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HYDROLOGIC AND WATER QUALITY INVESTIGATIONS RELATED TO PLACER MINING IN INTERIOR ALASKA: SUMMER 1989

by

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INTRODUCTION

Monitoring of interior Alaska streams affected by placer mining was continued during the 1989 field season by Alaska Division of Geological and Geophysical Surveys (DGGS) investigators. The study, which began in 1984, is a combined effort of the Alaska Departments of Environmental Conservation (ADEC) and Fish and Game (ADF&G). Results of the previous field seasons can be found in Ray (1989), Mack et. al. (1988), Mack et al. (1987), Mack and Moorman (1987), and Mack and Moorman (1986).

The 1989 summer field season plan was to maintain two automated sites on Birch Creek (at the Steese Highway bridge and above Twelve Mile Creek), one on Faith Creek (at Steese Highway bridge), and two on Goldstream Creek (at Ballaine Road and at Minto Flats). Turbidity, total suspended solids, and discharge (except at Goldstream Creek sites) were monitored at each site. Grab samples were collected from additional streams in the Birch Creek and Chatanika River drainages

Two additional sites were added this year to obtain data on nonpoint-source sediment input. The site chosen was an area on Gold Dust Creek which had recently been mined with no reclamation work performed. The site probably represents a "worst case scenario" as the creek runs through washed-out settling ponds (the downstream site was located a few hundred feet below an old settling pond).

To ensure consistency of data between the different field seasons, the same sampling and analytical techniques were used during each field season. For details of the methods, see Mack et. al. (1988).

In late June, a large frontal system from the Bering Sea dumped large amounts of precipitation over the entire interior from Healy to Delta Junction, including the Birch Creek drainage. Storm totals averaged nearly two inches over most of the interior, however only 1.53 inches fell at Mile 101 Steese Highway (Appendix A) on June 24-26. Precipitation amounts must have been greater in the surrounding hills due to convergence and orographic affects on the moisture-laden winds.

This precipitation event resulted in the highest flows measured since the study began in 1984. Unfortunately, the flows were so high that most of the automated sampling equipment, staff gages, and datapods were affected. Of the automated five stations, only Faith Creek escaped damage or loss of data. The staff gage and pressure transducer at the upper site on Gold Dust Creek was washed out, however the electrical wire did not break, Once the extreme high water subsided, the staff gage and pressure transducer

settled on the bottom, allowing reconstruction of the hydrograph. The Isco sampler continued to sample with no loss of sediment data. The staff gage and pressure at the middle site on Gold Dust Creek also washed out. Although the hydrograph was reconstructed, the suction tube for the Isco sampler was out of water, resulting in the loss of some data at this site. The staff gage and pressure transducer at Birch Creek above Twelve Mile Creek also washed out. But like the upper site on Gold Dust Creek, it came to rest in a position which allowed the reconstruction of the hydrograph. Unfortunately, the Isco sampler had been turned upside-down, resulting in the loss of sediment data from June 9 through June 27. The site at Birch Creek at the Steese Highway bridge suffered the greatest damage and loss of data. The water level at the peak flow was approximately six feet higher than the level of the automated equipment. The staff gage and pressure transducer did not was out, however the Isco sampler was upside-down. Upon initial inspection and testing, the equipment appeared to be working on June 28. The equipment was reset and placed into operation again. However, upon returning some two weeks later, both the Isco and datapod had failed. This resulted in a loss of sediment data from June 16 through June 27 and June 28 through July 10. Continuous flow data was lost from June 26 to July 19.

RESULTS

Discharge

Despite the highest instantaneous flows measured since the study began, average streamflow during the summer of 1989 was generally below **average** when **compared to** the previous years of flow data (Table 1). The average at Faith Creek was the lowest since the study began at that site in 1986. The 49 cfs average flow in 1989 is half of the 100 cfs average of the three previous years. The highest average monthly flows on Faith Creek have typically occurred in August and September, however this year the low precipitation during these months (Appendix A) contributed little to the flow. The average flows at both Birch Creek sites were the second lowest on record, second only to 1988 flows. All sites showed a trend

*Table I. Summary **of average** monthly **discharge data (discharge** values in **cfs).***

Site	Jun	Jul	Aug	Sep	Ave
Birch Creek at Bridge					
1989	3100*	2000*	675	507	1580
1988	2490	1230	1300	1370	1430
1987	4120	2570	2380	1010	2520
1986	3730	2370	700	828	1910
1985	4600	1710	1930	3790	3010
Birch Creek above 12 Mile Creek					
1989	164	89.5	37.4	27.4	73.8
1988	66.9	35.4	47.5	68.0	49.2
1987	1%	147	149	74.8	142
1986	207	125	71.2	76.5	120
Faith Creek					
1989	108	47.4	32.4	24.3	49.2
1988	81.8	46.1	91.3	93.9	70.6
1987	113	51.6	134	103	100
1986	107	88.4	141	149	123
Gold Dust Creek (upper)					
1989	8.8	6.1	2.1	1.6	4.7
Gold Dust Creek (middle)					
1989	28.1	19.6	7.1	4.3	14.9
Little Chena River at USGS gage					
1989	473	316	177	144	292

* Estimate

of decreasing flows from June to September.

The peak flow for each stream occurred during the large storm in late June. AU of these flows were the highest recorded since the study began. Table 2 gives the peak flow and estimated return period (as approximated by the criteria established by Kane and Janowicz, 1989) for each stream. The return period for Birch Creek at the Steese Highway bridge was calculated as greater than 100 years. This is clearly not the case as the flow during the 1967 flood was 84,000 cfs.

Figures 1-6 show the hydrographs of the six automated sites.

Table 2. Peak flows and estimated return period.

Site	Area (mi^2)	Peak Flow (cfs)	Return Period (years)
Birch Creek at Bridge	2150	43400*	
Birch Creek above 12 Mile Creek	85.4	1940	15
Faith Creek	61.1	710	4
Gold Dust Creek (upper)	3.2	180	20
Gold Dust Creek (middle)	11.3	400	15
Little Chena at USGS gage	372	2530	2

* - Calculated by Jon Kostohrys of the U.S. Bureau of Land Management

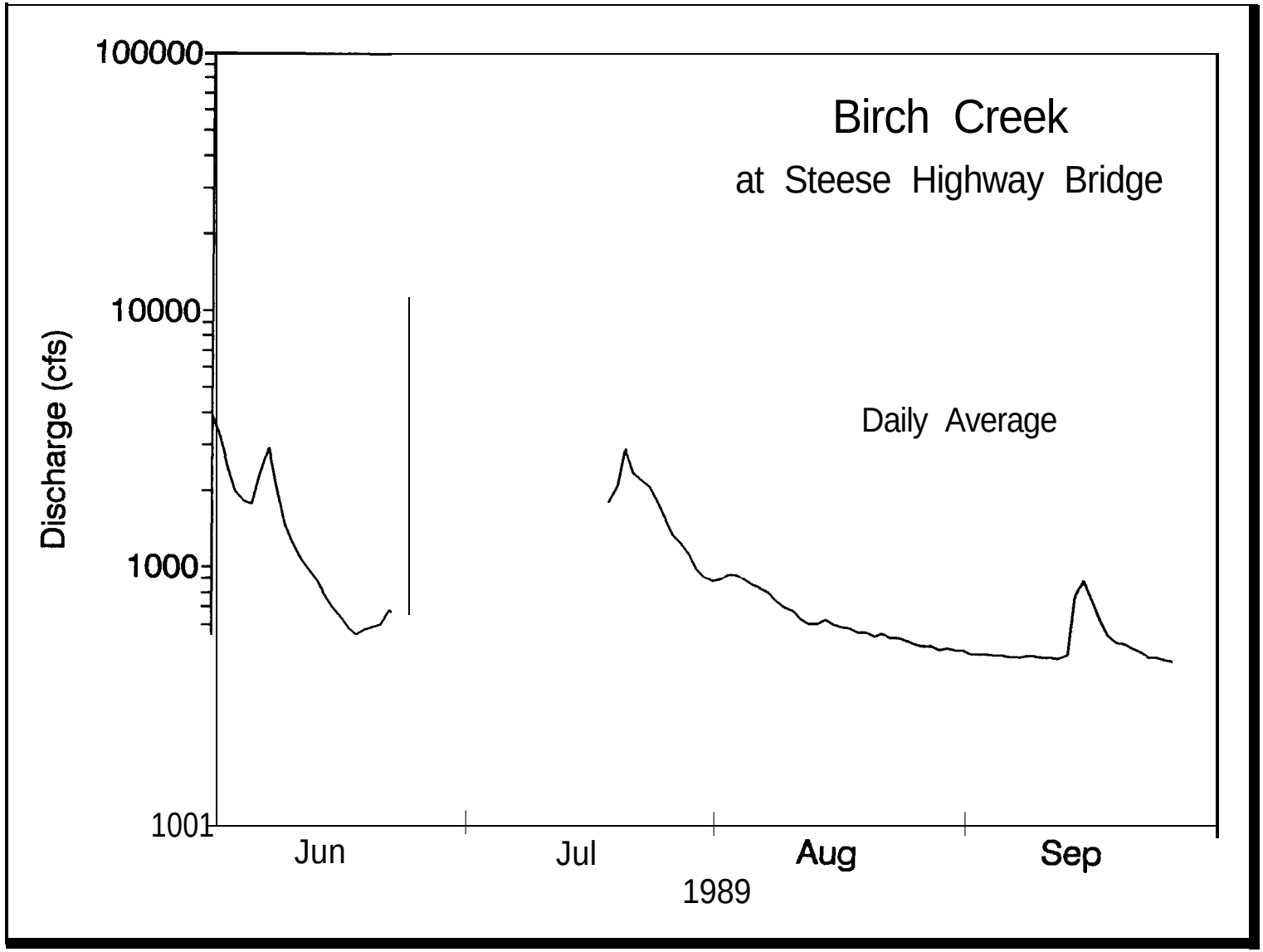

Figure 1. Hydrograph of Birch Creek at Steese Highway Bridge - 1989

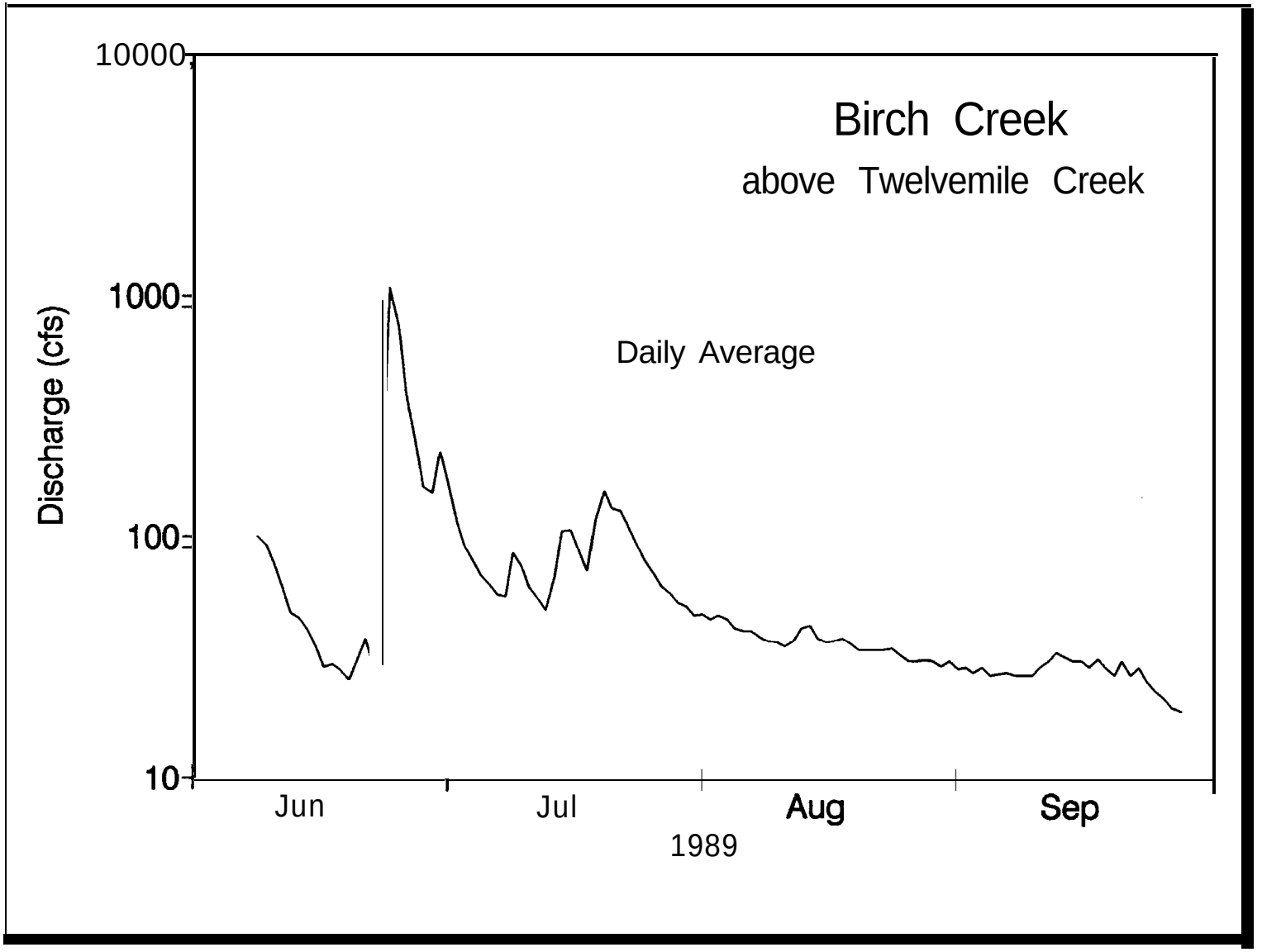

Figure 2. Hydrograph of Birch Creek above Twelvemile Creek - 1989

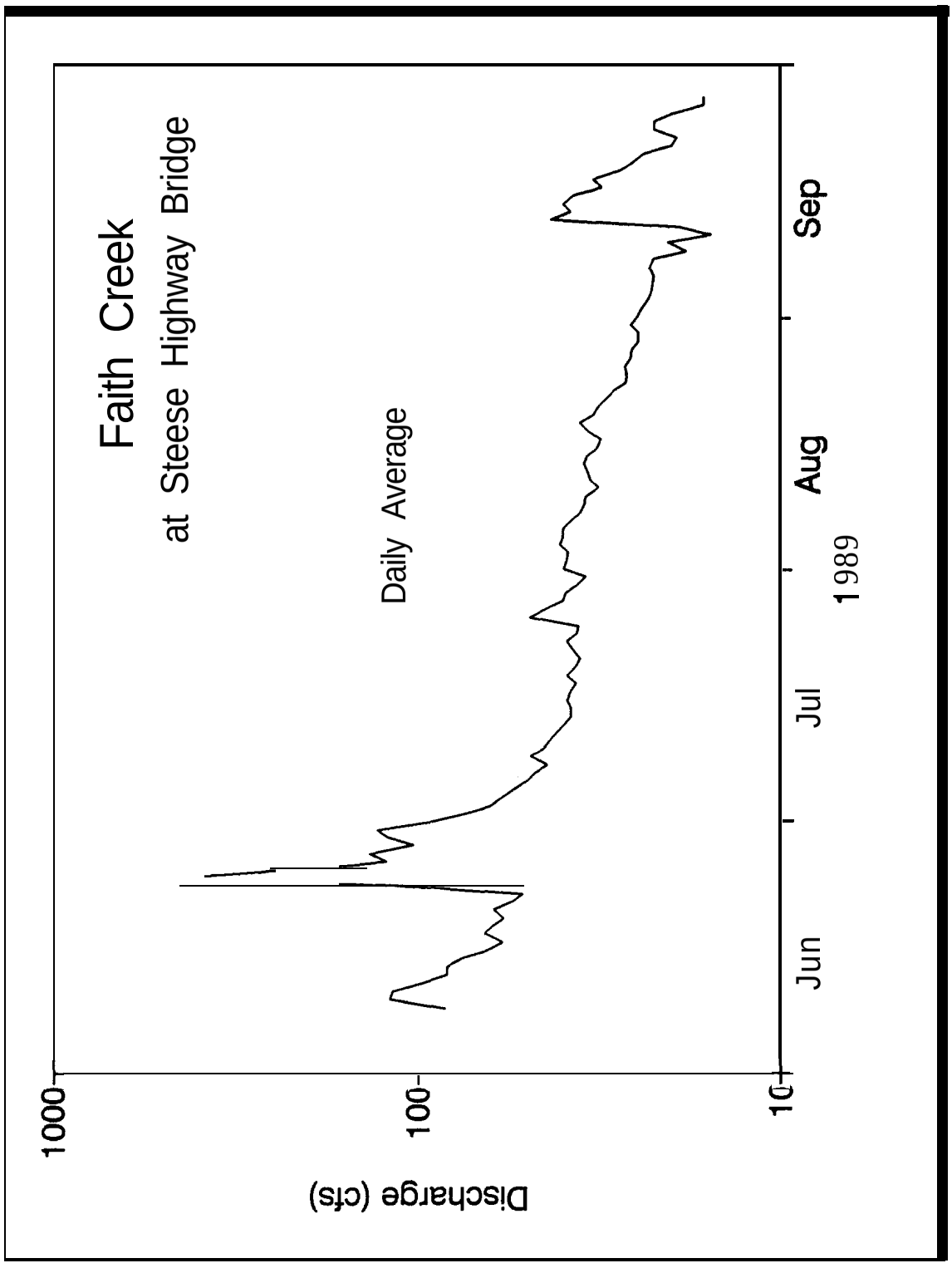

Figure 3. Hydrograph of Faith Creek at Steese Highway Bridge - 1989

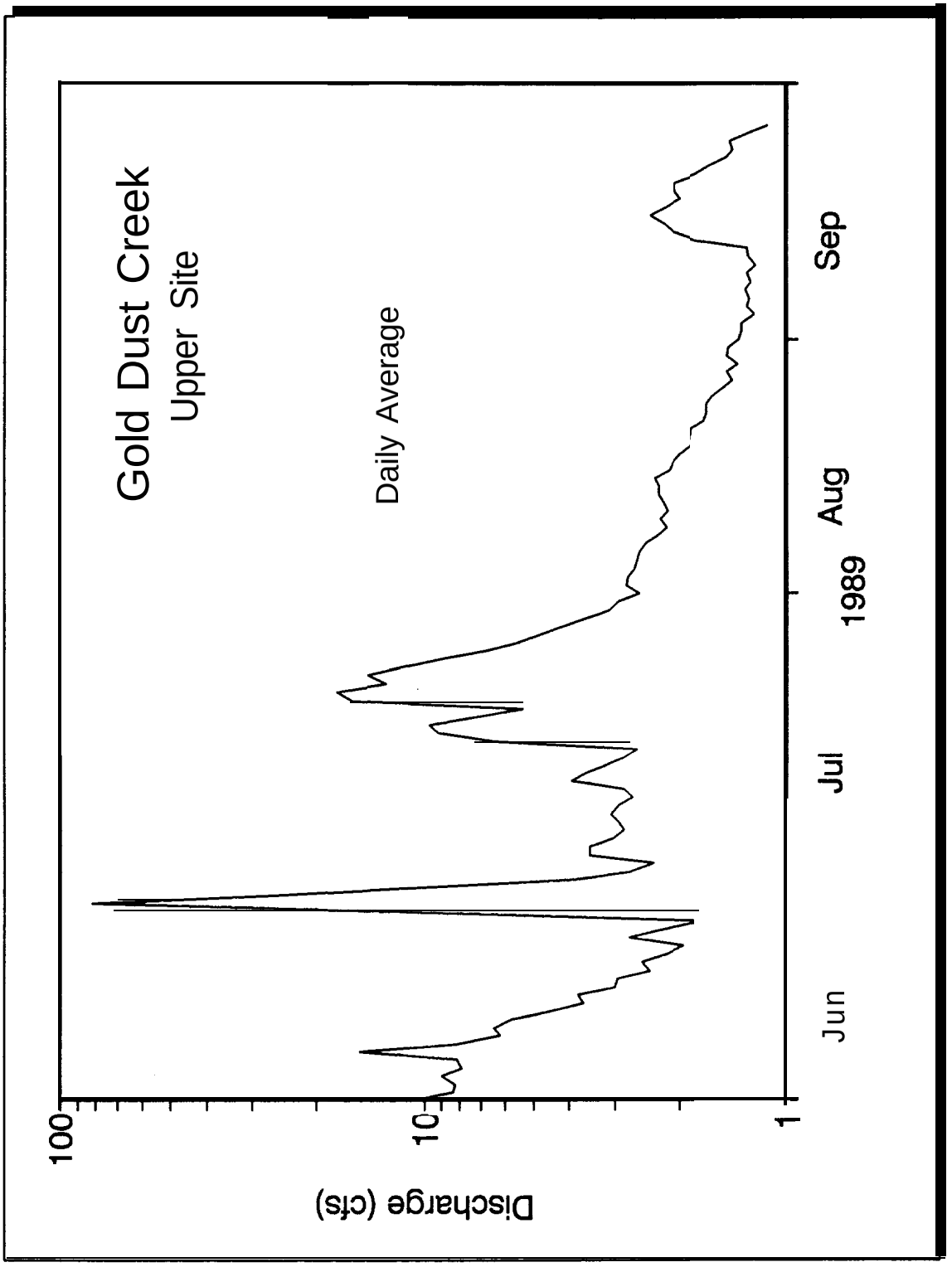

Figure 4. Hydrograph of Gold Dust Creek (upper site) - 1989

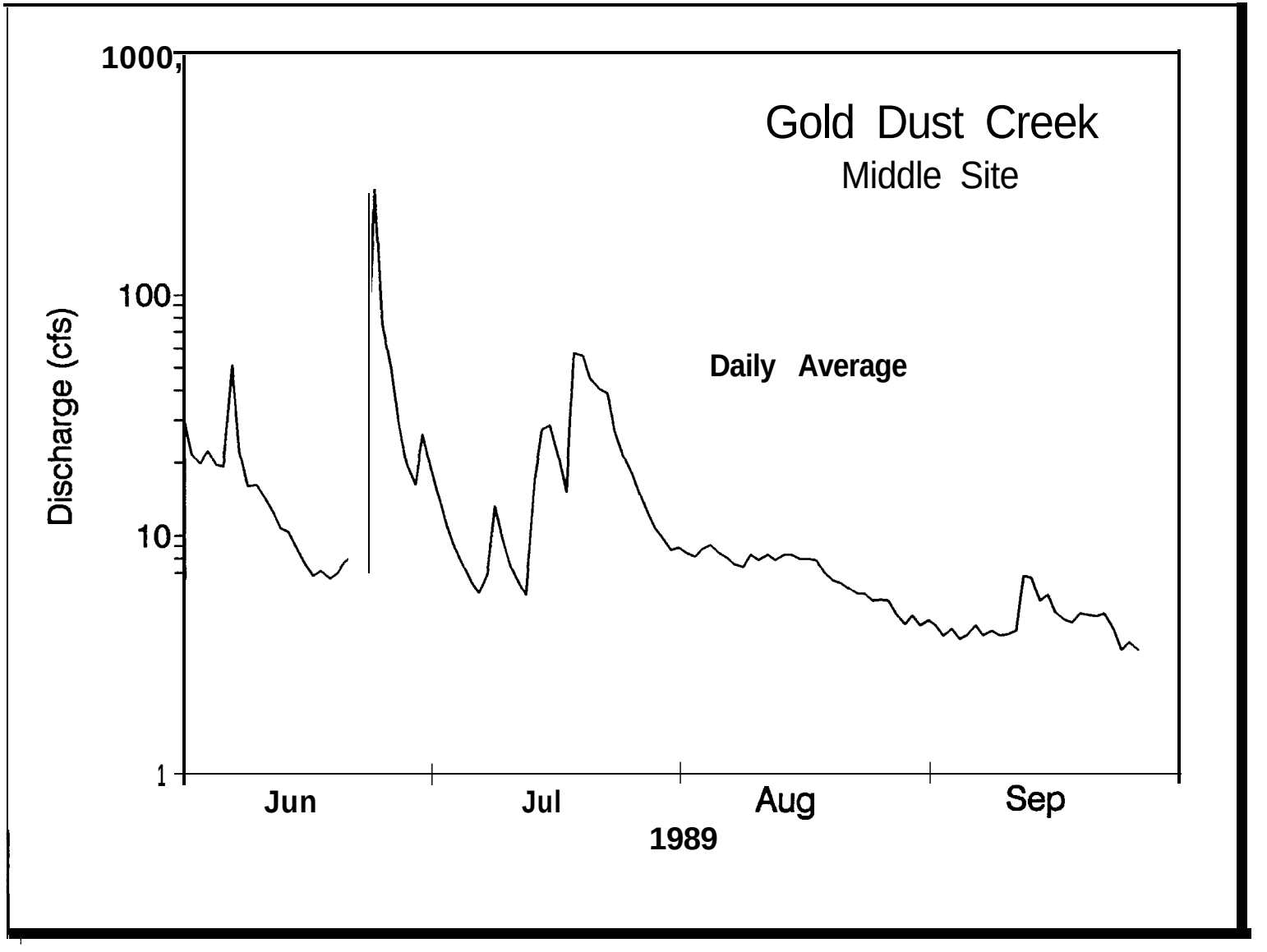

Figure 5. Hydrograph of Gold Dust Creek (middle site) - 1989

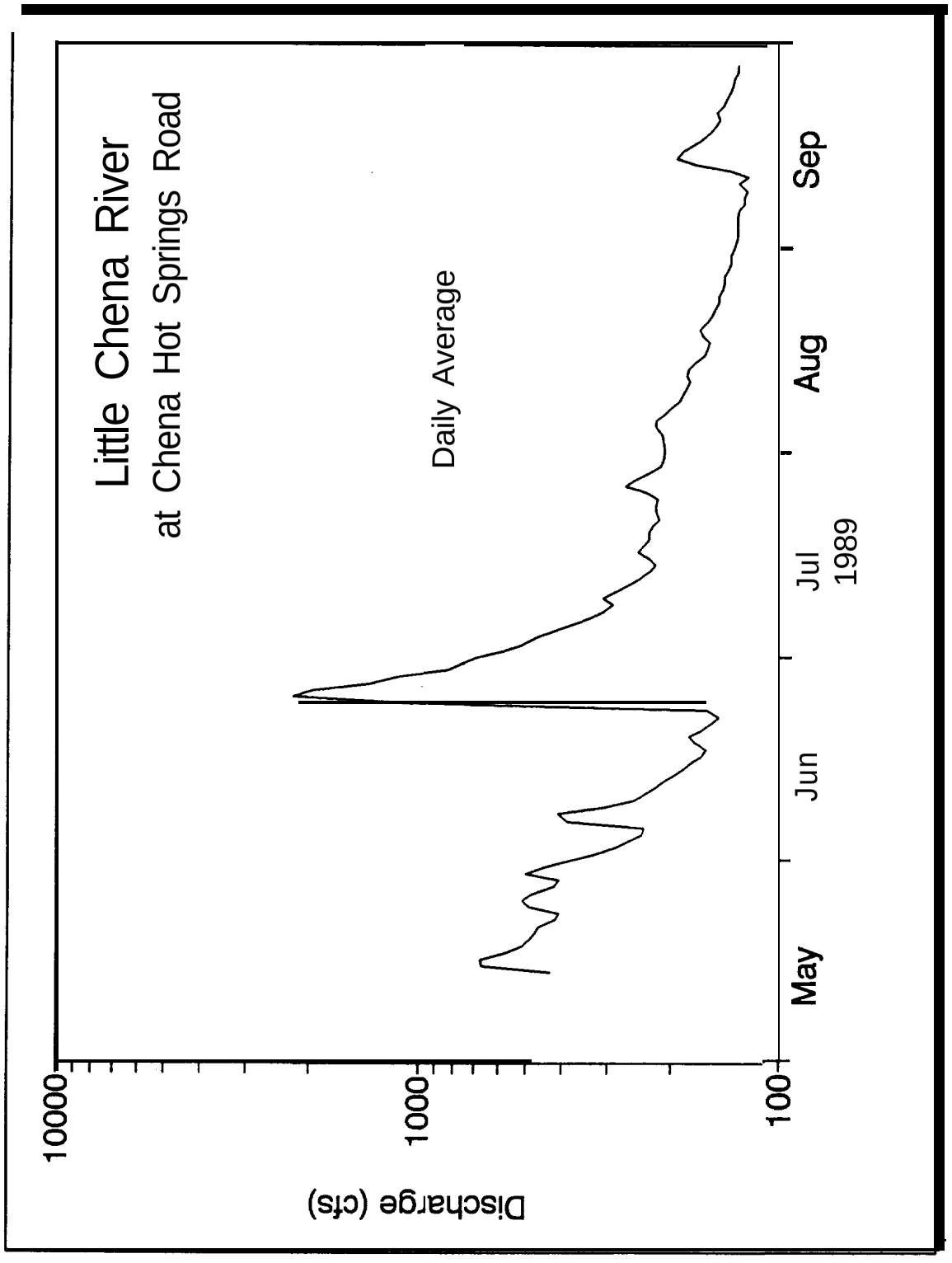

Figure 6. Hydrograph of Little Chena River at Chena Hot Springs Road - 1989

Turbidity

Turbidity values for the automated sites were highest in the months of June and July (Table 3). This was caused by the high flows in late June and early July. An additional storm in fate July which contributed to the high turbidity in the upper Birch Creek area. The mean turbidity is higher than the median turbidity at every site. This is due to the influence of the large turbidity values associated with the June storm. These high turbidity values skew the season mean, and do not necessarily depict the "average or normal" conditions of the stream. The median is not influenced by an isolated or outlying value and may represent the "average or normal" conditions better than the mean.

Table 3. Monthly mean and median turbidity values from automated sites in 1989. AN values are in NTUs.

Site	May	Jun	Jul	Aug	Sep	Season
Birch Creek above 12 Mile Creek						
Mean		76	79	63	23	56
Median		80	75	60	23	50
number of samples (n)		5	28	31	29	93
Birch Creek at Bridge						
Mean		18	23	5.6	3.8	12
Median		11	16	4.1	3.1	6.0
n		11	21	31	17	80
Faith Creek						
Mean		57	17	9.7	9.1	22
Median		5.5	5.3	7.8	10	7.1
n		22	31	31	14	98
Gold Dust Creek (upper)						
Mean		3.0	1.5	1.2	2.1	1.9
Median		1.2	1.3	0.90	1.2	1.1
n		30	31	31	13	105
Gold Dust Creek (middle)						
Mean		77	94	3.5	2.8	50
Median		15	80	3.2	2.3	9.1
n		28	23	29	13	93
Goldstream Creek at Ballaine						
Mean	21	57	73	49	16	51
Median	20	16	65	31	14	27
n	9	23	23	30	10	95

Table 3 (cont). Monthly mean and median turbidity values from au&mated sites in 1989. AN values are in NTUs.

Site	May	Jun	Jul	Aug	Sep	Season
Goldstream Creek at Minto						
Mean	8.0	5.5	9.3	8.0		7.6
Median	8.3	4.3	7.8	7.8		6.6
n	9	30	31	12		82
Little Chena River at USGS gage *						
Mean	16	100	3.7	4.1	4.3	7.2
Median	14	100	3.5	4.3	4.2	4.3
n	9	1	21	15	16	62

* May - June site located at Nordale Road

Table 4 shows the mean and median turbidity values from all the automated sites since the study began. All sites showed a continued decrease in both mean and median turbidity. Exceptions to this are minor. The mean turbidity increased from 11 to 12 NTU at Birch Creek above Twelvemile Creek and both the mean and median turbidity increased at Faith Creek.

Table 4. Seasonal mean and median turbidity values from automated sites for all years of available data. All values are in NTUs.

Site	n	Mean	Median
Birch Creek above 12 Mile Creek			
1989	93	56	50
1988	80	92	91
1987	107	206	150
1986	113	236	230
Birch Creek at Bridge			
1989	80	12	6.0
1988	98	11	7.1
1987	106	38	18
1986	54	54	23
1985	20	31	25
Faith Creek			
1989	98	22	7.1
1988	92	6.5	5.9
1987	121	21	14
1986	80	85	31

Table 4 (cont). Seasonal mean and median turbidity values from automated sites for all years of available data All values are in NTUs.

Site	n	Mean	Median
Gold Dust Creek (upper)			
1989	105	1.9	1.1
Gold Dust Creek (middle)			
1989	93	50	9.1
Goldstream Creek at Ballaine			
1989	95	51	27
1988	78	62	67
1987	64	185	170
Goldstream Creek at Minto			
1989	82	7.6	6.6
1988	105	25	19
1987	52	6.8	6.2
Little Chena River at USGS gage			
1989	62	7.2	4.3

The high flows from the large storm disturbed or damaged some of the automated samplers. As a result, some data from these critical times were lost. An attempt was made to estimate the median values of the streams if these samples had been included. Table 5 gives the results of what is considered the "worst case" median values from sites which suffered data loss. For example, Birch Creek above Twelvemile Creek lost 20 samples. If the assumption is made that these 20 samples were very high, then the median value would shift from 50 to 60 NTU. Probably less than half of those 20 samples were greater than the 50 NTU. This would not change the median value signiticantly. The "worst case" values show that the lost data did not signiticantly modify the median turbidity values.

Table 5. Calculation of the worst-case median values for 1989. AN values in NTUs.

Site	n-samples	n-missing	Median (data)	Median (worst case)
Birch Creek above 12 Mile Creek				
1989	93	20	50 n=93	60 n=113
Birch Creek at Bridge				
1989	80	29	6.0 n=80	9.9 n=109
Gold Dust Creek (middle)				
1989	93	12	9.1 n=93	11 n=105
Goldstream Creek at Ballaine				
1989	95	16	27 n=95	45 n=111

Total Suspended Solids

Total suspended solids (TSS) values were the highest in the months of June and July, and decreased in the months of August and September (Table 6). The high values early in the season were caused by the large storm in late June. The median TSS value is lower than the mean TSS value at all sites. Table 7 gives the TSS results from previous years.

Table 6. Monthly mean and median TSS values from automated sites in 1989. All values are in mg/l.

Site	May	Jun	Jul	Aug	Sep	Season
Birch Creek above 12 Mile Creek						
Mean		357	209	43.7	21.5	104
Median		406	96.7	40.6	20.8	41.3
number of samples (n)		5	28	31	29	93
Birch Creek at Bridge						
Mean		99.6	111	28.8	14.2	57.0
Median		94.0	70.1	28.0	13.3	32.7
n		11	21	31	17	80
Faith Creek						
Mean		186	18.3	9.55	9.14	51.9
Median		16.4	9.79	8.97	9.50	9.75
n		22	31	31	14	98
Gold Dust Creek (upper)						
Mean		27.0	9.17	4.05	9.81	12.8
Median		3.87	5.45	3.33	5.71	3.87
n		30	31	31	13	105
Gold Dust Creek (middle)						
Mean		638	1780	97.3	14.9	666
Median		51.8	1070	41.9	10.7	69.1
n		28	23	29	13	93
Goldstream Creek at Ballaine						
Mean	61.0	280	180	115	59.1	160
Median	60.3	36.6	145	97.7	57.6	88.1
n	9	23	23	30	10	95
Goldstream Creek at Minto						
Mean	16.3	15.3	17.2	12.9		15.8
Median	14.0	11.0	10.5	11.2		11.0
n	9	30	31	12		82
Little Chena River at USGS gage *						
Mean	122	467	22.9	74.3	32.4	59.3
Median	95.6	467	20.2	45.6	29.4	32.1
n	9	1	21	15	16	62

*** May - June site located at Nordale Road**

Table 7. Seasonal mean ond median Tss values from automated sites for all years of available data. AU values are in NTUs.

Site	n	Mean	Median
Birch Creek above 12 Mile Creek			
1989	**93**	104	41.3
1988	**80**	83.7	75.0
1987	107	**1360**	339
1986	**113**	293	214
Birch Creek at Bridge			
1989	80	57.0	32.7
1988	98	**123**	28.0
1987	106	332	**112**
1986	**54**	267	166
1985	12	50.6	26.3
Faith Creek			
1989	98	51.9	9.75
1988	92	14.7	11.5
1987	121	85.4	28.5
1986	75	599	61.0
Gold Dust Creek (upper)			
1989	105	12.8	3.87
Gold Dust Creek (middle)			
1989	93	666	69.1
Goldstream Creek at Ballaine			
1989	95	160	88.1
1988	78	129	84.9
1987	67	**159**	145
Goldstream Creek at Minto			
1989	82	**15.8**	11.0
1988	105	68.1	50.8
1987	52	26.1	21.7
Little Chena River at USGS gage *			
1989	62	59.3	32.1

* **May - June** site located at **Nordale Road**

Sediment Load

Table 8 shows the monthly and seasonal sediment loads for the automated sites. The sediment loads in 1988 were much less than previously measured. This is probably a function of two factors; lower discharges and less sediment input from placer mining. The lower discharge translates to lower stream power, resulting in less sediment eroded from streambanks and disturbed areas. Since major events account for the majority of the annual natural sediment input (Ray and Maurer, 1989; Mach et al., 1988), the seasonal sediment load is less. The low turbidity values at low flow also indicates that there was less sediment input from placer mining than in previous years. These factors combined resulted in very low seasonal sediment loads.

Table 8. Average daily sediment load by month and season (tons/&y).

Site	Jun	Jul	Aug	Sep	Ave
Birch Creek at Bridge					
1989	1020	51.5	56.5	18.5	213
1988	2810	188	90.7	175	772
1987	8660	6580	1100		5260
1986	7270	1450		567	3100
Birch Creek above 12 Mile Creek					
1989	172	63.6	4.4	1.6	44.4
1988	8.1	8.7	9.1	31.4	12.1
1987	4580	1110	426	32.0	1150
1986	420	79.2	40.2	48.3	147
Faith Creek					
1989	185	2.6	0.83	0.51	42.7
1988	6.0	1.4	5.0	3.1	3.4
1987	119	8.9	22.1	13.6	30.9
1986	57.2	31.3	548	57.9	174
Gold Dust Creek (upper)					
1989	3.1	0.11	0.02	0.03	0.92
Gold Dust Creek (middle)					
1989	168	167	2.1	0.22	91.3
Little Chena River at USGS gage					
1989	*	16.8	35.0	13.5	89.4

* see Appendix C

Grab Sites

The turbidity and Tss values continued to improve (Table 9). Some sites did show an increase in the mean turbidity and Tss, but this was due to storm samples. Notice that the turbidity and Tss increased in the unmined basins.

Table 9. Mean and Median values for turbidity and total suspended solids from grab-sample sites.

Site	number of samples	Mean Turb	Mean Tss	Median Turb	Median Tss
Albert Creek					
1989	6	63	213	1.7	2.00
1988	1	0.8	2.15	0.8	2.15
1987	0				
1986	17	19		2.6	
Bedrock Creek					
1989	11	8.8	40.7	1.5	2.60
1988	15	1.0	1.71	0.8	1.27
1987	3	0.8	7.93	0.5	1.60
1986	20	1.9		1.1	
1985	23	0.8		0.5	
1984	9	1.0		1.0	
Boulder Creek					
1989	11	16	139	1.9	2.80
1988	14	0.7	1.76	0.7	1.46
1987	3	1.0	10.6	0.4	1.60
1986	88	2.7	19.6	1.2	6.4
1985	13	2.0		0.5	
1984	2	2.8		2.8	
Chatanika River at 39 Mile Steese					
1989	11	1.1	1.43	0.9	1.20
1988	2	0.7	2.68	0.7	2.68
1987	1	23	154	23	154
1986	10	4.7		2.2	
1985	28	10		7.6	
1984	24	24		19	
Crooked Creek below Bedrock					
1989	6	48	84.8	38	19.2
1988	2	58	33.9	58	33.9
1987	1	72	43.7	72	43.7

Table 9 (cont). Mean and Median values for turbidity and total suspended solids from grab samples.

Site	number of samples	Mean Turb	Mean Tss	Median Turb	Median Tss
Crooked Creek at Steese					
1989	12	45	131	31	7.15
1988	13	120	93.4	110	81.3
1987	3	140	530	90	102
1986	25	150		140	
1985	34	410		240	
1984	7	840		790	
Deadwood Creek					
1989	13	43	93.1	14	6.60
1988	14	54	63.9	47	52.9
1987	13	180	275	110	81.9
1986	26	65		36	
1985	35	670		350	
1984	4	920		1100	
Eagle Creek					
1989	12	410	405	343	210
1988	7	490	344	120	70.4
1987	1	920	1660	920	1660
Ketchem Creek					
1989	13	190	725	157	501
1988	15	300	288	230	200
1987	12	620	463	520	304
1986	25	240		140	
1985	33	820		650	
1984	4	880		750	
Mammoth Creek					
1989	14	125	120	68	30.7
1988	15	260	463	200	179
1987	4	180	359	180	204
1986	117	290	620	250	310
1985	31	350		290	
1984	8	400		310	
Ptarmigan Creek					
1989	11	1.2	2.26	1.1	1.89
1988	8	0.9	1.49	1.0	1.33
1987	1	1.4	11.7	1.4	11.7
Sourdough Creek					
1989	10	2.1	2.18	1.4	2.04
Twelve Mile Creek					
1989	11	1.8	7.24	0.9	0.85
1988	13	0.7	1.83	0.6	1.24
1987	4	0.6	3.87	0.6	2.20

Non-Point Source Sites

Gold Dust Creek was chosen for the non-point source study because of its location (near other study areas), drainage size (similar to others in the Birch Creek drainage), and because it had been recently mined and remained unreclaimed. This site also represents a "worst case scenario", as several old settling ponds remain in the creek bottom (one such settling pond is a few hundred feet above the downstream sampling site).

The study was to incorporate three sampling sites: one above any mining (Gold Dust upper); one below old mining but above present day activity (Gold Dust middle); and one below present day activity. However the effluent from the present day mining did not return to Gold Dust Creek, but instead discharged into Birch Creek. This combined with the flood damage from the June 25th storm eliminated this site. Sampling continued on Gold Dust upper and middle sites after the late-June storm.

Figure 7 shows the discharge for the two sites plotted on log scale. The ratio of the basins is approximately 1:3.5 (3.2 mi^2 for GDU and 11.3 mi^2 for GDM). The ratio of the discharge of the two sites follows this ratio throughout the field season.

Figure 8 shows the turbidity for the two sites. The median turbidity for upper Gold Dust Creek was 1.1 NTU and for middle Gold Dust Creek was 9.1 NTU. In early June the turbidity was about 20 times greater at the middle site, decreasing to 10 times greater prior to the late-June storm. A large difference in turbidities was present during the month of July, due to numerous storm events. However during August and September the turbidity was only two to three times greater at the middle site, a value closer to the basin ratio of 3.5. Figure 9 shows the total suspended solids for the two sites. This plot is very similar to the turbidity plot, with the same explanation applying.

The sediment load for the two sites was 0.92 tons/day at the upper site and 91.3 tons/day at the middle site. This corresponds to 0.29 $tons/day/mi^2$ at the upper site to 8.1 $tons/day/mi^2$ at the middle site. The $load/mi^2$ at the middle site is 28 times greater than at the upper site.

The sediment load is not evenly distributed through the season. Most of the sediment transported occurs in relatively short period of time, usually associated with a storm event. At the upper site, 91% of the season sediment load transported in two days. At the middle site, 86% of the season sediment load was transported in 6 days.

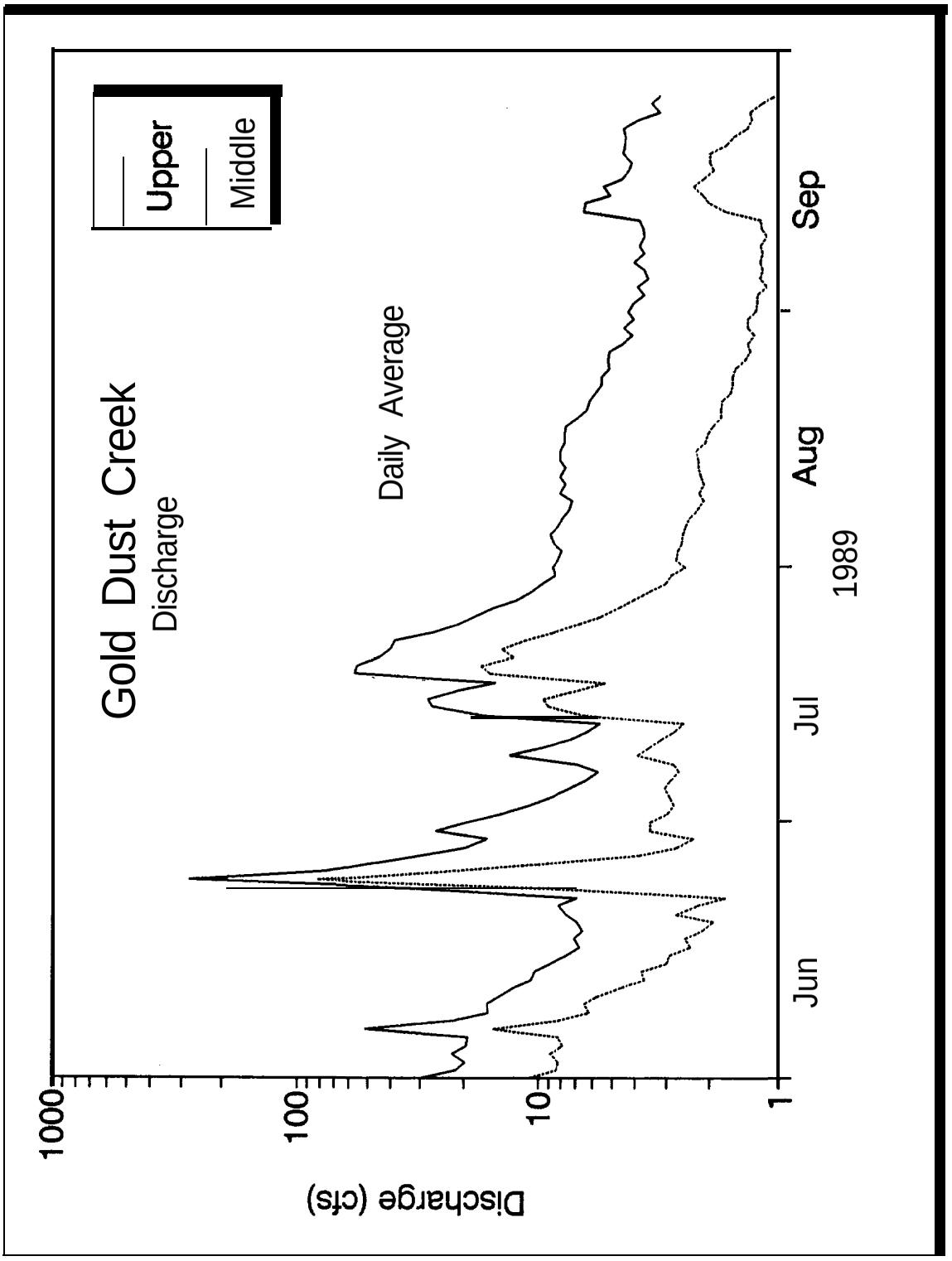

Figure 7. Hydrographs of upper and middle Gold Dust Creek sites.

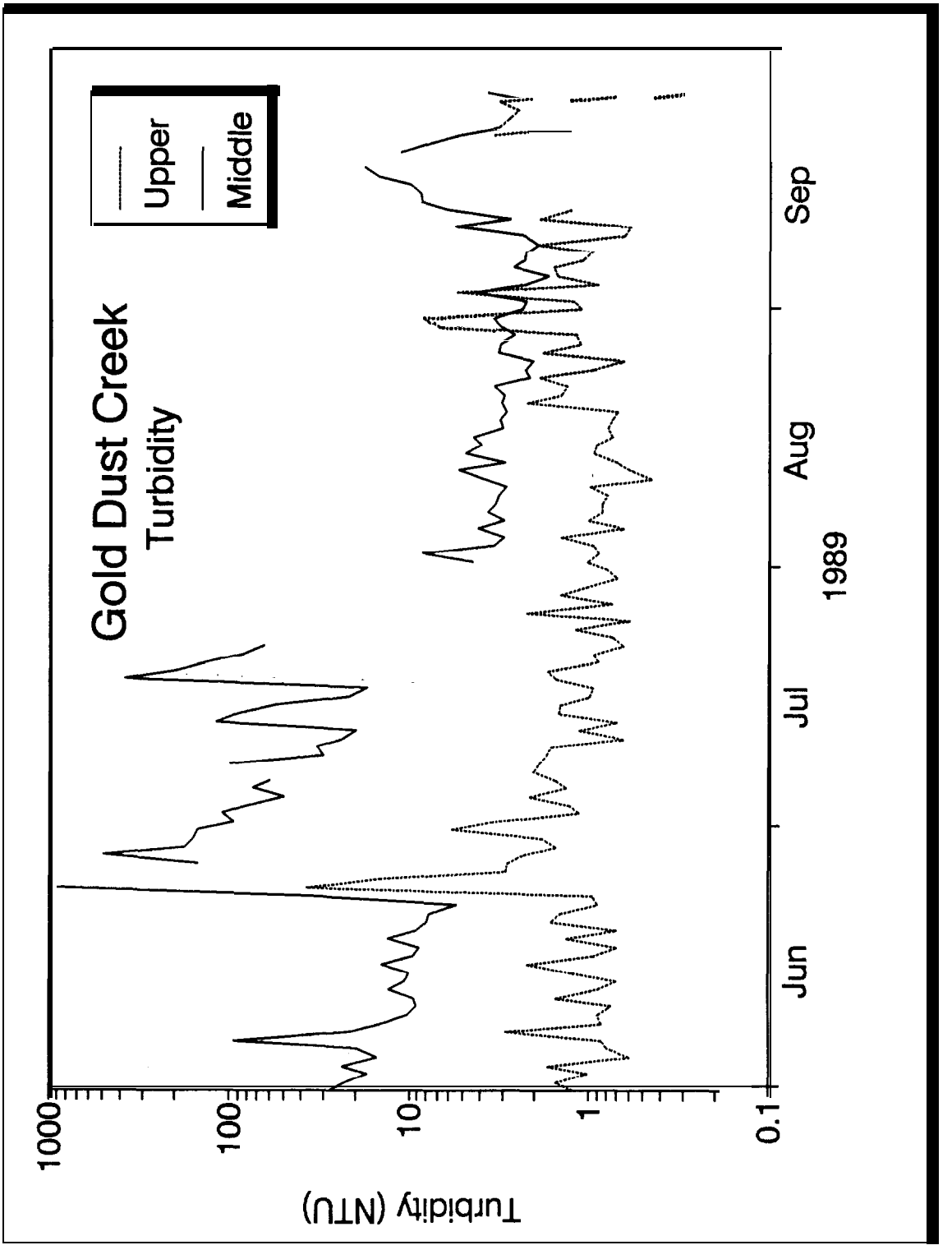

Figure 8 Turbidity from upper and middle Gold Dust Creek sites.

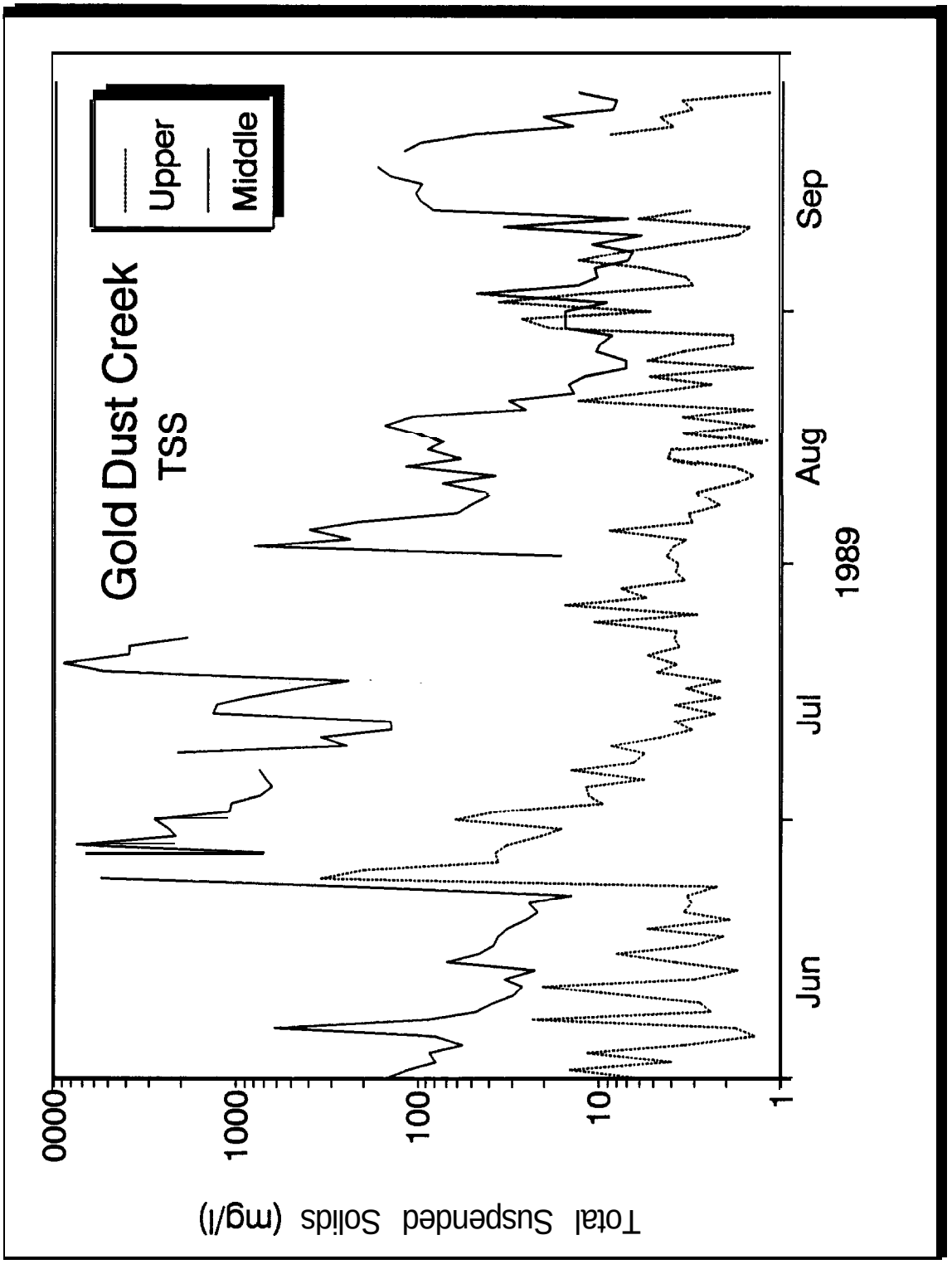

Figure 9. Total suspended solids from upper and middle Gold Dust Creek sites.

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Appendix A

Mile 101 Steese Highway

Daily Precipitation • 1989 (inches)

Date	Jun	Jul	Aug	Sep
1	0.03	0.16	Tr	---
2	Tr		0.06	---
3	---		0.02	---
4	Tr		Tr	---
5	---	---	Tr	---
6	Tr		0.09	0.08
7	0.40		Tr	---
8	0.01	---		
98	Tr	Tr	Tr	---
10	0.04	0.26	Tr	---
11	0.02	---	0.03	---
12	Tr	---	---	0.14
13	---	Tr	Tr	0.04
14	---	Tr	0.25	0.28
15	0.01	0.38	0.01	0.04
16	0.01	0.14	---	
17	---	0.13	---	
18	0.09	Tr	---	---
19	0.01	Tr	0.04	---
20	---	0.32	0.04	---
21	0.03	0.17	Tr	---
22	0.21	0.12	Tr	Tr
23	Tr	0.06	---	---
24	0.12	0.04	Tr	
25	0.89	Tr	Tr	---
26	0.52	Tr		Tr
27	---	0.07	---	0.13
28	0.05	Tr	Tr	---
29	---	---	---	---
30	0.04	Tr	Tr	---
31		0.01	0.06	
Total	2.48	1.86	0.60	0.71

Season Total • 5.65 inches

Appendix B

Birch Creek above Twelve Mile Creek

Daily Average Discharge - 1989 (cfs)

Date	May	Jun	Jul	Aug	Sep
1			227	47.1	30.3
2			160	47.4	28.2
3			114	45.2	28.4
4			913	47.1	27.0
5			77.9	45.2	28.4
6			68.4	41.8	26.6
7			62.8	40.5	26.9
8			56.8	40.4	27.3
9		99.9	56.4	38.3	26.6
10		913	85.4	36.9	26.6
11		77.4	74.6	36.2	26.6
12		60.8	61.2	35.2	28.4
13		48.1	54.8	36.9	303
14		45.9	493	41.4	33.1
15		41.2	67.5	423	31.4
16		345	104	37.6	30.3
17		28.7	105	36.2	30.3
18		29.7	86.8	36.9	28.4
19		28.0	71.6	37.6	31.1
20		25.4	116	36.1	28.4
21		30.5	154	33.9	26.6
22		37.5	130	33.9	303
23		293	126	33.9	26.6
24		152	110	33.9	28.4
25		1070	91.1	34.2	24.8
26		736	79.1	32.1	23.0
27		389	70.3	30.3	21.3
28		247	61.9	30.3	19.5
29		160	57.3	30.5	19.0
30		150	52.8	30.3	
31			50.9	29.0	
Ave		164	89.5	37.4	27.4

Season Average - 73.8 cfs

Peak Flow - 1940 cfs on June 25

Birch Creek at Steese Hwy Bridge

Daily Average Discharge - 1989 (cfs)

Date	May	Jun	Jul	Aug	Sep
1		3930		929	493
2		3270		895	491
3		2440		908	478
4		2000		951	475
5		1810		941	477
6		1770		908	472
7		2320		868	470
8		2940		844	463
9		2090		804	467
10		1490		755	471
11		1250	1250	712	470
12		1080		686	465
13		986		644	464
14		890		611	462
15		786		612	477
16		707		638	793
17		641		615	923
18		584		602	756
19		552		589	649
20		578	1780	575	536
21		590	2060	571	504
22		607	2840	553	485
23		689	2320	564	451
24		660	2160	544	428
25		2880	2070	546	403
26			1820	532	399
27			1530	516	389
28		10000	1330	511	385
29			1240	510	
30			1120	493	
31			994	4 %	
Ave		2170	1770	675	507

Season Average - 1087 cfs

Peak Flow - 43400 cfs on June 26

Appendix B (cont)

Faith Creek above Steese Hwy Bridge

Daily Average Discharge - 1989 (cfs)

Date	May	Jun	Jul	Aug	Sep
1			128	34.1	255
2			88.6	39.1	24.5
3			72.9	383	23.6
4			625	38.0	23.0
5			57.7	40.1	22.4
6			54.0	39.2	22.2
7			49.2	38.9	22.1
8			47.2	37.3	22.5
9		84.0	435	35.2	21.9
10		119	48.4	343	17.9
11		117	44.8	34.1	20.1
12		98.7	43.1	31.4	15.4
13		83.1	40.9	32.9	18.8
14		83.1	39.2	33.4	41.9
15		74.3	37.5	34.4	36.9
16		63.8	37.5	33.7	38.7
17		58.1	38.5	31.6	36.2
18		64.9	37.6	30.8	30.5
19		61.8	363	33.1	32.1
20		575	38.4	35.1	27.0
21		61.2	36.3	32.5	25.0
22		54.4	35.4	31.4	23.2
23		50.9	36.9	29.7	19.6
24		116	38.5	28.2	19.1
25		448	36.1	26.2	21.8
26		209	35.7	26.0	21.8
27		121	48.5	26.2	19.6
28		135	44.0	25.4	16.1
29		102	39.3	25.3	16.0
30		120	38.6	24.3	
31			36.0	24.3	
Ave		108	47.4	32.4	24.3

Season Average - 49.2 cfs

Peak Flow - 710 cfs on June 25

Appendix B (cont)

Gold Dust Creek (upper site)

Daily Average Discharge • 1989 (cfs)

Date	May	Jun	Jul	Aug	Sep
1		10.8	3.51	2.91	1.45
2		8.34	351	2.56	1.35
3		8.19	3.00	2.79	1.33
4		8.96	2.83	2.75	133
5		7.87	2.92	2.64	1.23
6		8.17	3.07	261	1.29
7		15.2	2.91	2.56	1.27
8		8.19	2.67	2.46	1.30
9		6.19	2.83	2.30	1.26
10		6.43	3.94	2.17	1.29
11		5.76	3.57	2.24	1.22
12		4.56	3.17	2.15	1.28
13		3.67	2.82	2.22	1.29
14		3.78	2.60	2.28	1.78
15		2.99	6.44	2.28	2.08
16		2.93	9.14	2.32	2.17
17		2.40	9.61	2.13	2.41
18		252	6.92	2.07	2.19
19		2.15	5.36	1.99	1.99
20		1.94	15.8	1.85	2.06
21		2.74	17.4	1.84	2.06
22		2.24	12.7	1.83	1.78
23		1.74	14.2	1.69	1.65
24		8.29	11.5	1.66	1.47
25		82.2	8.85	1.66	1.41
26		26.1	6.84	1.61	1.43
27		10.1	5.60	1.49	1.28
28		3.84	4.77	1.41	1.13
29		2.74	4.15	1.45	
30		2.34	3.54	1.36	
31			3.07	1.45	
Ave		8.78	6.11	2.09	1.56

Season Average • 4.68 cfs

Peak Flow • 180 cfs on June 25

Appendix B (cont)

Gold Dust Creek (middle site)

Daily Average Discharge - 1989 (cfs)

Date	May	Jun	Jul	Aug	Sep
1		29.9	26.1	8.60	4.13
2		21.7	193	8.76	4.38
3		19.9	14.2	8.42	4.16
4		22.5	10.9	8.10	3.75
5		19.7	8.93	8.69	4.03
6		19.4	7.40	9.04	3.62
7		513	6.42	8.42	3.77
8		22.1	5.71	8.00	4.13
9		16.0	6.94	7.53	3.76
10		16.1	13.1	7.34	3.96
11		14.5	9.73	8.15	3.77
12		12.6	7.43	7.83	3.82
13		10.7	6.37	8.24	3.94
14		10.3	5.61	7.85	6.64
15		8.91	16.9	8.14	6.61
16		7.62	27.2	8.15	5.23
17		6.78	283	7.87	5.53
18		7.09	21.1	7.88	4.69
19		6.62	14.9	7.76	4.34
20		6.87	57.0	6.96	4.23
21		7.60	55.4	6.40	4.61
22		8.18	44.8	6.24	4.56
23		6.93	40.3	5.96	4.52
24		31.0	39.0	5.63	4.65
25		268	273	5.64	3.99
26		76.0	21.0	5.23	3.31
27		49.8	18.4	5.30	3.53
28		29.5	15.2	5.26	3.28
29		19.7	12.3	4.62	
30		16.2	10.7	4.21	
31			9.69	4.56	
Ave		28.1	19.6	7.12	4.32

Season Average - 14.9 cfs

Peak Flow - 400 cfs on June 25

Appendix B (cont)

Little Chena River at Chena Hot Springs Road
US Geological Survey Station #15511000

Daily Average Discharge - 1989 (cfs)

Date	May	Jun	Jul	Aug	Sep
1		384	758	211	139
2		326	690	209	137
3		283	583	210	134
4		260	519	211	133
5		241	469	212	133
6		237	418	222	133
7		388	374	222	133
8		410	336	209	132
9		304	309	201	128
10		255	289	192	128
11		236	309	187	126
12		222	285	183	132
13		207	264	180	125
14		194	246	183	140
15	429	184	229	181	174
16	665	176	222	172	1%
17	671	164	231	163	188
18	564	160	249	161	177
19	512	173	239	158	
20	488	178	231	164	
21	474	164	231	168	
22	461	155	226	161	
23	417	148	217	155	
24	406	159	220	153	
25	490	1070	222	149	
26	514	2220	218	149	
27	484	1950	235	146	
28	418	1380	269	145	
29	406	1140	254	145	
30	502	836	232	141	
31	449		214	139	
Ave	491	473	316	177	144

Season Average - 318 cfs

Peak Flow - 2530 cfs on June 27

Appendix C

Birch Creek above Twelve Mile Creek

Daily Sediment Load - 1989 (tons)

Date	May	Jun	Jul	Aug	Sep
1			459	7.18	3.15
2			102	4.52	1.38
3			393	4.77	1.67
4			20.6	4.93	3.23
5			21.2	5.99	1.78
6			82.5	4.10	1.71
7				5.02	1.54
8				4.98	1.27
9		41.4		5.63	1.29
10			22.6	3.77	1.43
11			16.1	1.84	1.26
12			12.7	2.85	0.90
13			9.04	3.01	1.69
14			9.57	2.82	1.59
15		3.25	26.8	938	2.38
16			83.6	4.97	1.90
17			34.4	1.53	1.63
18			20.0	1.67	1.89
19			18.4	3.87	2.45
20			249	5.58	2.14
21			465	6.57	1.94
22			92.0	6.64	2.42
23			66.4	9.02	1.39
24			25.9	3.93	1.62
25			24.4	3.88	1.27
26			19.0	3.38	1.03
27			13.4	3.31	0.87
28		398	12.1	337	0.28
29		175	7.41	3.10	0.18
30		243	11.3	2.06	
31			8.11	3.22	
Total		861	1970	137	47.3
Ave		172	63.6	4.42	1.63

Season Total - 4130 tons

Season Average - 44.4 tons/day

Appendix C (cont)

Birch Creek at Steese Hwy Bridge

Daily Sediment Load - 1989 (tons)

Date	May	Jun	Jul	Aug	Sep
1		1820		104	11.8
2		1670		106	21.2
3		967		28.2	22.4
4				118	9.85
5				161	13.1
6				91.1	10.6
7		1050		67.0	44.6
8		743		90.1	16.9
9		182		105	18.0
10		83.2		102	15.1
11		49.6	207	77.9	13.6
12		31.2		57.9	15.2
13				92.7	31.4
14				39.0	22.2
15		12.1		25.6	22.9
16				48.1	
17				53.1	
18				54.1	
19				41.0	23.7
20			368	29.6	
21			558	18.2	
22			1520	19.1	
23			648	32.7	
24			1660	83.1	
25			551	17.1	
26			344	15.7	
27			275	17.6	
28		4590	190	19.8	1.48
29			117	12.1	
30			165	12.7	
31			80.0	12.7	
Total		6610	6690	1750	314
Ave		1020	515	56.5	18.5

Season Total - 15360 tons

Season Average - 213 tons/day

Appendix C (cont)

Faith Creek above Steese Hwy Bridge

Daily Sediment Load • 1989 (tons)

Date	May	Jun	Jul	Aug	Sep
1			19.5	2.63	0.69
2			6.17	0.92	0.63
3			3.70	1.12	0.52
4			1.88	1.05	0.70
5			1.52	1.36	0.62
6			1.23	1.27	1.09
7			0.88	0.83	0.58
8			1.56	0.70	0.72
9		5.43	0.77	0.43	0.54
10		9.39	0.65	0.38	
11		5.88	2.35	0.44	0.41
12		3.76	0.85	0.48	0.39
13		2.52	0.63	0.59	0.36
14		6.97	0.69	0.55	
15		2.64	0.71	0.48	
16		1.65	0.41	0.94	
17		1.30	0.73	0.56	
18		1.31	0.72	0.46	
19		1.30	1.21	0.49	0.27
20		0.97	1.52	0.92	
21		1.01	0.68	1.41	
22		0.64	4.22	0.59	
23		0.77	2.53	1.15	
24		14.7	0.96	0.85	
25		3650	0.87	0.63	
26		206	2.42	0.84	
27		68.9	4.00	0.55	
28		46.3	4.02	0.69	
29		16.9	6.58	0.66	0.11
30		21.9	6.44	0.99	
31			0.70	0.75	
Total		4070	81.1	25.7	7.63
Ave		185	2.62	0.83	0.54

Season Total • 4180 tons

Season Average • 42.7 tons/day

Appendix C **(cont)**

Gold Dust Creek (upper site)

Daily Sediment Load - 1989 (tons)

Date	May	Jun	Jul	Aug	Sep
1		0.18	0.15	0.03	0.11
2		0.33	0.58	0.03	0.02
3		0.09	0.31	0.03	**0.13**
4		0.28	0.07	0.03	0.05
5		0.07	0.09	0.02	0.01
6		0.03	0.10	0.06	0.01
7		0.07	0.04	0.02	0.02
8		0.51	0.10	0.02	0.05
9		0.04	0.05	0.01	0.03
10		0.05	0.06	0.02	0.01
11		0.11	0.08	0.02	0.01
12		0.25	0.04	0.01	0.01
13		0.03	0.02	0.01	0.02
14		0.02	0.03	0.01	0.02
15		0.03	0.04	0.03	
16		0.06	0.10	0.02	
17		0.02	0.06	0.01	
18		0.01	0.06	0.02	
19		0.03	0.03	0.01	0.02
20		0.01	0.21	0.02	
21		0.03	0.17	0.01	
22		0.02	0.19	0.06	
23		0.02	0.14	0.03	
24		0.05	0.12	0.01	
25		76.69	0.09	0.02	
26		**13.93**	**0.20**	0.01	
27		0.98	0.04	0.02	
28		0.38	0.20	0.01	0.00
29		0.24	0.06	0.01	
30		**0.13**	0.07	0.01	
31			0.03	0.07	
Total		94.7	3.53	0.68	0.52
Ave		3.16	0.11	0.02	0.03

Season Total - 99.4 tons

Season Average - 0.92 tons/day

Appendix C (cont)

Gold Dust Creek (middle site)

Daily Sediment Load ▪ 1989 (tons)

Date	May	Jun	Jul	Aug	Sep
1		12.0	165		0.17
2		6.55	146		0.18
3		4.22	41.4	037	0.10
4		5.23	313	173	0.49
5		2.98	17.8	5.58	0.14
6		4.22	12.7	9.78	0.10
7		85.2	12.0	4.78	0.11
8		5.25	11.5	1.32	0.08
9		2.05	0.0	1.05	0.07
10		1.64	74.3	0.81	0.12
11		1.17	6.43	0.92	0.06
12		0.89	6.87	1.54	0.35
13		0.95	2.40	0.83	0.08
14		0.62	2.15	2.43	
15		1.66	61.2	1.25	
16		0.94	94.1	1.94	
17		0.70	66.6	1.52	
18		0.69	24.8	2.30	
19		0.57	9.65	3.20	1.13
20		0.47	826	2.01	
21		0.44	1310	0.44	
22		0.54	468	0.53	
23		0.26	425	0.22	
24		19.6	193	0.23	
25		3980		0.19	
26				0.10	
27				0.10	
28		55.8		0.15	0.11
29		400		0.12	
30		93.2		0.10	
31				0.19	
Total		4690	4010	61.3	3.29
Ave		168	167	2.12	0.22

Season Total ▪ 8760 tons

Season Average ▪ 91.3 tons/day

Appendix C (cont)

Little Chena. River*

Daily Sediment Load - 1989 (tons)

Date	May	Jun	Jul	Aug	Sep
1				4.79	
2				7.26	
3					11.9
4					9.24
5					4.59
6			529		3.43
7			24.1		3.28
8			20.0		8.28
9			17.4		13.8
10			15.8		19.0
11			16.1		6.50
12			11.8		4.35
13			28.1		3.01
14			17.7	13.9	22.1
15	66.1		13.6	27.8	25.4
16	340		11.8	61.3	47.3
17	510		8.74	68.4	16.9
18	221		11.2	79.4	16.1
19	132		8.50	63.0	
20	95.1		6.22	63.0	
21	123		5.98	14.2	
22	93.3		29.9	41.4	
23	96.6		21.5	19.1	
24			15.3	14.3	
25			11.7	11.6	
26		2800	5.23	4.89	
27					
28					
29					
30					
31					
Total	1680	2800	354	489	215
Ave	186	2800	16.8	35.0	13.5

Season Total - 5540 tons

Season Average - 89.4 tons/day

* May and June sediment data from site at Nordale Road.
July - September sediment data and all flow data from USGS station on Chena Hot Springs Road.

Appendix

Automated Data

Units: Turbidity - NTU
TSS - mg/l

Location	Date	Time	Turbidity	TSS
Birch ab 12 Mile	09-Jun-89		65	153
Birch ab 12 Mile	09-Jun-89	1225	70	129
Birch ab 12 Mile	15-Jun-89	2030	30	29.2
Birch ab 12 Mile	28-Jun-89		110	596
Birch ab 12 Mile	28-Jun-89	1325	60	171
Birch ab 12 Mile	29-Jun-89		80	406
Birch ab 12 Mile	30-Jun-89		95	603
Birch ab 12 Mile	01-Jul-89		120	748
Birch ab 12 Mile	02-Jul-89		75	238
Birch ab 12 Mile	03-Jul-89		80	128
Birch ab 12 Mile	04-Jul-89		55	83.5
Birch ab 12 Mile	05-Jul-89		110	101
Birch ab 12 Mile	06-Jul-89		110	447
Birch ab 12 Mile	10-Jul-89		50	98.0
Birch ab 12 Mile	11-Jul-89		55	80.2
Birch ab 12 Mile	11-Jul-89	1454	65	33.1
Birch ab 12 Mile	12-Jul-89		80	76.7
Birch ab 12 Mile	13-Jul-89		65	61.1
Birch ab 12 Mile	14-Jul-89		75	72.0
Birch ab 12 Mile	15-Jul-89		110	147
Birch ab 12 Mile	16-Jul-89		120	297
Birch ab 12 Mile	17-Jul-89		65	121
Birch ab 12 Mile	18-Jul-89		60	85.2
Birch ab 12 Mile	19-Jul-89	1300	55	37.4
Birch ab 12 Mile	19-Jul-89		60	95.4
Birch ab 12 Mile	20-Jul-89		240	797
Birch ab 12 Mile	21-Jul-89		190	1120
Birch ab 12 Mile	22-Jul-89		85	263
Birch ab 12 Mile	23-Jul-89		80	195
Birch ab 12 Mile	24-Jul-89		55	87.1
Birch ab 12 Mile	25-Jul-89		75	99.5
Birch ab 12 Mile	26-Jul-89		80	89.2
Birch ab 12 Mile	27-Jul-89		55	70.7
Birch ab 12 Mile	28-Jul-89		17	72.6
Birch ab 12 Mile	29-Jul-89		11	47.9
Birch ab 12 Mile	30-Jul-89		22	79.4
Birch ab 12 Mile	31-Jul-89		22	59.0
Birch ab 12 Mile	01-Aug-89		31	56.5
Birch ab 12 Mile	02-Aug-89		29	35.4
Birch ab 12 Mile	03-Aug-89		26	39.1
Birch ab 12 Mile	03-Aug-89	1057	34	12.6
Birch ab 12 Mile	04-Aug-89		75	38.8
Birch ab 12 Mile	05-Aug-89		85	49.2

Appendix D **(cont)**

Location	Date	Time	Turbidity	TSS
Birch ab 12 Mile	06-Aug-89		38	36.4
Birch ab 12 Mile	07-Aug-89		65	46.0
Birch ab 12 Mile	08-Aug-89		70	45.7
Birch ab 12 Mile	09-Aug-89		90	54.4
Birch ab 12 Mile	10-Aug-89		75	37.9
Birch ab 12 Mile	11-Aug-8-9		27	18.8
Birch ab 12 Mile	12-Aug-89		50	30.1
Birch ab 12 Mile	13-Aug-89		60	30.2
Birch ab 12 Mile	14-Aug-89		45	25.3
Birch ab 12 Mile	15-Aug-89		140	82.2
Birch ab 12 Mile	16-Aug-89		70	49.0
Birch ab 12 Mile	17-Aug-89		15	15.7
Birch ab 12 Mile	18-Aug-89		31	16.8
Birch ab 12 Mile	19-Aug-89		70	38.1
Birch ab 12 Mile	20-Aug-89		95	57.4
Birch ab 12 Mile	21-Aug-89		120	71.8
Birch ab 12 Mile	22-Aug-89		110	72.5
Birch ab 12 Mile	23-Aug-89		100	98.5
Birch ab 12 Mile	23-Aug-89	1340	80	32.7
Birch ab 12 Mile	24-Aug-89		40	42.9
Birch ab 12 Mile	25-Aug-89		65	42.0
Birch ab 12 Mile	26-Aug-89		55	39.0
Birch ab 12 Mile	27-Aug-89		70	40.6
Birch ab 12 Mile	28-Aug-89		60	41.3
Birch ab 12 Mile	29-Aug-89		50	37.6
Birch ab 12 Mile	30-Aug-89		50	25.3
Birch ab 12 Mile	31-Aug-89		34	41.1
Birch ab 12 Mile	Ol-Sep89		50	38.6
Birch ab 12 Mile	02-Sep89		22	18.2
Birch ab 12 Mile	03-Sep-89		24	21.7
Birch ab 12 Mile	04-Sep-89		50	44.3
Birch ab 12 Mile	05-Sep-89		30	23.1
Birch ab 12 Mile	06-Sep-89		28	23.7
Birch ab 12 Mile	07-Sep-89		22	21.2
Birch ab 12 Mile	08-Sep-89		22	17.2
Birch ab 12 Mile	09-Sep-89		23	18.0
Birch ab 12 Mile	10-Sep-89		22	19.9
Birch ab 12 Mile	11-Sep89		19	17.5
Birch ab 12 Mile	12-Sep-89		11	11.8
Birch ab 12 Mile	13-Sep89		12	20.8
Birch ab 12 Mile	14-Sep-89		23	17.8
Birch ab 12 Mile	15-Sep-89		38	28.1
Birch ab 12 Mile	16-Sep-89		31	23.3
Birch ab 12 Mile	17-Sep89		23	20.0
Birch ab 12 Mile	18-Sep89		25	24.6
Birch ab 12 Mile	19-Sep-89		40	29.2
Birch ab 12 Mile	19-Sep-89	1210	27	18.2
Birch ab 12 Mile	20-Sep-89		30	27.9

Appendix D (cont)

Location	Date	Time	Turbidity	TSS
Birch ab 12 Mile	21-Sep-89		8.0	27.0
Birch ab 12 Mile	22-Sep-89		11	29.7
Birch ab 12 Mile	23-Sep-89		28	193
Birch ab 12 Mile	24-Sep-89		30	21.1
Birch ab 12 Mile	25-Sep-89		28	19.0
Birch ab 12 Mile	26-Sep-89		11	16.5
Birch ab 12 Mile	27-Sep-89		8.3	15.2
Birch ab 12 Mile	28-Sep-89		3.7	5.40
Birch ab 12 Mile	29-Sep-89	950	3.2	3.60
Birch ab 12 Mile	10-Oct-89	1325	3.2	135
Birch at bridge	01-Jun-89	1800	22	174
Birch at bridge	01-Jun-89	1830	28	169
Birch at bridge	02-Jun-89	1400	26	189
Birch at bridge	02-Jun-89	400	34	326
Birch at bridge	03-Jun-89	2000	14	88.0
Birch at bridge	03-Jun-89	0	19	180
Birch at bridge	03-Jun-89	1000	20	147
Birch at bridge	07-Jun-89	1400	14	168
Birch at bridge	08-Jun-89	1000	14	93.7
Birch at bridge	08- Jun-89	0	7.3	71.4
Birch at bridge	08-Jun-89	2000	12	117
Birch at bridge	09- Jun-89	600	9.3	81.1
Birch at bridge	09-Jun-89		7.4	32.2
Birch at bridge	09-Jun-89	1615	6.9	14.8
Birch at bridge	10-Jun-89		3.7	20.7
Birch at bridge	11-Jun-89		2.9	14.7
Birch at bridge	12-Jun-89		3.5	10.7
Birch at bridge	15-Jun-89	1315	4.5	5.72
Birch at bridge	28-Jun-89	1600	80	170
Birch at bridge	11-Jul-89		30	61.4
Birch at bridge	11-Jul-89	918	25	24.0
Birch at bridge	12-Jul-89		21	73.5
Birch at bridge	13-Jul-89		16	62.1
Birch at bridge	14-Jul-89		16	54.5
Birch at bridge	15-Jul-89		17	48.9
Birch at bridge	16-Jul-89		17	57.7
Birch at bridge	17-Jul-89		110	427
Birch at bridge	18-Jul-89		75	261
Birch at bridge	19-Jul-89		23	116
Birch at bridge	20-Jul-89		15	76.7
Birch at bridge	20-Jul-89	930	14	33.6
Birch at bridge	21-Jul-89		21	100
Birch at bridge	22-Jul-89		30	198
Birch at bridge	23-Jul-89		17	104
Birch at bridge	24-Jul-89		13	285
Birch at bridge	25-Jul-89		9.2	98.7
Birch at bridge	26-Jul-89		8.0	70.1

Appendix D (con

Location	Date	Time	Turbidity	TSS
Birch at bridge	27-Jul-89		7.5	66.6
Birch at bridge	28-Jul-89		10	53.1
Birch at bridge	29-Jul-89		6.9	35.0
Birch at bridge	30-Jul-89		6.8	54.7
Birch at bridge	31-Jul-89		7.6	29.8
Birch at bridge	01-Aug-89		6.9	41.5
Birch at bridge	02-Aug-89		7.5	43.9
Birch at bridge	03-Aug-89	1710	5.2	3.92
Birch at bridge	03-Aug-89		8.8	11.5
Birch at bridge	04-Aug-89		15	45.9
Birch at bridge	05-Aug-89		16	63.4
Birch at bridge	06-Aug-89		5.7	37.2
Birch at bridge	07-Aug-89		4.1	28.6
Birch at bridge	08-Aug-89		9.9	39.6
Birch at bridge	09-Aug-89		4.2	48.3
Birch at bridge	10-Aug-89		9.0	50.3
Birch at bridge	11-Aug-89		5.5	40.6
Birch at bridge	12-Aug-89		3.8	31.3
Birch at bridge	13-Aug-89		7.7	53.3
Birch at bridge	14-Aug-89		3.7	23.7
Birch at bridge	15-Aug-89		5.3	15.5
Birch at bridge	16-Aug-89		4.4	28.0
Birch at bridge	17-Aug-89		3.8	32.0
Birch at bridge	18-Aug-89		3.8	33.3
Birch at bridge	19-Aug-89		2.1	25.8
Birch at bridge	20-Aug-89		2.8	19.1
Birch at bridge	21-Aug-89		1.8	11.8
Birch at bridge	22-Aug-89		1.9	12.8
Birch at bridge	23-Aug-89		8.2	21.5
Birch at bridge	23-Aug-89	1815	3.1	1.21
Birch at bridge	24-Aug-89		13	56.6
Birch at bridge	25-Aug-89		3.0	11.6
Birch at bridge	26-Aug-89		3.8	10.9
Birch at bridge	27-Aug-89		3.0	12.6
Birch at bridge	28-Aug-89		3.0	14.4
Birch at bridge	29-Aug-89		2.6	8.78
Birch at bridge	30-Aug-89		2.5	9.52
Birch at bridge	31-Aug-89		2.8	9.52
Birch at bridge	01-Sep-89		3.4	8.88
Birch at bridge	02-Sep-89		6.4	16.0
Birch at bridge	03-Sep-89		5.1	17.4
Birch at bridge	04-Sep-89		2.9	7.69
Birch at bridge	05-Sep-89		2.9	10.2
Birch at bridge	06-Sep-89		2.1	8.33
Birch at bridge	07-Sep-89		5.7	35.1
Birch at bridge	08-Sep-89		3.0	13.5
Birch at bridge	09-Sep-89		2.1	14.3
Birch at bridge	10-Sep-89		3.1	11.9

Appendix D (cont)

Location	Date	Time	Turbidity	TSS
Birch at bridge	11-Sep89		2.3	10.7
Birch at bridge	12-Sep-89		2.5	12.1
Birch at bridge	13-Sep-89		3.9	25.1
Birch at bridge	14-Sep-89		3.1	17.8
Birch at bridge	15-Sep-89		4.5	17.8
Birch at bridge	19-Sep-89	1745	20	5.84
Birch at bridge	19-Sep-89		11	13.3
Birch at bridge	28-Sep-89	1620	1.4	1.21
Birch at bridge	10-Oct-89	1040	20	0.68
Faith	09-Jun-89	950	4.4	7.10
Faith	09-Jun-89		5.7	24.0
Faith	10-Jun-89		3.4	29.4
Faith	11-Jun-89		3.0	18.6
Faith	12-Jun-89		3.4	14.1
Faith	13-Jun-89		5.0	11.2
Faith	14-Jun-89		5.5	31.1
Faith	15- Jun-89	2145	8.7	4.33
Faith	15-Jun-89		7.2	13.2
Faith	16-Jun-89		4.3	956
Faith	17-Jun-89		4.7	8.28
Faith	18-Jun-89		5.1	7.47
Faith	19-Jun-89		4.4	7.80
Faith	20-Jun-89		4.9	6.28
Faith	21-Jun-89		3.8	6.11
Faith	22-Jun-89		3.9	4.35
Faith	23-Jun-89		3.8	5.59
Faith	24-Jun-89		8.7	46.9
Faith	25-Jun-89		1000	3020
Faith	26-Jun-89		110	366
Faith	27-Jun-89		25	212
Faith	28-Jun-89		15	127
Faith	29-Jun-89		10	61.6
Faith	30-Jun-89		18	67.6
Faith	Ol-Jul-89		18	56.7
Faith	02-Jul-89		16	25.8
Faith	03-Jul-89		12	18.8
Faith	04-Jul-89		7.4	11.1
Faith	05-Jul-89		5.7	9.79
Faith	06-Jul-89		5.0	8.47
Faith	07-Jul-89		3.4	6.64
Faith	08-Jul-89		4.0	12.2
Faith	09-Jul-89		3.5	6.57
Faith	10-Jul-89		4.0	5.00
Faith	11-Jul-89		2.7	19.4
Faith	11-Jul-89	1606	3.3	3.79
Faith	12-Jul-89		3.6	7.30
Faith	13-Jul-89		3.1	5.70

Appendix D (cont)

Location	Date	Time	Turbidity	TSS
Faith	14-Jul-89		3.1	6.52
Faith	15-Jul-89		2.4	7.00
Faith	16-Jul-89		1.9	4.06
Faith	17-Jul-89		4.3	7.04
Faith	18-Jul-89		2.7	7.06
Faith	19-Jul-89		7.9	12.4
Faith	19-Jul-89	1040	3.6	6.95
Faith	20-Jul-89		12	14.6
Faith	20-Jul-89	1710	13	103
Faith	21-Jul-89		3.9	6.90
Faith	22-Jul-89		40	44.2
Faith	23-Jul-89		22	25.4
Faith	24-Jul-89		5.3	9.26
Faith	25-Jul-89		4.5	8.92
Faith	26-Jul-89		9.1	25.2
Faith	27-Jul-89		29	30.6
Faith	27-Jul-89	1215	3.2	4.43
Faith	28-Jul-89		65	33.9
Faith	29-Jul-89		95	62.1
Faith	30-Jul-89		110	61.8
Faith	31-Jul-89		5.5	7.23
Faith	01-Aug-89		38	28.6
Faith	01-Aug-89	1125	12	4.41
F a i t h	02-Aug-89		6.6	8.76
Faith	03-Aug-89	910	10	3.68
Faith	03-Aug-89		5.1	10.9
Faith	04-Aug-89		11	10.2
Faith	05-Aug-89		9.1	12.6
Faith	06-Aug-89		11	12.0
Faith	07-Aug-89		7.0	7.87
Faith	08-Aug-89		2.6	6.98
Faith	09-Aug-89		3.0	4.54
Faith	10-Aug-89		2.3	4.11
Faith	11-Aug-89		3.6	4.77
Faith	12-Aug-89		4.3	5.67
Faith	13-Aug-89		5.5	6.60
Faith	14-Aug-89		5.4	6.11
Faith	15-Aug-89		7.5	5.18
Faith	16-Aug-89		6.7	10.3
Faith	17-Aug-89		11	6.53
Faith	18-Aug-89		8.9	5.57
Faith	19-Aug-89		11	5.45
Faith	20-Aug-89		16	9.76
Faith	21-Aug-89		24	16.1
Faith	22-Aug-89		12	6.90
Faith	23-Aug-89	1215	14	4.21
Faith	23-Aug-89		8.6	14.4
Faith	24-Aug-89	1535	8.0	3.23

Appendix D (cont)

Location	Date	Time	Turbidity	TSS
Faith	24-Allg-89		6.2	11.2
Faith	25-Aug-89		7.8	8.97
Faith	26-Aug-89		13	12.0
Faith	27-Aug-89		6.2	7.80
Faith	28-Aug-89		7.3	10.1
Faith	29-Aug-89		11	9.63
Faith	30-Aug-89		13	15.1
Faith	31-Aug-89		14	115
Faith	Ol-Sep-89		15	10.0
Faith	02-Sep-89		8.5	952
Faith	03-Sep-89		11	8.24
Faith	04-Sep-89		11	11.2
Faith	05-Sep-89		11	10.2
Faith	06-Sep-89		10	18.2
Faith	07-Sep-89		13	9.73
Faith	08-Sep-89		13	11.8
Faith	09-Sep-89		9.2	9.21
Faith	ll-Sep-89		10	7.64
Faith	12-Sep-89		5.8	9.47
Faith	13-Sep-89		5.5	7.02
Faith	19-Sep-89	1020	2.0	3.11
Faith	29-Sep-89	1110	1.7	2.47
Faith	10-Oct-89	1415	2.2	0.60
Gold Dust (lower)	01-Jun-89	1600	23	102
Gold Dust (lower)	01-Jun-89		28	135
Gold Dust (lower)	02-Jun-89		28	238
Gold Dust (lower)	03- Jun-89		15	98.4
Gold Dust (lower)	04-Jun-89		37	404
Gold Dust (lower)	05-Jun-89		21	157
Gold Dust (lower)	06-Jun-89		19	74.9
Gold Dust (lower)	07-Jun-89		180	2780
Gold Dust (lower)	08-Jun-89		45	279
Gold Dust (lower)	09-Jun-89		24	172
Gold Dust (lower)	09-Jun-89	1855	19	29.9
Gold Dust (lower)	10-Jun-89		14	82.0
Gold Dust (lower)	11-Jun-89		9.2	50.0
Gold Dust (lower)	12-Jun-89		11	46.7
Gold Dust (lower)	13-Jun-89		18	47.2
Gold Dust (lower)	14-Jun-89		15	37.9
Gold Dust (lower)	15-Jun-89	1810	14	13.2
Gold Dust (lower)	28-Jun-89	1402	150	510
Gold Dust (lower)	19-Jul-89	1800	8.8	98.1
Gold Dust (middle)	01-Jun-89	1440	28	141
Gold Dust (middle)	01-Jun-89		28	149
Gold Dust (middle)	02-Jun-89		23	112
Gold Dust (middle)	03-Jun-89		17	78.5

Appendix D (cont)

Location	Date	Time	Turbidity	TSS
Gold Dust (middle)	04-Jun-89		24	86.3
Gold Dust (middle)	05-Jun-89		15	56.2
Gold Dust (middle)	06-Jun-89		20	80.6
Gold Dust (middle)	07-Jun-89		95	616
Gold Dust (middle)	08-Jun-89		21	88.0
Gold Dust (middle)	09-Jun-89		15	47.4
Gold Dust (middle)	10-Jun-89		10	37.9
Gold Dust (middle)	11-Jun-89		9.1	29.8
Gold Dust (middle)	12-Jun-89		9.4	26.4
Gold Dust (middle)	13-Jun-89		13	33.1
Gold Dust (middle)	14-Jun-89		11	225
Gold Dust (middle)	15-Jun-89		10	69.1
Gold Dust (middle)	15-Jun-89	1700	8.4	11.7
Gold Dust (middle)	16-Jun-89		14	45.8
Gold Dust (middle)	17-Jun-89		9.6	38.2
Gold Dust (middle)	18-Jun-89		8.8	36.0
Gold Dust (middle)	19-Jun-89		13	32.1
Gold Dust (middle)	20-Jun-89		9.2	25.3
Gold Dust (middle)	21-Jun-89		8.0	21.6
Gold Dust (middle)	22-Jun-89		7.8	24.3
Gold Dust (middle)	23-Jun-89		5.4	14.0
Gold Dust (middle)	24-Jun-89		36	235
Gold Dust (middle)	25-Jun-89		900	5510
Gold Dust (middle)	28-Jun-89	1421	150	700
Gold Dust (middle)	29-Jun-89		500	7510
Gold Dust (middle)	30- Jun-89		180	2130
Gold Dust (middle)	01-Jul-89		160	2340
Gold Dust (middle)	02-Jul-89		150	2810
Gold Dust (middle)	03-Jul-89		95	1080
Gold Dust (middle)	04-Jul-89		110	1070
Gold Dust (middle)	05-Jul-89		80	740
Gold Dust (middle)	06-Jul-89		50	638
Gold Dust (middle)	07-Jul-89		75	691
Gold Dust (middle)	08-Jul-89		60	746
Gold Dust (middle)	10-Jul-89		100	2100
Gold Dust (middle)	11-Jul-89		30	245
Gold Dust (middle)	11-Jul-89	1330	27	167
Gold Dust (middle)	12-Jul-89		33	343
Gold Dust (middle)	13-Jul-89		24	140
Gold Dust (middle)	14-Jul-89		20	142
Gold Dust (middle)	15-Jul-89		120	1340
Gold Dust (middle)	16-Jul-89		90	1280
Gold Dust (middle)	17-Jul-89		55	871
Gold Dust (middle)	18-Jul-89		22	436
Gold Dust (middle)	19-Jul-89	1650	9.2	119
Gold Dust (middle)	19-Jul-89		17	239
Gold Dust (middle)	20-Jul-89	I.510	200	1970
Gold Dust (middle)	20-Jul-89	1600	190	1970

Appendix D (cont)

Location	Date	Time	Turbidity	TSS
Gold Dust (middle)	20-Jul-89		380	5370
Gold Dust (middle)	21-Jul-89		200	8790
Gold Dust (middle)	22-Jul-89		130	3870
Gold Dust (middle)	23-Jul-89		85	3910
Gold Dust (middle)	24-Jul-89		65	1840
Gold Dust (middle)	03-Aug-89	1345	4.5	16.2
Gold Dust (middle)	04-Aug-89		8.6	791
Gold Dust (middle)	05-Aug-89		3.4	238
Gold Dust (middle)	06-Aug-89		3.0	401
Gold Dust (middle)	07-Aug-89		4.2	210
Gold Dust (middle)	08-Aug-89		3.0	61.3
Gold Dust (middle)	09-Aug-89		3.7	51.5
Gold Dust (middle)	10-Aug-89		3.3	41.1
Gold Dust (middle)	11-Aug-89		3.2	41.9
Gold Dust (middle)	12-Aug-89		2.9	72.9
Gold Dust (middle)	13-Aug-89		3.9	37.3
Gold Dust (middle)	14-Aug-89		5.3	117
Gold Dust (middle)	15-Aug-89		2.9	56.9
Gold Dust (middle)	16-Aug-89		5.0	88.4
Gold Dust (middle)	17-Aug-89		4.0	71.4
Gold Dust (middle)	18-Aug-89		4.5	108
Gold Dust (middle)	19-Aug-89		3.0	153
Gold Dust (middle)	20-Aug-89		3.1	107
Gold Dust (middle)	21-Aug-89		2.9	25.5
Gold Dust (middle)	22-Aug-89		3.1	31.7
Gold Dust (middle)	23-Aug-89	1130	1.8	4.84
Gold Dust (middle)	23-Aug-89		3.0	13.8
Gold Dust (middle)	24-Aug-89		3.4	14.8
Gold Dust (middle)	25-Aug-89		2.2	12.2
Gold Dust (middle)	26-Aug-89		2.3	7.09
Gold Dust (middle)	27-Aug-89		2.1	7.12
Gold Dust (middle)	28-Aug-89		3.3	10.5
Gold Dust (middle)	29-Aug-89		3.2	10.0
Gold Dust (middle)	30-Aug-89		2.6	8.46
Gold Dust (middle)	31-Aug-89		3.1	15.6
Gold Dust (middle)	Ol-Sep89		3.4	15.5
Gold Dust (middle)	02-Sep-89		2.3	15.6
Gold Dust (middle)	03-Sep-89		2.2	9.12
Gold Dust (middle)	04-Sep-89		4.3	48.0
Gold Dust (middle)	05-Sep-89		2.3	13.1
Gold Dust (middle)	06-Sep-89		1.7	10.3
Gold Dust (middle)	07-Sep-89		2.6	10.7
Gold Dust (middle)	08-Sep-89		2.3	6.96
Gold Dust (middle)	09-Sep-89		2.2	6.62
Gold Dust (middle)	10-Sep-89		1.9	10.9
Gold Dust (middle)	ll-Sep89		23	5.85
Gold Dust (middle)	12-Sep-89		5.6	34.2
Gold Dust (middle)	13-Sep-89		2.8	7.05

Appendix D (cont)

Location	Date	Time	Turbidity	TSS
Gold Dust (middle)	19-Sep-89	1335	12	96.3
Gold Dust (middle)	28-Sep-89	1140	3.7	13.1
Gold Dust (upper)	01-Jun-89	1120	0.60	0.21
Gold Dust (upper)	01-Jun-89		1.2	6.14
Gold Dust (upper)	02-Jun-89		15	145
Gold Dust (upper)	03-Jun-89		1.0	3.96
Gold Dust (upper)	04-Jun-89		1.7	115
Gold Dust (upper)	05-Jun-89		0.60	3.38
Gold Dust (upper)	06-Jun-89		0.80	1.38
Gold Dust (upper)	07-Jun-89		0.85	1.78
Gold Dust (upper)	08-Jun-89		2.9	23.0
Gold Dust (upper)	09-Jun-89		0.85	2.43
Gold Dust (upper)	10- Jun-89		0.90	2.78
Gold Dust (upper)	11-Jun-89		0.75	6.87
Gold Dust (upper)	12-Jun-89		1.5	20.5
Gold Dust (upper)	13-Jun-89		0.90	3.00
Gold Dust (upper)	14-Jun-89		0.70	1.71
Gold Dust (upper)	15-Jun-89	1600	0.35	0.21
Gold Dust (upper)	15-Jun-89		1.3	3.77
Gold Dust (upper)	16-Jun-89		2.2	8.00
Gold Dust (upper)	17-Jun-89		0.95	3.01
Gold Dust (upper)	18-Jun-89		0.70	2.06
Gold Dust (upper)	19-Jun-89		1.3	5.37
Gold Dust (upper)	20-Jun-89		0.70	1.88
Gold Dust (upper)	21-Jun-89		1.6	3.40
Gold Dust (upper)	22-Jun-89		1.4	3.10
Gold Dust (upper)	23-Jun-89		0.90	3.27
Gold Dust (upper)	24-Jun-89		0.95	2.22
Gold Dust (upper)	25-Jun-89		38	346
Gold Dust (upper)	26-Jun-89		15	198
Gold Dust (upper)	27-Jun-89		2.9	35.9
Gold Dust (upper)	28-Jun-89	1455	0.65	0.65
Gold Dust (upper)	28-Jun-89		2.9	36.7
Gold Dust (upper)	29-Jun-89		2.3	32.6
Gold Dust (upper)	30-Jun-89		1.5	21.1
Gold Dust (upper)	Ol-Jul-89		1.8	16.0
Gold Dust (upper)	02-Jul-89		5.8	61.6
Gold Dust (upper)	03-Jul-89		3.5	37.7
Gold Dust (upper)	04-Jul-89		1.1	9.45
Gold Dust (upper)	05-Jul-89		1.3	11.4
Gold Dust (upper)	06-Jul-89		2.2	11.8
Gold Dust (upper)	07-Jul-89		1.3	5.59
Gold Dust (upper)	08-Jul-89		15	14.2
Gold Dust (upper)	09-Jul-89		2.0	6.46
Gold Dust (upper)	10-Jul-89		1.9	5.60
Gold Dust (upper)	11-Jul-89	1227	0.55	0.64
Gold Dust (upper)	11-Jul-89		1.7	8.58

Appendix D **(cont)**

Location	Date	Time	Turbidity	TSS
Gold Dust (upper)	12-Jul-89		1.6	4.64
Gold Dust (upper)	13-Jul-89		0.65	3.06
Gold Dust (upper)	14-Jul-89		1.1	3.87
Gold Dust (upper)	15-Jul-89		0.70	230
Gold Dust (upper)	16-Jul-89		1.5	3.88
Gold Dust (upper)	17-Jul-89		15	2.16
Gold Dust (upper)	18-Jul-89		1.0	3.33
Gold Dust (upper)	19-Jul-89	1530	0.45	1.20
Gold Dust (upper)	19-Jul-89		0.95	2.15
Gold Dust (upper)	20-Jul-89		1.5	4.85
Gold Dust (upper)	21-Jul-89		1.7	3.71
Gold Dust (upper)	22-Jul-89		0.90	5.45
Gold Dust (upper)	23-Jul-89		0.95	3.64
Gold Dust (upper)	24-Jul-89		0.65	3.84
Gold Dust (upper)	25-Jul-89		0.75	3.75
Gold Dust (upper)	26-Jul-89		1.2	10.7
Gold Dust (upper)	27-Jul-89		0.60	2.89
Gold Dust (upper)	28-Jul-89		2.2	15.4
Gold Dust (upper)	29-Jul-89		0.75	553
Gold Dust (upper)	30-Jul-89		1.5	7.54
Gold Dust (upper)	31-Jul-89		1.1	3.40
Gold Dust (upper)	01-Aug-89		0.70	3.82
Gold Dust (upper)	02-Aug-89		0.80	3.65
Gold Dust (upper)	03-Aug-89	1245	2.5	2.05
Gold Dust (upper)	03-Aug-89		1.0	4.25
Gold Dust (upper)	04-Aug-89		0.90	3.92
Gold Dust (upper)	05-Aug-89		0.95	3.34
Gold Dust (upper)	06-Aug-89		1.5	8.81
Gold Dust (upper)	07-Aug-89		0.65	3.08
Gold Dust (upper)	08-Aug-89		1.0	3.25
Gold Dust (upper)	09-Aug-89		0.85	2.20
Gold Dust (upper)	10-Aug-89		0.85	2.67
Gold Dust (upper)	11-Aug-89		0.80	2.86
Gold Dust (upper)	12-Aug-89		1.0	1.70
Gold Dust (upper)	13-Aug-89		0.45	1.39
Gold Dust (upper)	14-Aug-89		0.60	1.76
Gold Dust (upper)	15-Aug-89		0.70	4.08
Gold Dust (upper)	16-Aug-89		0.95	3.93
Gold Dust (upper)	17-Aug-89		0.90	1.19
Gold Dust (upper)	18-Aug-89		0.75	3.33
Gold Dust (upper)	19-Aug-89		0.80	1.43
Gold Dust (upper)	20-Aug-89		0.75	3.48
Gold Dust (upper)	21-Aug-89		0.70	1.45
Gold Dust (upper)	22-Aug-89		2.2	13.1
Gold Dust (upper)	23-Aug-89		1.4	5.96
Gold Dust (upper)	24-Aug-89		1.3	2.41
Gold Dust (upper)	24-Aug-89	1230	0.65	1.24
Gold Dust (upper)	25-Aug-89		1.9	5.36

Appendix D (cont)

Location	Date	Time	Turbidity	TSS
Gold Dust (upper)	26-Aug-89		1.0	1.44
Gold Dust (upper)	27-Aug-89		0.65	552
Gold Dust (upper)	28-Aug-89		1.9	3.43
Gold Dust (upper)	29-Aug-89		1.1	1.86
Gold Dust (upper)	30-Aug-89		1.2	1.86
Gold Dust (upper)	31-Aug-89		7.0	19.0
Gold Dust (upper)	Ol-Sep-89		8.4	27.0
Gold Dust (upper)	02-Sep-89		1.1	5.22
Gold Dust (upper)	03-Sep-89		1.2	36.4
Gold Dust (upper)	04-Sep-89		5.4	12.8
Gold Dust (upper)	05-Sep-89		0.90	3.07
Gold Dust (upper)	06-Sep-89		1.5	3.35
Gold Dust (upper)	07-Sep-89		1.6	5.71
Gold Dust (upper)	08-Sep-89		1.1	13.2
Gold Dust (upper)	09-Sep-89		1.0	7.48
Gold Dust (upper)	10-Sep-89		2.0	3.83
Gold Dust (upper)	11-Sep89		0.65	1.75
Gold Dust (upper)	12-Sep-89		0.60	151
Gold Dust (upper)	13-Sep-89		1.9	6.16
Gold Dust (upper)	14-Sep-89		1.3	3.15
Gold Dust (upper)	19-Sep-89	1445	2.4	3.76
Gold Dust (upper)	28-Sep-89	1240	0.30	1.17
Goldstream at Ballaine	23-May-89		18	101
Goldstream at Ballaine	24-May-89		23	72.0
Goldstream at Ballaine	25-May-89		m	62.8
Goldstream at Ballaine	26-May-89		25	65.9
Goldstream at Ballaine	27-May-89		27	60.3
Goldstream at Ballaine	28-May-89		19	50.0
Goldstream at Ballaine	29-May-89		19	44.8
Goldstream at Ballaine	30-May-89		21	48.1
Goldstream at Ballaine	31-May-89		18	44.4
Goldstream at Ballaine	Ol-Jun-89		14	35.5
Goldstream at Ballaine	02-Jun-89		12	35.6
Goldstream at Ballaine	03-Jun-89		12	29.6
Goldstream at Ballaine	04-Jun-89		13	35.5
Goldstream at Ballaine	05-Jun-89		80	152
Goldstream at Ballaine	06-Jun-89		13	31.7
Goldstream at Ballaine	07-Jun-89		10	27.8
Goldstream at Ballaine	08-Jun-89		14	34.4
Goldstream at Ballaine	09-Jun-89		19	37.7
Goldstream at Ballaine	10-Jun-89		16	36.6
Goldstream at Ballaine	11-Jun-89		19	44.7
Goldstream at Ballaine	12-Jun-89		12	39.3
Goldstream at Ballaine	13-Jun-89		16	28.8
Goldstream at Ballaine	14-Jun-89		15	26.9
Goldstream at Ballaine	15-Jun-89	1100	22	13.6
Goldstream at Ballaine	16-Jun-89		12	28.7

Appendix D **(cont)**

Location	Date	Time	Turbidity	TSS
Goldstream at Ballaine	24-Jun-89		100	904
Goldstream at Ballaine	25-Jun-89		260	921
Goldstream at Balhine	26-Jun-89		180	795
Goldstream at Ballaine	27-Jun-89		170	1110
Goldstream at Ballaine	28-Jun-89		130	847
Goldstream at Balhine	29-Jun-89		100	746
Goldstream at Ballaine	30-Jun-89		65	487
Goldstream at Ballaine	01-Jul-89		85	480
Goldstream at Ballaine	02-Jul-89		80	455
Goldstream at Ballaine	03-Jul-89		45	314
Goldstream at Ballaine	04-Jul-89		40	224
Goldstream at Ballaine	05-Jul-89		18	159
Goldstream at Ballaine	14-Jul-89		95	313
Goldstream at Ballaine	15-Jul-89		60	159
Goldstream at Ballaine	16-Jul-89		60	119
Goldstream at Ballaine	17-Jul-89		65	112
Goldstream at Ballaine	18-Jul-89		60	107
Goldstream at Ballaine	19-Jul-89		55	76.8
Goldstream at Ballaine	20-Jul-89		38	67.8
Goldstream at Ballaine	21-Jul-89		50	91.1
Goldstream at Balhine	22-Jul-89		55	83.7
Gold&ream at Ballaine	23-Jul-89		120	300
Goldstream at Ballaine	24-Jul-89		65	169
Goldstream at Ballaine	25-Jul-89		45	94.8
Goldstream at Ballaine	26-Jul-89		60	102
Goldstream at Ballaine	27-Jul-89		100	154
Goldstream at Ballaine	28-Jul-89		120	153
Goldstream at Ballaine	29-Jul-89		130	145
Goldstream at Ballaine	30-Jul-89		120	136
Goldstream at Ballaine	31-Jul-89		120	118
Goldstream at Ballaine	01-Aug-89		110	142
Goldstream at Ballaine	01-Aug-89		130	158
Goldstream at Ballaine	02-Aug-89		110	144
Goldstream at Ballaine	03-Aug-89		140	161
Goldstream at Ballaine	04-Aug-89		100	116
Goldstream at Ballaine	05-Aug-89		90	106
Goldstream at Ballaine	06-Aug-89		130	122
Goldstream at Ballaine	07-Aug-89		50	98.7
Goldstream at Ballaine	08-Aug-89		50	110
Goldstream at Ballaine	09-Aug-89		45	68.3
Goldstream at Ballaine	10-Aug-89		45	55.6
Goldstream at Ballaine	11-Aug-89		27	69.5
Goldstream at Ballaine	12-Aug-89		26	55.0
Goldstream at Ballaine	13-Aug-89		22	41.8
Goldstream at Ballaine	14-Aug-89		23	60.8
Goldstream at Ballaine	15-Aug-89		24	87.3
Goldstream at Ballaine	16-Aug-89		29	141
Goldstream at Ballaine	17-Aug-89		33	176

Appendix D (cont)

Location	Date	Time	Turbidity	TSS
Goldstream at Ballaine	18-Aug-89		39	241
Goldstream at Ballaine	19-Aug-89		85	2%
Goldstream at Ballaine	20-Aug-89		75	332
Goldstream at Ballaine	22-Aug-89		32	141
Goldstream at Ballaine	23-Aug-89		19	71.3
Goldstream at Ballaine	24-Aug-89		14	55.0
Goldstream at Ballaine	25-Aug-89		20	73.6
Goldstream at Ballaine	26-Aug-89		17	53.1
Goldstream at Ballaine	27-Aug-89		18	96.6
Goldstream at Ballaine	28-Aug-89		26	122
Goldstream at Ballaine	29-Aug-89		23	112
Goldstream at Ballaine	30-Aug-89		13	47.5
Goldstream at Ballaine	31-Aug-89		14	39.3
Goldstream at Ballaine	Ol-Sep-89		11	31.1
Goldstream at Ballaine	02-Sep-89		14	33.8
Goldstream at Ballaine	03-Sep-89		19	88.1
Goldstream at Ballaine	04-Sep-89		19	81.4
Goldstream at Ballaine	05-Sep-89		15	66.8
Goldstream at Ballaine	06-Sep-89		11	38.9
Goldstream at Ballaine	07-Sep89		23	97.6
Goldstream at Ballaine	08-Sep-89		11	48.4
Goldstream at Ballaine	09-Sep-89		30	81.6
Goldstream at Ballaine	10-Sep-89		9.2	23.8
Goldstream at Minto	23-May-89		9.8	32.9
Goldstream at Minto	24-May-89		9.1	21.8
Goldstream at Minto	25-May-89		7.7	15.0
Goldstream at Minto	26-May-89		6.2	10.9
Goldstream at Minto	27-May-89		8.3	13.4
Goldstream at Minto	28-May-89		8.3	15.1
Goldstream at Minto	29-May-89		8.9	14.0
Goldstream at Minto	30-May-89		6.4	14.0
Gold&ream at Minto	31-May-89		7.1	9.70
Goldstream at Minto	01-Jun-89		6.7	15.3
Goldstream at Minto	02-Jun-89		5.1	8.64
Goldstream at Minto	03-Jun-89		5.6	10.2
Goldstream at Minto	04-Jun-89		3.1	11.8
Goldstream at Minto	05-Jun-89		5.4	12.7
Goldstream at Minto	06-Jun-89		5.1	10.3
Goldstream at Minto	07-Jun-89		4.0	12.3
Goldstream at Minto	08-Jun-89		4.8	10.3
Gold&ream at Minto	09-Jun-89		3.9	29.6
Goldstream at Minto	10-Jun-89		4.2	8.29
Goldstream at Minto	11-Jun-89		3.8	11.3
Goldstream at Minto	12-Jun-89		4.9	9.23
Goldstream at Minto	W-Jim-89		4.2	8.21
Goldstream at Minto	14-Jun-89		3.4	11.1
Goldstream at Minto	15-Jun-89		3.8	8.19

Appendix D (cont)

Location	Date	Time	Turbidity	TSS
Goldstream at Minto	16-Jun-89		3.6	7.42
Goldstream at Minto	17-Jun-89		3 5	7.09
Goldstream at Minto	18-Jun-89		3.4	15.4
Goldstream at Minto	19-Jun-89		3.5	6.83
Goldstream at Minto	20-Jun-89		7.0	25.6
Goldstream at Minto	21-Jun-89		4.9	7.64
Goldstream at Minto	22-Jun-89		3.7	5.32
Goldstream at Minto	23-Jun-89		3.0	13.2
Goldstream at Minto	24-Jun-89		4.4	13.3
Goldstream at Minto	25-Jun-89		3.1	10.8
Goldstream at Minto	26-Jun-89		4.3	6.98
Goldstream at Minto	27-Jun-89		9.3	24.7
Goldstream at Minto	28-Jun-89		9.8	23.4
Goldstream at Minto	29-Jun-89		15	44.6
Goldstream at Minto	30-Jun-89		19	69.5
Goldstream at Minto	01-Jul-89		31	66.7
Goldstream at Minto	02-Jul-89		27	56.4
Goldstream at Minto	03-Jul-89		15	63.2
Goldstream at Minto	04-Jul-89		15	35.7
Goldstream at Minto	05-Jul-89		8.9	27.2
Goldstream at Minto	06-Jul-89		9.1	28.1
Goldstream at Minto	07-Jul-89		11	20.4
Goldstream at Minto	08-Jul-89		11	26.6
Goldstream at Minto	09-Jul-89		8.2	14.4
Goldstream at Minto	10-Jul-89		6.6	14.9
Goldstream at Minto	11-Jul-89		8.5	11.0
Goldstream at Minto	12-Jul-89		8.8	12.8
Goldstream at Minto	13-Jul-89		8.2	9.00
Goldstream at Minto	14-Jul-89		9.1	10.5
Goldstream at Minto	15-Jul-89		7.8	8.92
Goldstream at Minto	16-Jul-89		7.9	10.5
Goldstream at Minto	17-Jul-89		6.7	8.09
Goldstream at Minto	18-Jul-89		6.3	5.14
Goldstream at Minto	19-Jul-89		6.0	4.28
Goldstream at Minto	20-Jul-89		7.3	7.54
Goldstream at Minto	21-Jul-89		6.7	5.44
Goldstream at Miito	22-Jul-89		6.3	6.35
Goldstream at Minto	23-Jul-89		6.1	5.86
Goldstream at Minto	24-Jul-89		5.9	10.8
Goldstream at Minto	25-Jul-89		5.6	755
Goldstream at Minto	26-Jul-89		5.8	9.50
Gold&ream at Minto	27-Jul-89		5.6	6.77
Goldstream at Minto	28-Jul-89		7.5	10.0
Goldstream at Minto	29-Jul-89		6.1	9.47
Goldstream at Minto	30-Jul-89		5.4	11.4
Goldstream at Minto	31-Jul-89		7.8	8.54
Goldstream at Minto	01-Aug-89		6.1	8.92
Goldstream at Minto	02-Aug-89		6.1	7.10

Appendix D (cont)

Location	Date	Time	Turbidity	TSS
Goldstream at Minto	03-Aug-89		8.2	7.94
Goldstream at Minto	04-Aug-89		5.9	7.45
Goldstream at Minto	05-Aug-89		5.5	735
Goldstream at Minto	06-Aug-89		8.6	173
Goldstream at Minto	07-Aug-89		6.7	9.54
Goldstream at Minto	08-Aug-89		73	12.8
Goldstream at Minto	09-Aug-89		12	19.5
Goldstream at Minto	10-Aug-89		11	23.0
Goldstream at Minto	11-Aug-89		8.7	13.6
Goldstream at Minto	12-Aug-89		9.2	20.6
L Chena ab Nordale	15-May-89		7.9	57.1
L Chena ab Nordale	E-May-89		20	190
L Chena ab Nordale	17-May-89		32	282
L Chena ab Nordale	18-May-89		18	145
L Chena ab Nordale	19-May-89		14	95.6
L Chena ab Nordale	20-May-89		11	72.2
L Chena ab Nordale	21-May-89		14	96.4
L Chena ab Nordale	22-May-89		12	75.0
L Chena ab Nordale	23-May-89		14	85.9
L Chena ab Nordale	26-Jun-89	1400	40	202
L Chena ab Nordale	26-Jun-89		100	467
L Chena at USGS gage	06-Jul-89		4.9	47.0
L Chena at USGS gage	07-Jul-89		4.1	23.9
L Chena at USGS gage	08-Jul-89		3.5	22.1
L Chena at USGS gage	09-Jul-89		3.2	20.9
L Chena at USGS gage	10-Jul-89		3.1	20.2
L Chena at USGS gage	11-Jul-89		3.4	19.4
L Chena at USGS gage	12-Jul-89		2.9	15.3
L Chena at USGS gage	13-Jul-89		5.8	39.5
L Chena at USGS gage	14- Jul-89		4.3	26.7
L Chena at USGS gage	15-Jul-89		4.2	22.0
L Chena at USGS gage	16-Jul-89		2.8	19.7
L Chena at USGS gage	17-Jul-89		2.9	14.0
L Chena at USGS gage	18-Jul-89		3.5	16.6
L Chena at USGS gage	19-Jul-89		2.8	13.2
L Chena at USGS gage	20-Jul-89		2.3	10.0
L Chena at USGS gage	21-Jul-89		2.7	9.59
L Chena at USGS gage	22-Jul-89		5.1	49.1
L Chena at USGS gage	23-Jul-89		5.5	36.7
L Chena at USGS gage	24-Jul-89		4.7	25.7
L Chena at USGS gage	25-Jul-89		3.8	19.5
L Chena at USGS gage	26-Jul-89		2.4	8.89
L Chena at USGS gage	01-Aug-89		2.3	8.42
L Chena at USGS gage	02-Aug-89		2.7	12.9
L Chena at USGS gage	14-Aug-89		5.2	28.1
L Chena at USGS gage	15-Aug-89		4.6	56.9

Appendix D (cont)

Location	Date	Time	Turbidity	TSS
L Chena at USGS gage	16-Aug-89		4.3	132
L Chena at USGS gage	17-Aug-89		4.6	156
L Chena at USGS gage	18-Aug-89		5.9	183
L Chena at USGS gage	19-Aug-89		5.4	148
L Chena at USGS gage	20-Aug-89		55	142
L Chena at USGS gage	21-Aug-89		3.1	313
L Chena at USGS gage	22-Aug-89		4.7	95.3
L Chena at USGS gage	23-Aug-89		3.6	45.6
L Chena at USGS gage	24-Aug-89		3.2	34.7
L Chena at USGS gage	25-Aug-89		33	28.8
L Chena at USGS gage	26-Aug-89		25	12.2
L Chena at USGS gage	03-Sep-89		5.1	32.9
L Chena at USGS gage	04-Sep-89		3.4	25.8
L Chena at USGS gage	05-Sep-89		2.7	12.8
L Chena at USGS gage	06-Sep-89		3.6	9.55
L Chena at USGS gage	07-Sep-89		3.1	9.13
L Chena at USGS gage	08-Sep-89		4.5	23.2
L Chena at USGS gage	09-Sep-89		4.7	40.1
L Chena at USGS gage	10-Sep-89		6.8	55.0
L Chena at USGS gage	ll-Sep89		4.1	19.1
L Chena at USGS gage	12-Sep-89		3.3	12.2
L Chena at USGS gage	13-Sep-89		2.6	8.94
L Chena at USGS gage	14-Sep-89		6.5	58.4
L Chena at USGS gage	15-Sep-89		4.6	54.2
L Chena at USGS gage	16-Sep-89		4.9	895
L Chena at USGS gage	17-Sep-89		4.3	333
L Chena at USGS gage	18-Sep-89		3.9	33.8

Appendix E

Location	Date	Time	Turb	TSS	Comments
Albert Creek	01-Jun-89	2150	3.8	21.9	at Steese Highway
Albert Creek	09-Jun-89	1650	1.8	1.90	
Albert Creek	15-Jun-89	1350	1.3	2.07	
Albert Creek	11-Jul-89	1000	1.6	1.43	
Albert Creek	20-Jul-89	1300	370	1250	
Albert Creek	03-Aug-89	1638	1.1	1.05	
Bedrock Creek	01-Jun-89	2230	1.2	5.29	at Steese Highway
Bedrock Creek	09-Jun-89	1738	0.80	1.05	
Bedrock Creek	15-Jun-89	1450	0.50	2.10	
Bedrock Creek	11-Jul-89	1100	5.6	17.7	
Bedrock Creek	20-Jul-89	1355	75	402	
Bedrock Creek	28-Jul-89	915	2.0	4.83	
Bedrock Creek	03-Aug-89	1540	8.8	6.72	
Bedrock Creek	23-Aug-89	1545	1.8	2.19	
Bedrock Creek	19-Sep-89	1955	0.8	2.55	
Bedrock Creek	28-Sep-89	1430	0.7	1.43	
Bedrock Creek	10-Oct-89	1125	1.5	1.28	
Birch Creek	22-Aug-89	1400	200	130	below Gold Dust Creek
Boulder Creek	01-Jun-89	2220	2.9	16.5	at Steese Highway
Boulder Creek	09-Jun-89	1730	1.2	2.85	
Boulder Creek	15-Jun-89	1440	0.40	0.99	
Boulder Creek	11-Jul-89	1050	3.2	8.61	
Boulder Creek	20-Jul-89	1340	160	1460	
Boulder Creek	28-Jul-89	850	3.1	13.4	
Boulder Creek	03-Aug-89	1600	6.3	18.6	
Boulder Creek	23-Aug-89	1610	1.9	2.67	
Boulder Creek	19-Sep-89	1940	0.55	1.00	
Boulder Creek	28-Sep-89	1450	0.40	0.40	
Boulder Creek	10-Oct-89	1120	1.4	0.21	
Chatanika River	09-Jun-89	2020	1.6	3.46	at 39 Mile Steese Highway
Chatanika River	15-Jun-89	2225	0.85	2.21	
Chatanika River	11-Jul-89	1700	0.95	1.24	
Chatanika River	19-Jul-89	936	0.65	1.91	
Chatanika River	20-Jul-89	1738	1.0	1.65	
Chatanika River	03-Aug-89	1955	1.9	1.06	
Chatanika River	23-Aug-89	1020	1.1	2.08	
Chatanika River	24-Aug-89	1630	0.80	0.41	
Chatanika River	19-Sep-89	845	0.85	0.88	
Chatanika River	29-Sep-89	1200	0.45	0.21	
Chatanika River	10-Oct-89	1510	1.4	0.61	
Chatanika River	01-Aug-89	1555	3.1	0.80	above Sourdough Creek

Appendix E (cont)

Location	Date	Time	Turb	TSS	Comments
Crooked Creek	15-Jun-89	1452	60	37.3	below Bedrock Creek
Crooked Creek	20-Jul-89	1400	130	412	
Crooked Creek	03-Aug-89	1545	80	45.7	
Crooked Creek	23-Aug-89	1550	15	5.01	
Crooked Creek	19-Sep-89	1950	2.8	3.46	
Crooked Creek	28-Sep-89	1440	2.3	4.78	
Crooked Creek	09-Jun-89	1700	17	39.6	at Steese Highway
Crooked Creek	15-Jun-89	1400	30	20.5	
Crooked Creek	11-Jul-89	1010	38	75.0	
Crooked Creek	20-Jul-89	1310	260	1340	
Crooked Creek	27-Jul-89	1815	55	65.7	
Crooked Creek	03-Aug-89	1630	40	7.96	
Crooked Creek	23-Aug-89	1615	32	3.37	
Crooked Creek	24-Aug-89	1000	19	1.90	
Crooked Creek	30-Aug-89	815	32	6.30	
Crooked Creek	19-Sep-89	1820	8.8	5.05	
Crooked Creek	28-Sep-89	1510	3.1	5.28	
Crooked Creek	10-Oct-89	1010	2.4	0.45	
Deadwood Creek	09-Jun-89	1720	140	128	at Circle Hot Springs Road
Deadwood Creek	15-Jun-89	1430	60	34.1	
Deadwood Creek	11-Jul-89	1040	7.9	3.85	
Deadwood Creek	20-Jul-89	1330	170	875	
Deadwood Creek	20-Jul-89	800	50	90.4	
Deadwood Creek	27-Jul-89	1845	60	35.1	
Deadwood Creek	03-Aug-89	1620	32	18.0	
Deadwood Creek	23-Aug-89	1925	14	6.64	
Deadwood Creek	24-Aug-89	955	11	5.05	
Deadwood Creek	29-Aug-89	1825	9.0	3.41	
Deadwood Creek	19-Sep-89	1836	2.0	4.76	
Deadwood Creek	28-Sep-89	1720	1.7	2.47	
Deadwood Creek	10-Oct-89	1000	3.7	2.68	
Eagle Creek	09-Jun-89	1815	1100	1390	above Ptarmigan Creek
Eagle Creek	15-Jun-89	1930	1100	865	
Eagle Creek	11-Jul-89	1130	340	278	
Eagle Creek	19-Jul-89	1845	350	249	
Eagle Creek	20-Jul-89	1430	700	1420	
Eagle Creek	27-Jul-89	1340	270	146	
Eagle Creek	03-Aug-89	1440	230	116	
Eagle Creek	23-Aug-89	1455	360	171	
Eagle Creek	24-Aug-89	1435	350	146	
Eagle Creek	19-Sep-89	1005	70	63.9	
Eagle Creek	28-Sep-89	1355	4.1	6.75	
Eagle Creek	10-Oct-89	1230	7.7	4.77	

Appendix E **(cont)**

Location	Date	Time	Turb	TSS	Comments
Fairbanks Creek	15-Aug-89	1245	1000	3840	above Moose Creek
Fairbanks Creek	15-Aug-89	1250	0.85	1.18	above Too Much Gold Creek
Gold Dust Creek (south trib)	01-Jun-89	1100	3.1	19.9	above Gold Dust Creek (main)
Ketchem Creek	15-Jun-89	1420	130	315	at Circle Hot Springs Road
Ketchem Creek	11-Jul-89	1030	600	2090	
Ketchem Creek	20-Jul-89	1325	290	1320	
Ketchem Creek	20-Jul-89	755	220	849	
Ketchem Creek	03-Aug-89	1613	370	2340	
Ketchem Creek	09-Jun-89	1710	100	501	
Ketchem Creek	27-Jul-89	1855	180	709	
Ketchem Creek	23-Aug-89	1915	160	417	
Ketchem Creek	24-Aug-89	945	90	189	
Ketchem Creek	29-Aug-89	1915	100	121	
Ketchem Creek	19-Sep-89	1830	190	551	
Ketchem Creek	28-Sep-89	1730	55	11.4	
Ketchem Creek	10-Oct-89	945	22	11.0	
Mammoth Creek	01-Jun-89	2245	110	130	at Steese Highway
Mammoth Creek	09-Jun-89	1745	200	190	
Mammoth Creek	15-Jun-89	1500	65	41.4	
Mammoth Creek	11-Jul-89	1105	4.5	16.6	
Mammoth Creek	20-Jul-89	1410	240	673	
Mammoth Creek	28-Jul-89	925	85	40.6	
Mammoth Creek	03-Aug-89	1530	330	95.7	
Mammoth Creek	23-Aug-89	1535	25	5.59	
Mammoth Creek	24-Aug-89	1020	75	21.0	
Mammoth Creek	29-Aug-89	1730	600	452	
Mammoth Creek	30-Aug-89	850	8.5	3.05	
Mammoth Creek	19-Sep-89	2000	5.2	6.69	
Mammoth Creek	28-Sep-89	1420	4.9	5.16	
Mammoth Creek	10-Oct-89	1135	3.1	2.17	
McManus Creek	24-Aug-89	1545	1.2	1.68	above Faith Creek
Moose Creek	15-Aug-89	1145	2.8	4.78	above Fairbanks Creek
Moose Creek	15-Aug-89	1100	1.0	3.29	above Fairbanks Creek (1/2 mile)
Ptarmigan Creek	09-Jun-89	1815	1.1	3.14	above Eagle Creek
Ptarmigan Creek	15-Jun-89	1930	1.8	3.03	
Ptarmigan Creek	11-Jul-89	1131	1.1	1.89	
Ptarmigan Creek	19-Jul-89	1845	0.80	3.51	
Ptarmigan Creek	20-Jul-89	1430	1.3	5.92	
Ptarmigan Creek	27-Jul-89	1340	0.35	0.77	
Ptarmigan Creek	03-Aug-89	1440	0.95	1.70	

Appendix E (cont)

Location	Date	Time	Turb	TSS	Comments
Ptarmigan Creek	23-Aug-89	1455	2.4	0.82	above Eagle Creek
Ptarmigan Creek	19-Sep-89	1605	1.8	2.67	
Ptarmigan Creek	28-Sep-89	1355	0.55	121	
Ptarmigan Creek	10-Oct-89	1230	1.1	0.15	
Sourdough Creek	09-Jun-89	1945	1.1	3.97	at Steese Highway
Sourdough Creek	15-Jun-89	2200	0.70	1.24	
Sourdough Creek	11-Jul-89	1630	4.1	2.94	
Sourdough Creek	19-Jul-89	1010	4.8	2.41	
Sourdough Creek	20-Jul-89	1708	4.1	4.50	
Sourdough Creek	03-Aug-89	1930	15	1.67	
Sourdough Creek	23-Aug-89	1050	1.4	0.21	
Sourdough Creek	19-Sep-89	920	1.4	3.54	
Sourdough Creek	29-Sep-89	1135	0.90	1.33	
Sourdough Creek	10-Oct-89	1425	0.75	0.00	
Twelve Mile Creek	09-Jun-89	1250	0.75	0.63	above Birch Creek
Twelve Mile Creek	15-Jun-89	2045	0.90	0.43	
Twelve Mile Creek	28-Jun-89	1335	11	67.7	
Twelve Mile Creek	11-Jul-89	1521	0.75	3.33	
Twelve Mile Creek	19-Jul-89	1430	0.60	0.63	
Twelve Mile Creek	20-Jul-89	1620	0.85	0.85	
Twelve Mile Creek	03-Aug-89	1058	1.2	1.03	
Twelve Mile Creek	23-Aug-89	1415	0.45	0.40	
Twelve Mile Creek	19-Sep-89	1210	0.40	1.47	
Twelve Mile Creek	29-Sep-89	950	035	0.43	
Twelve Mile Creek	10-Oct-89	1325	2.7	2.70	