 13:45						18700					2090																													
1996-02-09 17:20						7000					170																													
1996-03-11 16:30						12500					210																													
1996-03-12 09:00						15400					300																													
1996-03-14 11:46						10300					240																													

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 -s.u.: standard units  
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 deg C: Degree Celsius  
 cfs: Cubic feet per second  
 as N: as Nitrogen  
 ANC - acid neutralization capacity  
 BP: barometric pressure  
 M: Presence of material verified but not quantified  
 (USGS 1997)

APPENDIX 2.6-2B

HISTORICAL WATER CHEMISTRY DATA  
USGS 06342900 SOUTH BRANCH HEART RIVER NEAR SOUTH HEART

Sample date/time	Fecal coliform M-FC 0.7uMF/col/col/100 mL	Fecal streptococci KF MF. col/100 mL	Phenolic compounds wat unfil ug/L	Hepta-chlor, susp sed ug/L	Phytoplankton tot cells /mL	Residue on evap at 180 degC mg/L	Residue wat filt sum of constituents mg/L	Residue wat dissolved tons/d	Residue wat filt tons/acre-ft	Suspnd. Sedimenr sieve diametr % <.063mm	Ammonia wat unfil mg/L	Ammonia wat filt mg/L	Phosphorous wat unfilter mg/L as PO4	Tot nitrogen water unfil mg/L as NO3	Mercury wat filt ug/L	Mercury susp sed ug/L	Mercury wat unfiltered ug/L	Gross alpha radio-activity wat filt U-nat, pCi/L	Gross alpha radio-activity susp. Sed U-nat, pCi/L	Gross beta radio-activity wat filt Sr/Y-90 pCi/L	Gross beta radio-activity susp. Sed Sr/Y-90 pCi/L	suspended sed concentration mg/L	suspended sed disch tons/d	K-40 wat filt pCi/L	Deuterium/Protium ratio wat unf per mil	Tot cell count cells/mL	
1979-03-27 09:40	E 13	E 1300			60	338	307	184	.46					13.0	< .10		< .1	< 4.3	2.6	10.0	3.2	59	32			60	
1979-04-10 16:55																							447	624			
1979-04-13 10:30	E 4	1200			290	265	293	48.7	.36		.11		.61	5.2								157	29			290	
1979-05-15 09:15	E 11	53			1900	1480	1440	8.39	2.01		.01		.18	3.4								29	.16			1900	
1979-06-12 16:00	100	200			1400	1720	1680	.09	2.34		.10		.21	4.9								21	.00			1400	
1979-08-07 14:10	330	1100			18000	462	495	.01	.63		.07		.89	5.4	< .10	.1	< .5	9.0	16.0	6.5	8.4	200	.01			18000	
1979-09-05 12:15	320	1900			160000	593		.13	.81		.06		.46	.6								28	.01			160000	
1980-03-18 10:00	E 23	1900				398	360	6.13	.54		.46		2.0	14.0	< .10	.1	.2	< 6.0	10.0	11.0	5.7	195	3.0				
1980-04-08 11:50	E 4	79			18000	712	705	2.69	.97		.18		.64	5.8								49	.19			18000	
1980-07-08 14:15	530	1000			14000	1020	998	.06	1.39		.07		.83	12.0	< .10	.1	.1	18.0	1.9	7.9	2.5	18	.00			14000	
1980-08-21 11:50																						18000	78				
1980-11-11 12:45						460	525	.31	.63		.15		4.0									3640	2.5				
1981-02-18 09:05			3		310	460	477	.37	.63				1.5	< .10	< .1	.1						162	.13	2.5		310	
1981-03-16 15:10					8900	589	586	.16	.80													15	.00	2.0		8900	
1981-03-26 10:50																											
1981-06-23 10:30			8	154	51000	417	420	.16	.57			94.0	.80	< .10	.1	.1	< 10.0	18.0	6.7	14.0		241	.09	2.5	6.60	51000	
1981-07-27 14:55			7			323	260	1.83	.44				23		.20	.5	.7					8600	49				
1981-08-18 13:00					10000	309	304	126	.42													583	238			10000	
1981-08-31 12:30					33000	562	552	.12	.76													38	.01			33000	
1982-02-20 00:00																											
1982-03-17 09:35																						1030					
1982-03-17 10:00																											
1982-03-31 08:05										99												385					
1982-03-31 10:50			5			220		404	.30				.71	< .10		.5	< 4.1	24.0	6.0	15.0							
1982-05-24 12:20																											
1982-06-24 11:10					1020			3.14	1.39				.21														
1982-10-27 11:20																											
1983-02-16 14:15																											
1983-04-19 15:15						1360							.31														
1983-06-14 15:50																											
1983-08-01 14:40			2										.40	< .10		.1	< 22.0	7.3	13.0	7.0							
1983-10-05 16:35																											
1995-06-03 16:55																											
1995-07-13 12:50	16																										
1995-07-13 18:10	16																										
1995-07-14 10:50	16																										
1995-07-18 15:50	70																										
1995-08-24 15:30																											
1995-08-25 13:45																											
1996-02-09 17:20																											
1996-03-11 16:30	430																										
1996-03-12 09:00																											
1996-03-14 11:46	60																										

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deg C: Degree Celsius

cfs: Cubic feet per second

as N: as Nitrogen

ANC - acid neutralization capacity

BP: barometric pressure

M: Presence of material verified but not quantified (USGS 1997)

APPENDIX 2.6-2C

HISTORICAL WATER CHEMISTRY DATA

USGS 06342920 HEART RIVER AT SOUTH HEART

Sample date/time	Water temperature deg C	Air temperature deg C	BP mm Hg	Instantaneous discharge cfs	Specific conductance µS/cm 25 degC	Dissolved oxygen mg/L	pH s.u.	Ammonia as N	Ammonia + org-N as N	Nitrite + Nitrate as N	Phosphorus mg/L	Calcium CaCO <sub>3</sub>	Magnesium mg/L	Sodium, mg/L	Potassium mg/L	Chloride- mg/L	Sulfate mg/L	Arsenic	Barium	Cadmium	Chromium	Copper, µg/L	Iron, µg/L	Lead, µg/L	Manganese µg/L	Zinc,	Selenium	Fecal coliform M- FC 0.7µMF/col/ col/ 100 mL	ANC, fixed end point lab mg/L as CaCO <sub>3</sub>
1995-06-03 14:30	21.0	28.0		43	583		7.6		.60	.190	1.05	11	2.9	130	4.4	4.5	148						80600		1060				137
1995-06-22 12:15	23.5	30.0		.18	2160	6.6	8.4	.049			.198	45	32.3	389	8.7	20.3	717						710		90				459
1995-07-13 12:30	23.5	26.0	697	23	815	4.8	8.0	.088	.71	.137	1.31	21	6.3	172	6.7	6.3	237						103000		1270		16	166	
1995-07-13 16:25	25.0	25.5	698	24	805	4.9	7.9	.075	.70	.222	1.23	17	5.1	168	6.1	6.1	222						4880		690		16	161	
1995-07-14 09:30	21.5	21.5	700	24	470	5.5	8.5	.110	.60	.216	2.27	7.0	1.1	111	3.4	< 3.0	91.0						155000		2220		1600	196	
1995-07-18 16:30	24.0	27.0		3.5	1770	9.5	8.3	.022	1.4		.283	36	23.7	318	9.8	32.0	521						840		120		650	293	
1995-08-17 11:15	22.0	30.0		.25	3450	7.2	8.6	.056	1.4		.169	59	59.8	711	17.2	28.3	1340						190		40		900	494	
1995-08-24 16:50	25.0	27.0		1100	311	4.7	8.7	.133	.70	.699	1.27	28	6.3	41.1	8.7	3.4	73.0						12100		1190			82	
1995-08-25 17:30	22.0	28.0	693	910	316	4.5	7.0	.020	.69	.401	.648	26	8.5	35.6	8.6	3.8	76.0						17100		940			91	
1995-09-20 10:42	10.0	8.0		.56	2350	12.2	7.1		.98		.107	91	53.7	441	12.4	12.4	821						590		270		10	487	
1995-10-13 10:53	8.4	7.0		.60	3280	7.5	7.8	.040	.97	.012	.122	67	47.1	666	10.0	20.2	1310						830		150			627	
1995-11-30 16:15	1.5	7.0	787	.82	3700	9.2	8.0		1.0	.013	.419	72	52.3	768	9.6	65.4	1100						930		240			852	
1996-02-09 15:00	.2	15.0	695	344	295	8.9	7.4	.264	1.7	.720	.463	15	7.9	35.9	12.0	7.8	96.0						6000		170			62	
1996-03-11 14:30	.0	10.5	714	11	1630	9.8	8.4	.363	1.8	.500	.346	44	32.6	274	12.6	13.9	632						4490		420		50	299	
1996-03-12 12:38	.4	11.2	718	842	424	12.2	8.4	.310	1.7	.840	.421	21	13.2	49.0	13.0	5.3	113						12100		350		180	75	
1996-03-14 15:15	1.4	13.0	705	162	331	11.9	7.3	.195	1.3	.570	.320	17	10.4	41.2	10.5	4.2	83.0						11600		260		170	75	

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cfs: Cubic feet per second

as N: as Nitrogen

ANC - acid neutralization capacity

BP: barometric pressure

M: Presence of material verified but not quantified

(USGS 1997)

APPENDIX 2.6-2D

HISTORICAL WATER CHEMISTRY DATA  
USGS 06342850 NORWEGIAN CREEK NEAR BELFIELD, ND

Sample date/time	Water temperature deg C	Air temperature deg C	BP	Instantaneous discharge cfs	Specific conductance µS/cm 25 deg C	Dissolved oxygen mg/L	Dissolved oxygen %sat	pH std s.u.	Carbon dioxide mg/L	ANC, fixed end point mg/L as CaCO <sub>3</sub>	Water unfiltered Carbonate mg/L as CaCO <sub>3</sub>	Bicarbonate water unfiltered fixed end point field mg/L	Carbonate water unfiltered fixed end point field mg/L	Total nitrogen water unfiltered mg/L	Total nitrogen water filtered mg/L	Organic nitrogen water unfiltered mg/L	Ammonia water unfiltered mg/L as N	Ammonia + org-N, water filtered mg/L as N	Ammonia + org-N, water unfiltered mg/L as N	Nitrite + Nitrate water unfiltered mg/L as N	Nitrite + Nitrate water filtered mg/L as N	Phosphate-water unfiltered mg/L	Phosphorous water unfiltered mg/L	Phosphorous water filtered mg/L	Organic carbon-water filtered mg/L	Organic carbon suspend sediment tot mg/L
1979-04-11 10:30	.0	-.5		53	645	9.6	76	7.8	2.7	86		105	.0	1.7		.92	.180		1.1	.580			.160	.080	18.0	
1979-05-04 08:30	6.0	.0		1.6	2600	9.1	83	8.1	4.4	280		346	.0	1.0		.90	.080		.98	.020		.250	.080	.020	22.0	2.0
1979-05-11 11:20	4.0	3.0		1.7	3240	11.6	96	8.2	4.0	320		396	.0	1.2		1.1	.060		1.2	.010		.210	.070	.020	43.0	1.5
1979-06-12 14:30	15.0	24.0		.06	4250	6.2	67	8.0	8.1	420		509	.0	1.8		1.6	.180		1.8	.020		.340	.110	.050	38.0	2.0
1980-03-19 09:15	.0	3.0		4.0	1210	10.9	83	7.6	5.0	102		124	.0	2.7		1.9	.500		2.4	.280	.300		.290	.210	31.0	2.0
1980-04-07 16:00	3.0	4.0		.23	2020	12.4	101	8.2	2.4	192		234	.0	1.6		1.3	.350		1.6	.010	.030		.220	.060	32.0	
1981-08-17 17:16	20.5	26.0		23	660	4.8	57	7.7			110			1.5		3.3	.330	1.3	3.6		.170		.450	.090	11.0	3.0

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ANC - acid neutralization capacity

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(USGS 1997)



APPENDIX 2.6-2D

HISTORICAL WATER CHEMISTRY DATA  
USGS 06342850 NORWEGIAN CREEK NEAR BELFIELD, ND

Sample date/time	Cyanide water unfiltered mg/L	Hardness water mg/L as CaCO <sub>3</sub>	Noncarb hardness-water unfiltered field mg/L as CaCO <sub>3</sub>	Calcium water filtered mg/L	Magnesium, water filtered mg/L	Sodium water filtered mg/L	Sodium absorption ratio	Sodium fraction of cations %	Sodium + Potassium water filtered mg/L as Na	Potassium water filtered mg/L	Chloride water filtered mg/L	Sulfate water filtered mg/L	Flouride, water filtered mg/L	Silica water filtered mg/L	Arsenic water filtered µg/L	Arsenic suspended sediment tot ug/L	Arsenic water unfiltered µg/L	Arsenic bed sediment tot ug/g	Barium, water filtered µg/L	Barium suspended sed recoverable ug/L	Barium water unfiltered recoverable µg/L	Barium bed sediment recoverable ug/g	Beryll-, water filtered ug/L	Beryll-suspended sed recoverable ug/L	Beryll- water unfiltered recoverable ug/L	Beryll-bed sediment recoverable ug/g
1979-04-11 10:30		130	44	24.0	16.0	86.0	3	59		5.20	3.1	220	.10	7.50	1.0		2	22	50.0		< 100	140	< 1		< 10	1
1979-05-04 08:30		570	290	120	65.0	420	8	61		7.40	7.5	1200	.30	5.70												
1979-05-11 11:20		670	350	120	90.0	500	8	62	530	8.00	8.5	990	.40	3.40												
1979-06-12 14:30		1000	580	170	140	630	9	58	640	10.0	6.9	1800	.40	2.10												
1980-03-19 09:15		190	88	34.0	25.0	190	7	67		10.0	5.2	480	.10	5.50	2.0	< 1	2	9	40.0	60	100	200	< 1	.0	< 10	1
1980-04-07 16:00		320	130	57.0	42.0	360	9	71	370	6.60	3.6	850	.20	5.30												
1981-08-17 17:16	.01	140	30	33.0	14.0	97.0	4	58		8.50	14.0	230	.20	9.00	3.0	< 1	< 1						< 1		< 10	

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(USGS 1997)

APPENDIX 2.6-2D

HISTORICAL WATER CHEMISTRY DATA  
USGS 06342850 NORWEGIAN CREEK NEAR BELFIELD, ND

Sample date/time	Boron-wat filtered	Cadmium water filtered	Cadmiuml- water unfiltered	Cadmiuml-bed sediment recoverable	Chromium-bed sediment recoverable	Chromium water filtered	Chromium suspad sed recoverable	Chromium water unfiltered recoverable	Cobalt water filtered	Cobalt suspdnd sed recoverable	Cobalt water unfiltered recoverable	Cobalt bed sediment recoverable	Copper water filtered	Copper suspdnd sed recoverable	Copper water unfiltered recoverable	Iron water unfiltered	Iron water filtered	Lead water unfiltered	Lead water filtered	Manganese water unfiltered	Manganese water filtered	molybdenum water filtered	molybdenum water unfiltered	Nickel water filtered	Nickel water unfiltered	Strontium wat fit
	ug/L	µg/L	µg/L	ug/g	ug/g	µg/L	µg/L	µg/L	ug/L	ug/L	ug/L	ug/g	µg/L	ug/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	ug/L	ug/L	ug/L	ug/L	ug/L
1979-04-11 10:30	210			.0	8.0	U		< 20	< 3		M	10	M		10		260			180	120	< 10	3	M	M	
1979-05-04 08:30	990																70									
1979-05-11 11:20	1300																70									
1979-06-12 14:30	M																60									
1980-03-19 09:15	140				10	10	.0	10	< 3	.0	M	20	< 10	.0	M		250		530	510	< 10	3	< 2	M	390	
1980-04-07 16:00	810																160									
1981-08-17 17:16	200	< 1	M			10	10	20					M	M	30	18000	140	M	M	540	M			M	M	

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APPENDIX 2.6-2D

HISTORICAL WATER CHEMISTRY DATA  
USGS 06342850 NORWEGIAN CREEK NEAR BELFIELD, ND

Sample date/time	Vanadium wat filt ug/L	Zinc wat filt µg/L	Zinc wat unfil. Recoverable µg/L	Aluminum filt ug/L	Lithium filt ug/L	Lithium unfil ug/L	Selenium wat filtered µg/L	Selenium wat unfiltered µg/L	Gross Alpha radioactive wat filt U-nat, pCi/L	Gross Beta radioactive wat filt Cs-137, pCi/L	Fecal coliform M-FC 0.7µMF/col/ col/ 100 mL	Fecal streptococci KF MF. col/ 100 mL	Phenolic compounds wat unfil ug/L	Phytoplankton tot cells cells /mL	Residue on evap at 180 degC mg/L	Residue wat filt sum of constituents mg/L	Residue wat dissolved tons/d	Residue wat filt tons/ acre-ft	Ammonia wat unfil unfltrd mg/L	Phosphorous wat unfilter mg/L as PO4	Tot nitrogen water unfil mg/L as NO3	Mercury wat filt ug/L	Mercury wat unfiltered ug/L	Gross alpha radio-activity wat filt U-nat, pCi/L	Gross beta radio-activity wat filt Sr/Y-90 pCi/L
1979-04-11 10:30	1.4	M	50	80	M	M	< 1	< 1	< 4.8	6.7	E 16	1700		220	445	414	63.7	.61			7.4	< .10	< .1	< 7.0	6.2
1979-05-04 08:30											E 870	410		13000	2060	2000	8.95	2.80	.10	.25	4.4				
1979-05-11 11:20											410	E 170		1800	2460	1920	11.3	3.35	.07	.21	5.4				
1979-06-12 14:30											E 810	3100		5400	3500	3010	.57	4.76	.22	.34	8.1				
1980-03-19 09:15	< 6.0	M	20	50	20	10	< 1	< 1	< 7.5	12.0	E 23	800		57000	860	814	9.29	1.17	.61	.89	12.0	< .10	.1	< 11.0	13.0
1980-04-07 16:00											E 1	120		9200	1460	1440	.91	1.99	.42	.67	7.1				
1981-08-17 17:16	< 3		90				1	1					15	3300	448	472	27.8	.61		1.4	< .10	.2			

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